



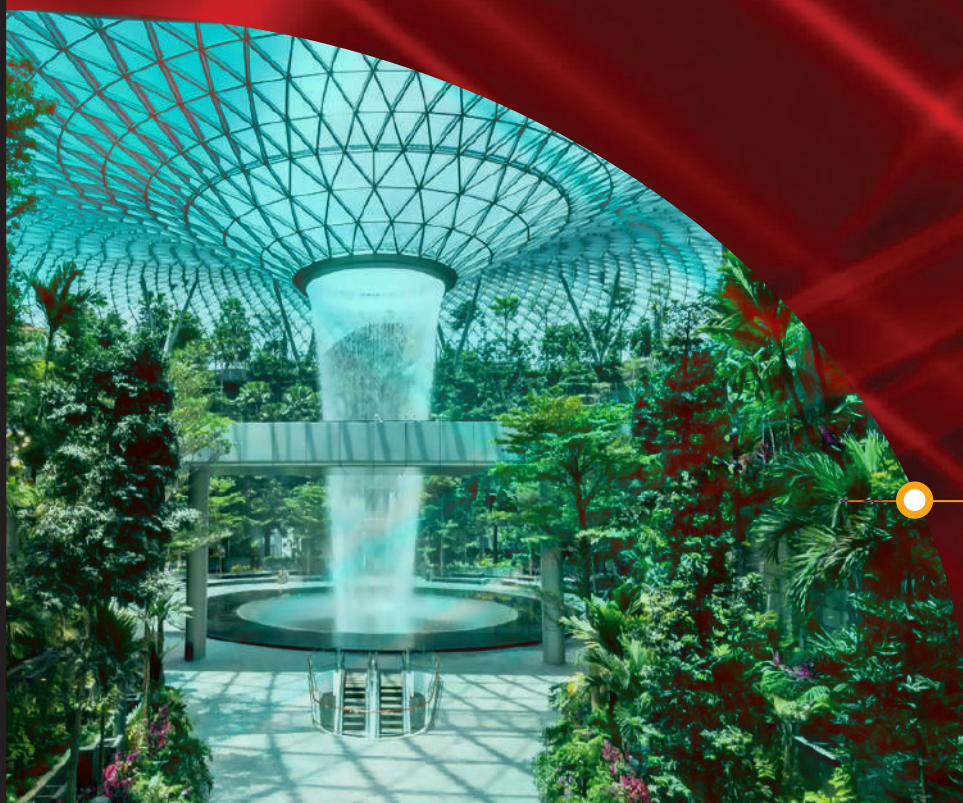
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ABSTRACTS

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High sensitivity C reactive protein and Recurrence of arial fibrillation after catheter ablation: a meta-analysis

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The recurrence after atrial fibrillation (AF) ablation is not uncommon. High sensitivity C reactive protein (hs-CRP) is one of the widely used inflammatory markers. We conducted meta-analysis to find association between hs-CRP levels and AF recurrence after ablation.

Methods

We searched PubMed, Embase and Wiley-Cochrane library from inception to January 1, 2022. Overall and subgroup analyses were performed. Standardized mean difference (SMD) and 95% confidence interval (CI) were used to evaluate the associations between hs-CRP levels and post-ablation AF recurrence. Statistical analysis was performed with Stata 14.0. The primary endpoint of this study is to investigate the association of AF recurrence after catheter ablation and hs-CRP levels.

Results

We identified ten studies and total 789 patients were included (299 recurrent vs 490 non-recurrent patients). The mean age was 57.7 years (76.4 % male). There was no different in baseline hs-CRP levels between AF recurrence and non-recurrence groups (WMD = 0.05, 95% CI = -0.04-0.15, p = 0.045). However, higher follow-up CRP levels after ablation was associated with higher AF recurrence (WMD = 0.09, 95% CI = 0.03-0.15, p <0.001). (Figure 1 and 2)

Conclusion

Higher post ablation hs-CRP level was associated with more AF recurrence. Hs-CRP may play a role as predictor of AF recurrence.

SUPPORTING DOCUMENTS

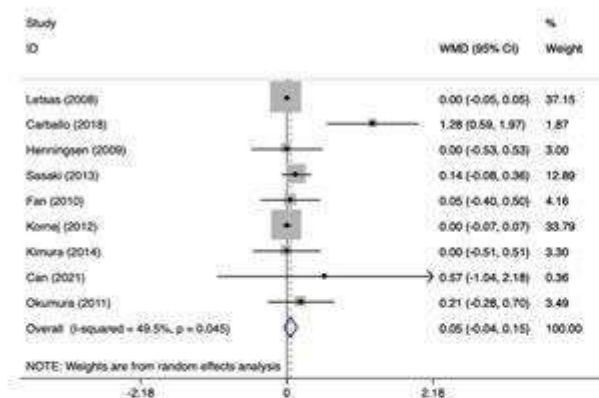


Figure 1. This Forrest plot illustrates the baseline CRP and recurrence rate of atrial fibrillation across the studies. The squares and horizontal line represent the mean difference (WMD) and 95% confidence interval (CI). The diamond represents the pooled results of WMD and 95% CI. Abbreviations: SD, standard deviation.

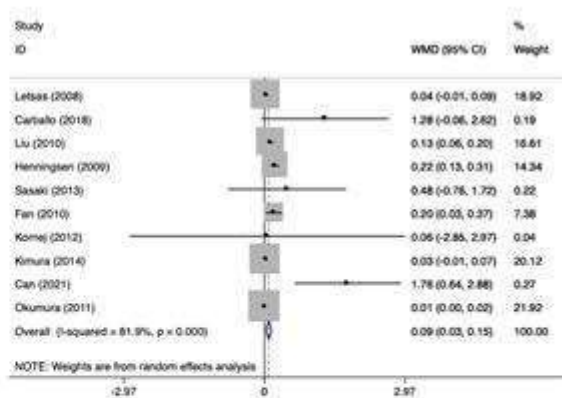


Figure 2. Forest plot of post-ablation CRP level and atrial fibrillation recurrence rate in ten studies. The squares and horizontal line represent the mean difference (WMD) and 95% confidence interval (CI). The diamond represents the pooled results of WMD and 95% CI which weighted mean difference does not include 0, suggesting a significant associatin between post-ablation CRP level and AF recurrence . Abbreviations: SD, standard deviation.

Catheter Ablation in Persistent Atrial Fibrillation: a Randomized Trial of Posterior Wall Isolation (PWI)

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OBJECTIVES

Pulmonary vein isolation (PVI) alone is less effective in persistent atrial fibrillation (PsAF). Posterior wall isolation (PWI) is a common adjunctive strategy to PVI, as the posterior wall is an important trigger and substrate site. The efficacy of PWI has not been assessed in a randomized setting.

MATERIALS AND METHODS

In this multi-centre, prospective, international randomized trial, 338 PsAF patients were randomized 1:1 to either PVI alone or PVI with PWI. Follow up was for a minimum of 12 months. The primary endpoint was freedom from any documented atrial arrhythmia of >30 seconds, after a single ablation procedure, off anti-arrhythmic therapy (AAD) at 12 months.

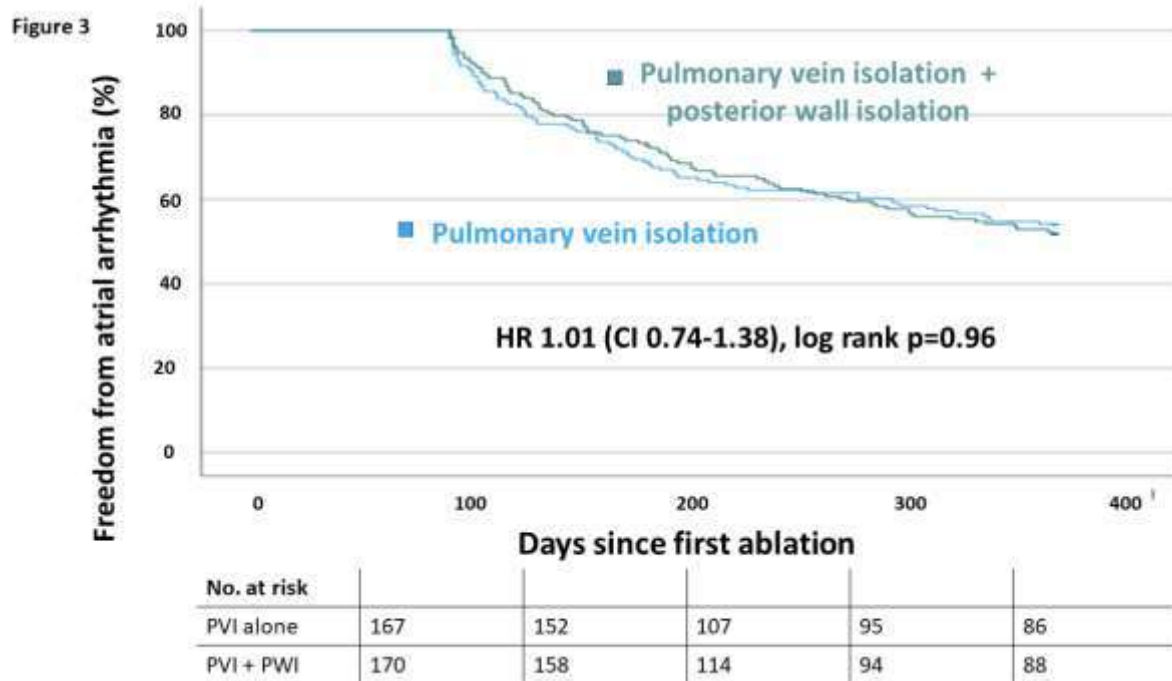
RESULTS

Median age was 65.6 (IQR 13.1) years, with 76.9% males. After 12 months, 53.9% of patients assigned to PVI alone were free from recurrent atrial arrhythmia off AAD from a single procedure, compared with 52.4% assigned to PVI with PWI (HR 1.01, CI 0.74-1.38, p=0.96). There were no significant differences in the secondary end points, including freedom from AF off AAD after a single procedure (PVI 53.3% vs PVI with PWI 54.1%, p=0.78), and freedom from atrial arrhythmia on/off AAD after multiple procedures (PVI 62.3% vs PVI with PWI 58.2%, p=0.51). Procedural times (121±57 minutes vs 142±69 minutes, p<0.01) and RF ablation times (28±12 minutes vs 34±21 minutes, p<0.01) were significantly shorter for PVI alone. Complication rates were 2.9%.

CONCLUSIONS

The addition of empirical posterior wall isolation to pulmonary vein isolation did not improve freedom from AF in those undergoing catheter ablation for PsAF.

SUPPORTING DOCUMENTS



Randomised Evaluation of the Impact of Catheter Ablation on Psychological Distress in Atrial Fibrillation (REMEDIAL) Study

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ABSTRACT

Objective: Assess the impact of atrial fibrillation (AF) catheter ablation (CA) on markers of psychological distress.

Methods: Randomised multicentre study of 100 patients with symptomatic AF comparing the impact of CA versus continued medical therapy during 12 months follow-up on: 1) Markers of psychological distress (mean HADS [Hospital Anxiety and Depression Scale] and prevalence of severe psychological distress [HADS >15]); 2) Health-Related Quality of Life measures (HRQOL: assessed by SF-36); 3) AF burden (monitored using AliveCor or Loop recorders); and 4) antiarrhythmic drugs (AAD) use.

Results: Mean age of the study cohort was 59±12 years (30% females). Compared to baseline, significant improvements in the mean HADS and prevalence of severe psychological distress were observed in the ablation group at 6 months (12 vs 8, $p < 0.001$ and 28% vs 15%, $p = 0.03$), and 12 months (12 vs 7, $p < 0.001$ and 28% vs 11%, $p = 0.01$) but not in the medical group at 6 months (12 vs 12, $p = 0.2$ and 32% vs 34%, $p = 0.7$) or 12 months (12 vs 11, $p = 0.1$ and 32% vs 30%, $p = 0.7$). At 12 months, compared to medical group, the ablation arm reported improvements in the 8 SF-36 health domains (7/8 vs 0/7), a reduction in the median AF burden (0 vs 16%, $p < 0.001$), and a reduction in AAD use (32 vs 89%, $p < 0.001$).

Conclusion: CA for AF was associated with significant improvement in psychological distress, anxiety and depression compared with medical therapy. These findings support a role for CA in targeting the psychological symptoms of AF.

SUPPORTING DOCUMENTS

Figure 1: Impact of catheter ablation and medical therapy on mean HADS and prevalence of psychological distress between baseline, 3, 6, and 12 months.

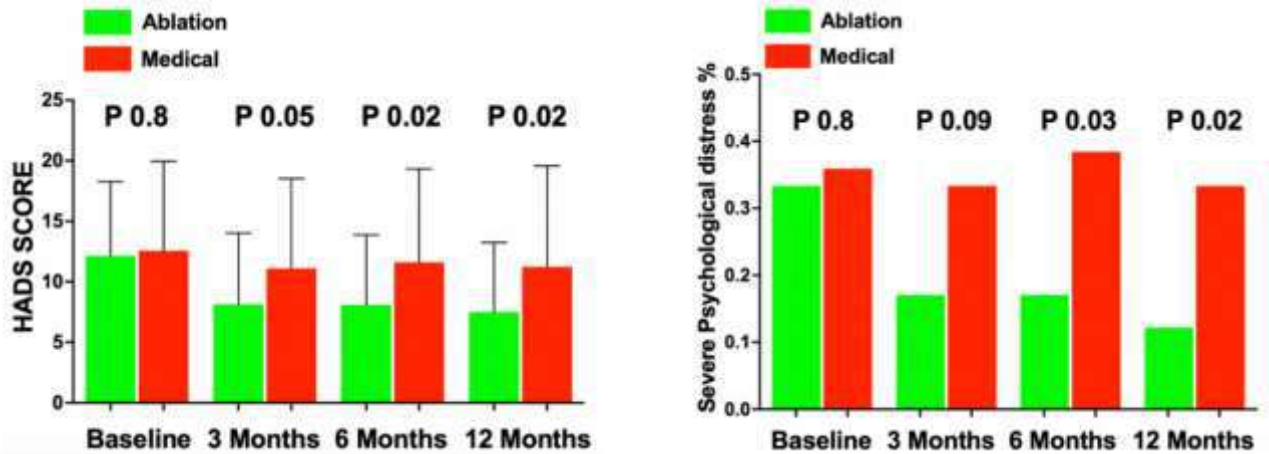
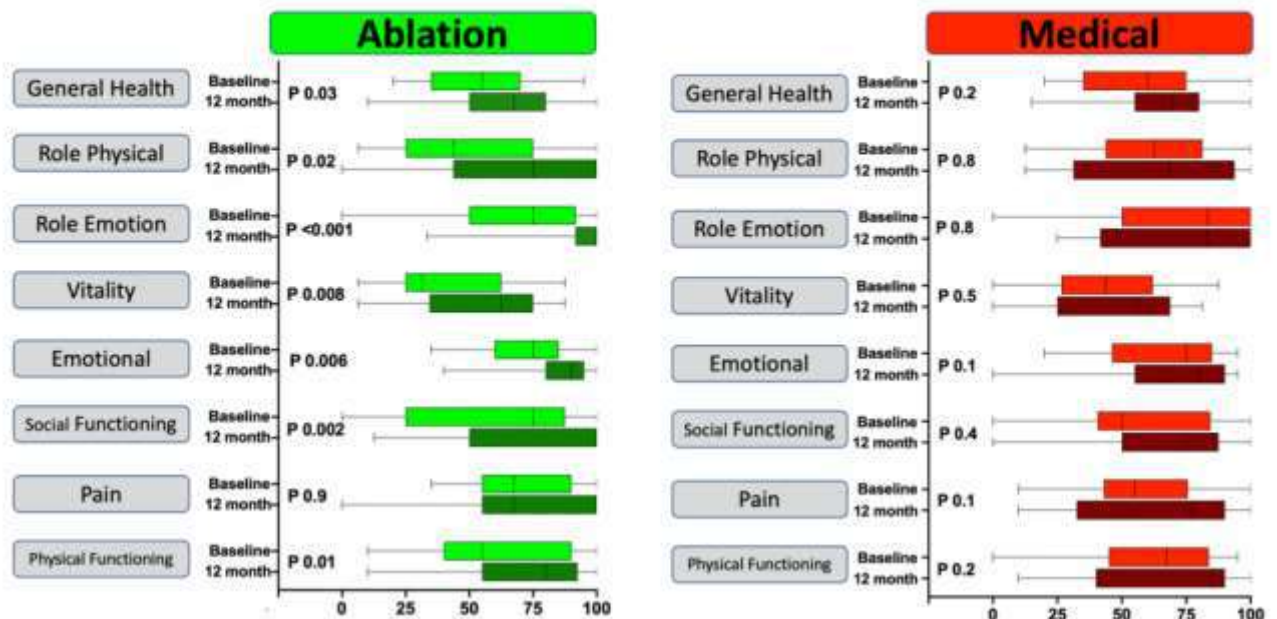


Figure 2: Impact of catheter ablation versus medical therapy on the 8 subscales of the SF-36 between baseline and 12 months.



Peak Frequency Module Accurately Identifies the Residual Gaps in AF Patients After PV isolation

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Objective

Conduction gap identified by peak-to-peak voltage after pulmonary vein isolation (PVI) has several limitations during atrial fibrillation (AF) ablation. This study tried to investigate whether the peak frequency (PF) module could identify conduction gaps and to predict future AF recurrence.

Methods

112 paroxysmal AF patients who underwent PVI were enrolled retrospectively. The left atrium 3D electroanatomical maps were constructed by HD grid catheter. After PVI, conduction gaps were defined as sites on the prior PVI line from which the activation propagated into the PV (Figure, Panel A). Each gap and non-gap areas were exported and analyzed by bipolar and omnipolar voltage Vmax, and bipolar and omnipolar PF modules.

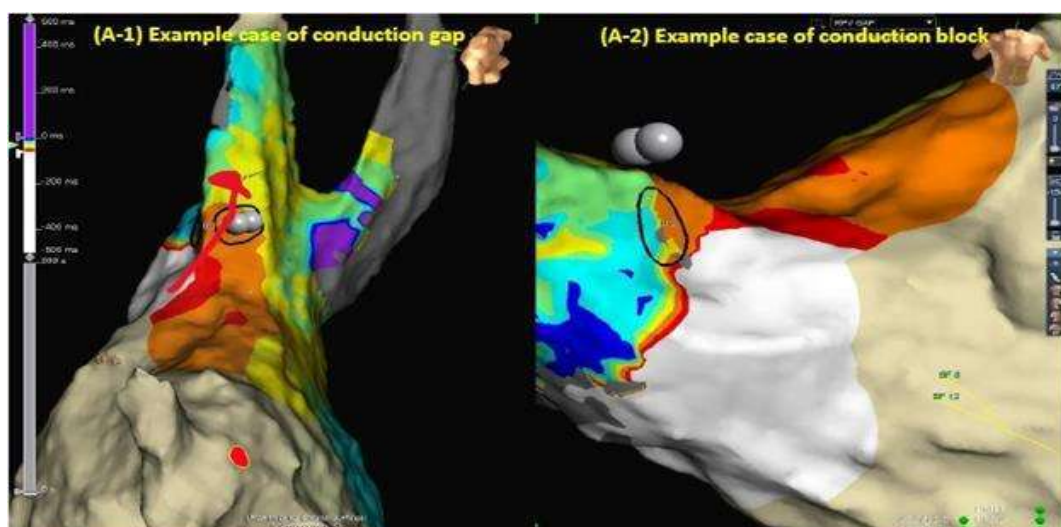
Results

50 conduction gaps were identified from initial 29 patients. The cut-off value for PF to detect conduction gap was 190 Hz and 222 Hz for bipolar and omnipolar electrogram respectively, and both had better AUC value than voltage criteria (Figure, panel B). Applying these cut-off value in the subsequent 83 patients, there was a significant higher AF recurrence rate for the presence of high PF over the PV antrum at the end of the procedure (96.0% vs. 4.0%, $p < 0.001$; 90.9% vs. 9.1%, $p < 0.001$, for bipolar and omnipolar respectively) at 12 months follow-up, which had a better prediction than voltage criteria (Figure, panel C and D).

Conclusion

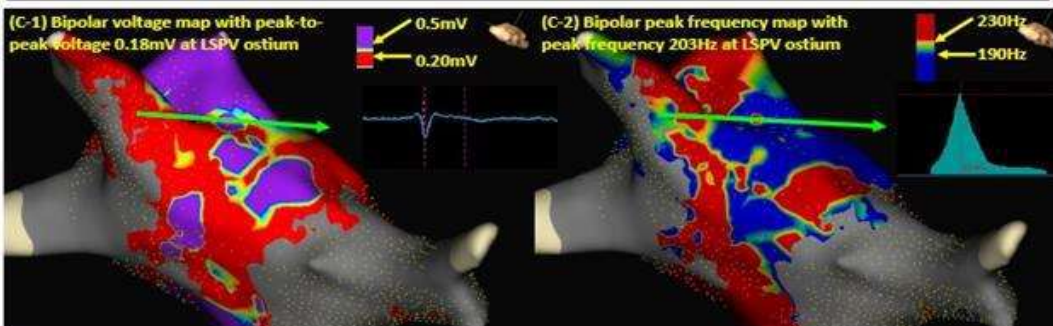
Compared to voltage criteria, PF is better in identifying residual conduction gaps. Besides, the presence of high PF over the PV antrum was of value to predict future AF recurrence.

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(B)

	Sensitivity	Specificity	Cut-off value	AUC
Bipolar peak-to-peak voltage	84.1	75.0	0.197 mV	0.875
Omnipolar peak-to-peak voltage	77.5	86.7	0.324 mV	0.867
Bipolar peak frequency	97.7	96.9	190.25 Hz	0.964
Omnipolar peak frequency	95.0	86.7	222.32 Hz	0.953



(D)

	Patients with AF recurrence (N = 25)			
	Sensitivity	Specificity	PPV	NPV
Bipolar peak-to-peak voltage	64.0%	63.8%	43.2%	83.4%
Omnipolar peak-to-peak voltage	68.2%	62.5%	41.7%	83.3%
Bipolar peak frequency	96.0%	82.8%	70.6%	98.0%
Omnipolar peak frequency	90.9%	62.5%	48.8%	94.6%

Panel A-1 showed an example of conduction gap, which was defined as a site on the prior circumferential PV isolation line from which the activation propagated into the PV and achieved PV potentials elimination by ablation block. Panel A-2 showed an example of conduction block, which was defined as a site adjacent to the conduction gap without activation propagated into the PV. Panel B showed the cut-off value and AUC value for each module to predict the conduction gap. Panel C-1 showed an example case for conduction block defined by peak-to-peak bipolar voltage criteria over left superior pulmonary vein (LSPV); however, using bipolar peak frequency module in the same patient, there was conduction gap over LSPV as shown in Panel C-2, and the patient had AF recurrence 3 months after the index procedure. Panel D showed the sensitivity, specificity, positive prediction value (PPV), and negative prediction value (NPV) for each module and the association with AF recurrence.

Atrial Cardiopathy markers in recurrent stroke - A Prospective observational study.

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Introduction: Atrial Cardiopathy (AC) is one of the presumed mechanisms of recurrent strokes.

Objective: To evaluate the static markers of atrial dysfunction (Atrial Cardiopathy) apart from atrial fibrillation(AF) and assess their ability to predict recurrent non-lacunar strokes.

Materials and Methods:

This is a single-centre prospective observational study of all ischemic strokes of non-lacunar aetiology admitted from May 2021 to March 2022. Clinical profiles of patients, neuroimaging and cardiac parameters (NT-proBNP, ECG and TTE markers) were collected. The data were analysed with univariate and multivariate regression models to determine the predictors of recurrent stroke.

Results: We included 107 subjects with a mean age of 63.9(±12) years in the study. 50% of patients had cryptogenic strokes and 25% had recurrent strokes at admission. Female gender, diabetes, dyslipidaemia (LDL p ~ 0.022), hypertriglyceridemia(p 0.009), elevated creatinine (p-0.03), coronary artery disease and paroxysmal AF were significant predictors of recurrent strokes. Univariate analysis showed that wall motion abnormality and LA Volume (by TTE) > 34ml/sq.m (p ~ 0.001) were associated with recurrent strokes. We did not find any association between ECG markers of atrial dysfunction, LA diameter and Nt-pro BNP with the recurrence of stroke.

Conclusion: High LA volume had a significant association with the risk of recurrence. The current study implies that cardiac substrate is a possible contributing factor to the risk of recurrence. Left atrial volume is a highly promising simple, easily accessible and stable marker of atrial dysfunction and can very well be predicting variable for further stroke events.

Patients-specific Human Induced Pluripotent Stem Cell-derived Atrial Cardiomyocytes Demonstrate Electrical Remodeling in LMNA-related Atrial Fibrillation

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OBJECTIVES

To explore the molecular mechanisms of atrial involvement in laminopathy.

MATERIALS AND METHODS

Human induced pluripotent stem cell (hiPSC) was derived from a 46-year-old male with familial atrial fibrillation and dilated cardiomyopathy carrying LMNA p.R335W heterozygous variant. Atrial cardiomyocytes (ACMs) were induced using a commercial differentiation kit and cultured for over 6 weeks for the following study. Functional tests and RNA sequencing were performed to test the electrical phenotypes in mutant and control cardiomyocytes.

RESULTS

Patient-specific iPSCs carrying LMNA p.R335W variant were differentiated into atrial cardiomyocytes which beat spontaneously and express cardiac troponin T and myosin light chain-2a. The mutant hiPSC-ACMs showed abnormal calcium handling and electrical activity compared with wildtype control using Ca²⁺ and voltage dye (FluoVolt). Bulk RNA-seq revealed differential expressed genes. SCN5A, which encodes the α -unit of the NaV1.5 channel, was downregulated in the LMNA-mutant ACMs.

CONCLUSION

Atrial cardiomyocytes carrying the LMNA variant show abnormal expressions of ion channels, which can offer insight into the mechanism of atrial electrical remodeling in laminopathy.

Clinical Outcomes of Conduction System Pacing

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OBJECTIVES

Conduction system pacing (CSP) comprising left bundle branch (LBBP) and His-bundle pacing (HBP) provide physiological ventricular activation. We compare pacing performances and clinical outcomes of CSP in bradycardia and heart failure (HF) patients to propensity-matched non-CSP controls.

MATERIALS AND METHODS

Consecutive patients from 2 affiliated hospitals undergoing cardiovascular implantable electronic device implantation for guideline-directed indications were enrolled in a prospective registry with linkages to electronic medical records. The impact of CSP was assessed.

RESULTS

Of 910 patients, CSP was attempted in 338 patients (191 LBBP, 147 HBP) (mean age 74±11years, 41% female, mean left ventricular ejection fraction 54±14%) and successful in 282 (81% LBBP vs 78% HBP, p=0.58). LBBP, compared to HBP, was associated with increased optimal device performance, defined as pacing thresholds <2.5V at ≤1ms, R-wave amplitude ≥5mV and absence of CSP-related complications (adjusted odds ratio 9.21, 95%CI 5.08-16.70, p<0.001). Extendable helix leads for CSP were associated with worse lead handling and increased loss of conduction system capture (p<0.05). For bradycardia (628 Right ventricular pacing and 213 CSP), CSP reduced composite outcome of HF-hospitalization, biventricular pacing upgrade or all-cause mortality when ventricular pacing was >20% (adjusted Hazard Ratio(aHR) 0.53, p=0.04). For HF, broad QRS and non-LBB block (48 CSP propensity-matched to biventricular cardiac resynchronisation therapy), CSP reduced HF-hospitalizations or all-cause mortality (aHR 0.42, p=0.01).

CONCLUSION

For bradycardia and heart failure patients fulfilling indications for device therapy, CSP especially LBBP reduces adverse events compared to conventional pacing in Asian patients. CSP should be the default pacing modality of choice.

The HARMS2-AF score to predict incident AF:development and external validation in the UKB and FHS

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¹Alfred Health, Prahran, Australia, ²Baker Heart and Diabetes Institute, Melbourne, Australia, ³University of Melbourne, Melbourne, Australia, ⁴Royal Melbourne Hospital, Melbourne, Australia

Objectives: Lifestyle risk factors are a modifiable target in atrial fibrillation (AF) management. However, the relative contribution of individual lifestyle RFs to AF incidence has not been described. We developed and validated a novel AF-lifestyle risk score to determine the risk of AF development in the general population.

Materials and Methods: The UK Biobank (UKB) is a large prospective cohort with outcomes measured >10 years. Lifestyle risk factors underwent multivariable regression analysis in the UKB and a weighted score was developed, which was externally validated in the Framingham Heart Study (FHS). Kaplan-Meier estimates ascertained the 10-year risk of AF development per 1-point increase in risk score.

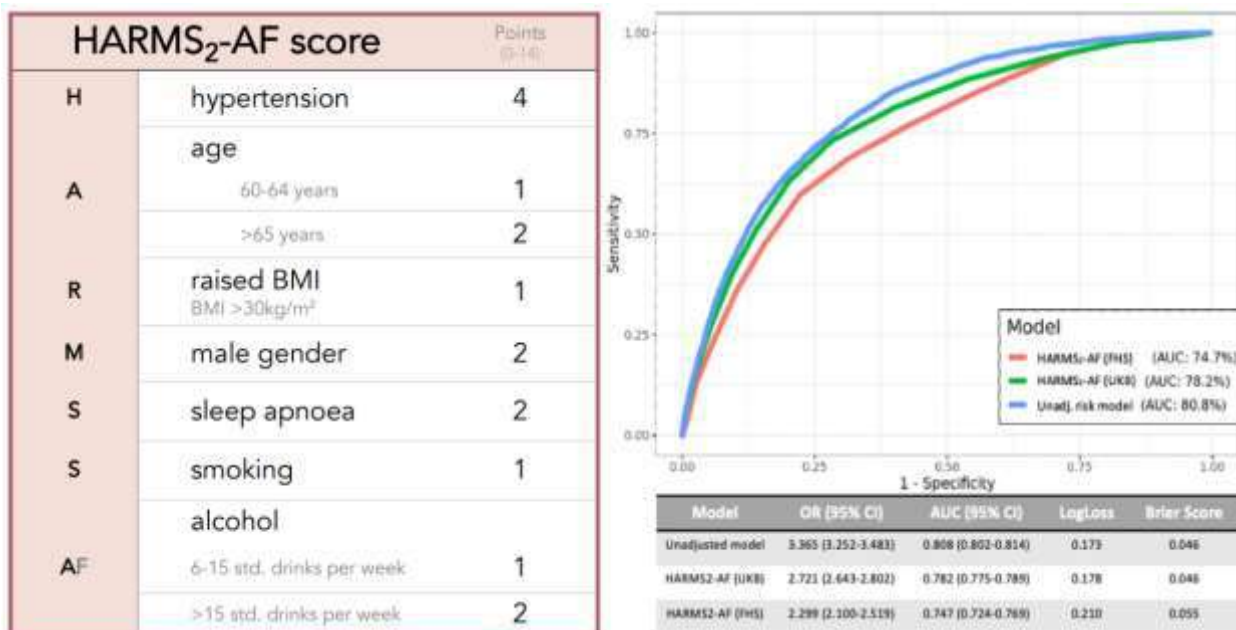
Results: In the UKB, AF incidence was 5.3% among 302,926 participants, with median time to AF 7.3 years (IQR 4.3-9.8).

Hypertension, sleep apnoea, male sex, age, obesity (BMI>30kg/m²), alcohol and smoking were predictive variables (all p<0.001); physical inactivity (OR 1.02, 95%CI 0.97-1.10, p=0.3), diabetes (OR 0.98, 95%CI 0.91-1.06, p=0.2) and BMI 27-30kg/m² (OR 1.02, 95%CI 0.97-1.07, p=0.424) were not significant.

The HARMS2-AF score (figure 1) had similar predictive performance (AUC=0.782, LogLoss 0.178, Brier Score 0.046) to the unweighted regression model (AUC 0.808) in UKB. Validation in the FHS (AF incidence 6.7% of 7206 participants) demonstrated an AUC of 0.747 (95% CI 0.724-0.769). Higher HARMS2-AF score (>5 points) was associated with heightened 10-year AF risk (score 5-9: OR 9.35, score 10-14: OR 33.34).

Conclusion: The HARMS2-AF score is a novel lifestyle risk score which may help identify individuals at risk of AF and assists in general population screening.

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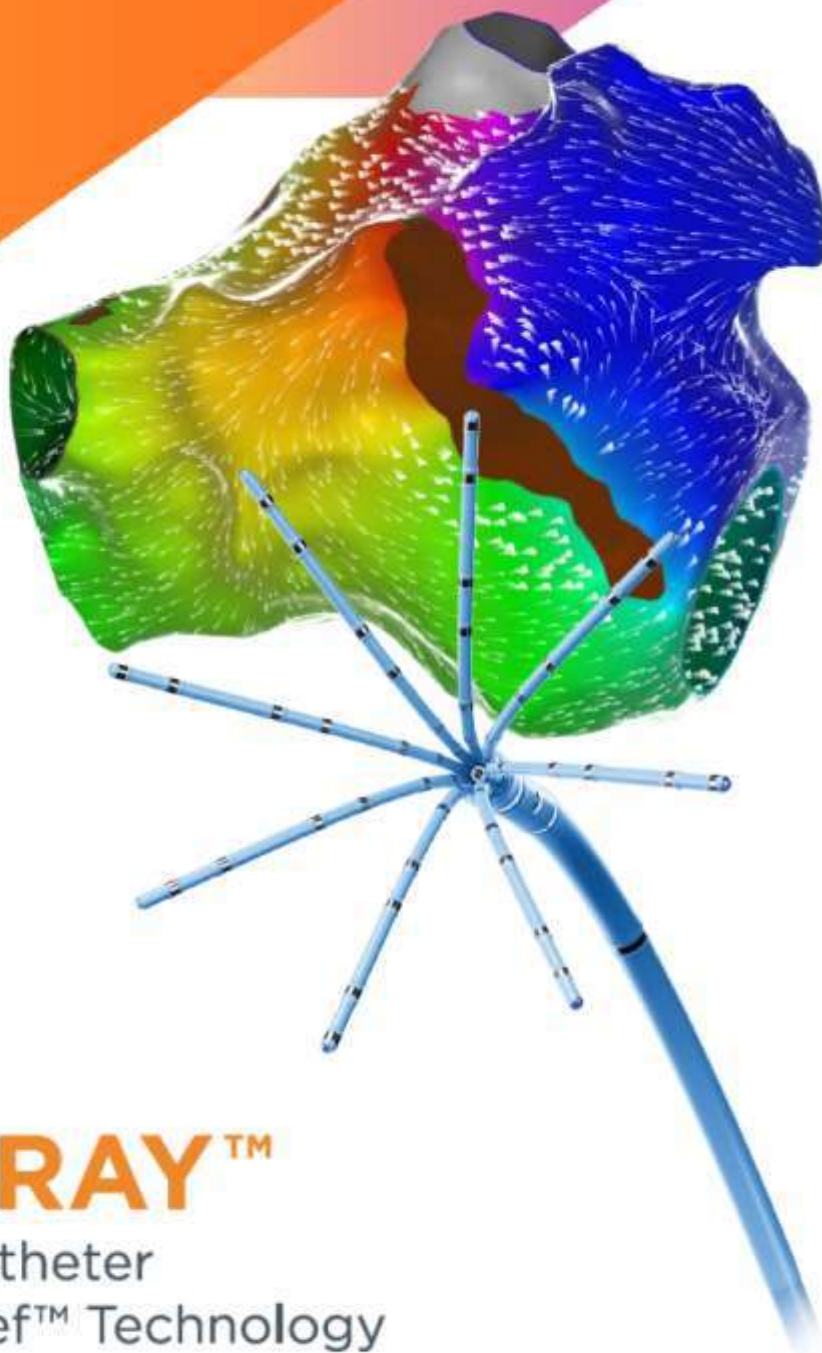
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Irrigated Temperature-Controlled Radiofrequency Ablation: Lesion Characteristics Using a High Thermal Diffusivity Catheter.

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Objective: Assess the efficacy of temperature-controlled, irrigated radiofrequency (RF) ablation in left ventricle (LV) using a high thermal diffusivity catheter tip.

Materials and Methods: In-Vivo experiments were performed in canine animal model after approval by the Institutional Animal Care and Use Committee. Temperature-controlled RF ablation with normal saline irrigation at 8cc/min was performed in the LV using DiamondTemp ablation system (Medtronic, Inc., Minneapolis, Minnesota). After ablation, Animals received 8-10% triphenyl tetrazolium chloride solution followed by same day animal sacrifice for gross pathology examination. Statistical associations were judged using Pearson correlation coefficient (ρ) and R^2 using multivariate regression.

Results: Data from 4 animal experiments were included in our analysis (19 total LV ablations). On average, the catheter-tissue interface temperature was $3 \pm 6.1^\circ\text{C}$ less than the set-temperature. for ablations longer 15s. Average lesion depth, maximum width and volume was $7 \pm 2.9\text{mm}$, $9 \pm 3.7\text{mm}$, and $257 \pm 312.0 \text{ [mm]}^3$ respectively. Higher temperature was associated with increased lesion depth, max width, and volume even after adjusting for duration of ablation and set power ($\rho=0.74$, 0.80 , 0.72 respectively & adjusted R^2 0.64 , 0.62 , 0.57 . $p\text{-value} < 0.01$ for all parameters). Maximum temperature was associated with higher percentage impedance drop and local signal amplitude drop ($\rho=0.85$, 0.52 respectively, $p\text{-value} < 0.05$). Larger impedance and signal amplitude drop also correlated with larger lesion volume ($\rho=0.84$, 0.52 $p\text{-value} < 0.05$).

Conclusion: Temperature-controlled, irrigated RF ablation is effective in LV ablation using a novel high thermal diffusivity catheter. Catheter-tissue interface temperature is a reliable marker that correlates with ablation lesion size in LV.

A Single-centre Experience with Open Window Mapping for Ablation of Accessory Pathways

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Objectives

The use of three-dimensional electroanatomic mapping for localization of accessory pathways (AP) improves the accuracy of substrate prediction, reduces fluoroscopy time and radiation dose. Mapping of accessory pathways (AP) typically involves identification of the earliest ventricular or atrial signals during retrograde or anterograde AP conduction by the operator which is time consuming and limits its efficacy. We report our initial experience in using Open-window mapping (OWM) strategy for the ablation of APs using CARTO 3 System (Version 7) and ThermoCool SmartTouch catheter for ablation (Biosense Webster, Inc).

Material and Methods

High density mapping with OWM strategy utilises an automated detection algorithm which annotates the sharpest local bipolar electrogram deflections (absolute dV/dt) regardless of their chamber of origin, thus, being less dependant on operators in the interpretation of signals. OWM was performed with windows of interest parameters set to include both atrial and ventricular signals.

Results

5 consecutive patients underwent OWM for ablation of AP. Mapping was performed in both anterograde and retrograde conduction in 4 patients. Median mapping time was 25±18min with median fluoroscopy time of 301±151seconds. OWM, when compared to manual point by point mapping, resulted in a more accurate identification of the pathway location. Ablation was successful in all 5 patients with a mean procedure time of 115±80minutes.

Conclusion

OWM is a useful tool that complements traditional mapping techniques and may be invaluable particularly in challenging AP cases. It has the potential to reduce ablation / procedural time and to improve outcomes for our patients.

Safety and Efficacy of Atrioventricular Nodal Reentry Tachycardia Ablation Using an Irrigated Contact Force Catheter

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Background: Atrioventricular Nodal Reentry Tachycardia (AVNRT) ablation is a common procedure in contemporary electrophysiology practice. Traditionally ablation for AVNRT has been performed with non-irrigated catheters, guided by fluoroscopy and intracardiac electrograms. Increasingly electroanatomic mapping systems are utilized to allow for low or zero fluoroscopy procedures. Contact force catheters can provide information on tissue contact and stability that can be helpful in patients with challenging anatomy. Available contact force catheters are irrigated and concern has existed for using irrigated tip ablation catheters for AVNRT ablation due to the potential to create lesions that are too deep and could increase the risk for AV block.

Methods: Review of procedural data from patients undergoing radiofrequency ablation for AVNRT using electroanatomical mapping combined with irrigated contact force catheter.

Results: 50 patients from 4 regions across Australia were included. Procedures were performed by 9 experienced electrophysiologists. No periprocedural complications occurred. Procedural success was achieved in 96%. Median lesion contact force (25-75 centile) was 4.0(2-6)g. Peak power was set at 50W, median baseline irrigation was at 2ml/min and 6ml/min during ablation. Median number of lesions was 9(4.5-17.5); with total ablation time of 203(95-366) seconds. 60% of the cases were performed without fluoroscopy.

Conclusion: ablation of AVNRT using an irrigated contact force catheter on low irrigation setting is safe and effective. Contact force catheters using low irrigation settings may safely improve success rates in AVNRT with challenging anatomy or ablation of other substrate in close proximity to vital structures

Redo Radiofrequency Catheter Ablation of Idiopathic Premature Ventricular Contractions From the Right Ventricular Outflow Tract

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OBJECTIVES

We present a case of a young female with high-frequency monomorphic premature ventricular contractions who underwent redo radiofrequency catheter ablation of the right ventricular outflow tract due to PVC recurrence.

RESULTS

A 24 year old female with no underlying structural heart disease presented with frequent palpitations and progressive dyspnea. There was no history of syncope nor family history of sudden cardiac death. The PVCs had a left bundle branch block morphology with inferior axis, qS in aVL, and transition at V3. Holter showed high PVC burden (30%) with symptom correlation. Echocardiogram showed normal-sized chambers with adequate left ventricular systolic function. Reversible causes were sought and ruled out. She was initially started on metoprolol and amiodarone but was unable to tolerate these. She underwent successful RF ablation of the posteroseptal RVOT and right coronary cusp of the aortic valve. Three weeks later, she had recurrence of symptoms and PVCs with the same morphology, necessitating a redo procedure. During the redo, no PVCs were noted after catheter placement and terbutaline infusion. Decreasing the heart rate using Esmolol resulted in several PVCs. Activation mapping, pace mapping and 3D mapping were performed. RF ablation was done at the posterior RVOT with no recurrence of PVC during the observation period. Reassessment of systolic LV function and Holter monitoring is planned after 3 months.

CONCLUSION

Ablation is recommended as first-line therapy for idiopathic RVOT PVCs. Recurrence of PVC can occur in 15% of patients and can be addressed with a redo ablation.

Dual Reversal of Tachycardia-induced Cardiomyopathy and Sinus Node Dysfunction by Rhythm Control Approach

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Background

Tachycardia-induced cardiomyopathy (TICM) is a subform of reversible dilated cardiomyopathy (DCM). Early recognition and prompt treatment of the arrhythmia results in symptom resolution and recovery of ventricular function.

Case Illustration

A 13-year-old girl was referred to NCC Harapan Kita with dyspnoea during activity, palpitation, and history of fainting. On admission, BP 95/59 mmHg, HR 170 bpm with NYHA III functional class. ECG showed atrial tachycardia. Echocardiography showed dilated all chambers with LVEF 32%, and moderate mitral regurgitation. The patient was initially diagnosed as DCM due to myocarditis. Cardiac MRI revealed no evidence of oedema and fibrosis in the myocardium. Holter monitoring revealed 590 episodes of sinus arrest with longest duration of >5.6 seconds. A sinus node dysfunction (SND) was diagnosed, treated with AAI permanent pacemaker (PPM) implantation. After PPM, the patient still had complaints of palpitation and readmission 4 times in a year despite optimal medication. Therefore, AT ablation was performed as definitive therapy. Soon after ablation, the LVEF improved to 63%, then increased to 75% at the last follow-up. The sinus node function also improved as indicated by decreasing of pacing percentage from 50% to 15%. Medication was rationalized after obtaining good reverse remodeling of the LVEF and sinus node function after ablation.

Summary

We describe a case of 13-year-old girl with TICM initially diagnosed as DCM. The definite diagnosis were AT-induced cardiomyopathy and SND, then treated with AAI PPM and AT ablation. After ablation, there was good reverse remodeling of the LVEF and sinus node function.

Supporting Documents



Fig. 1. The earliest atrial activation was seen at CS 1-2, indicating an ectopic position from the lateral LA



Fig. 2. 3D Activation mapping was created during atrial rhythm simultaneously and revealed the earliest activation at basal anterior left atrial appendage. Multiple RFA was delivered to that area and atrial rhythm was terminated consistently.

Ablation Therapies for Paroxysmal Atrial Fibrillation: A Systematic Review and Patient-Level Network Meta-Analysis

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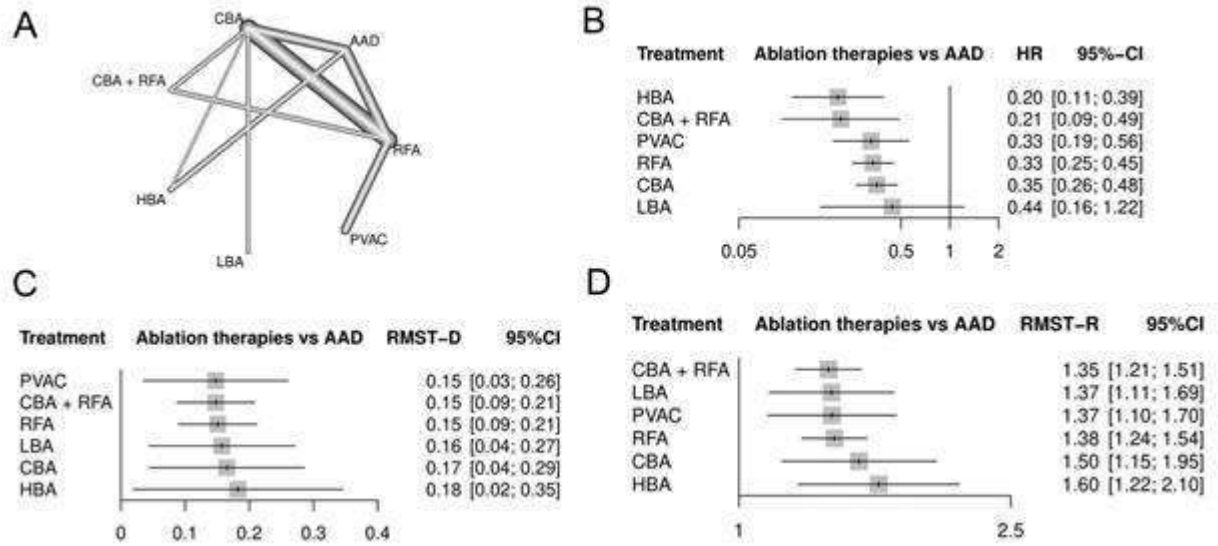
Objective(s): Despite promising trials, catheter ablation is still regarded as an adjunct to antiarrhythmic drugs (AAD) in the treatment of paroxysmal atrial fibrillation (PAF). This study aimed to compare of the effectiveness of various ablation therapies against each other, and versus AAD.

Materials and Methods: Randomized controlled trials or propensity score-matched studies comparing atrial tachyarrhythmia recurrence among any combination of ablation modalities or AAD were retrieved. Kaplan-Meier curves and risk tables for this outcome were graphically reconstructed to extract patient-level data. Frequentist network meta-analysis (NMA) using derived hazard ratios (HRs), as well as two restricted mean survival time (RMST) NMAs, were conducted. Treatment strategies were ranked using P-scores.

Result(s): Across 24 studies comparing six ablation therapies (5,132 patients), Frequentist NMA-derived HRs of AF recurrence compared to AAD were 0.35 (95%CI=0.25-0.48) for cryoballoon ablation (CBA), 0.34 (95%CI=0.25-0.47) for radiofrequency ablation (RFA), 0.14 (95%CI=0.07-0.30) for combined CBA and RFA, 0.20 (95%CI=0.10-0.41) for hot-balloon ablation (HBA), 0.43 (95%CI=0.15-1.26) for laser-balloon ablation (LBA), and 0.33 (95%CI=0.18-0.62) for pulmonary vein ablation catheter. RMST-based NMAs similarly showed significant benefit of all ablation therapies over AAD. The combination of CBA + RFA showed promising long-term superiority over CBA and RFA, while LBA showed favorable short-term efficacy.

Conclusion: The advantage of ablation therapies over AAD in preventing atrial tachyarrhythmia recurrence suggests that ablation should be considered as the first-line treatment for PAF in patients fit for the procedure. The promising nature of several specific therapies warrants further trials to elicit their long-term efficacy and perform cost-benefit analysis.

Supporting Documents



Impact of Catheter Stability on Ablation Using Local Impedance Sensing Catheter With High-power Short-duration Setting

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OBJECTIVES

Local impedance (LI) measurement during atrial fibrillation (AF) ablation has emerged as a novel indicator of tissue characteristics and the consequent durability of lesions created. We investigated the impact of catheter stability on lesion creation in pulmonary vein isolation (PVI) using high-power short-duration (HPSD) strategy with novel catheter capable of LI and contact force (CF) measurement.

MATERIALS AND METHODS

Forty consecutive patients who underwent PVI using HPSD (50 W) were divided into two groups. 28 Patients in high stability group (CF>5g for >90% of time, HS-G) were compared with 12 controls in low stability group (CF>5g for >25% of time, LS-G). In both groups, target CF was 5-40g and target, impedance drop was set to be 15% within 15 sec and 17% within 20sec for posterior wall and anterior wall respectively. PVI ablation circles were divided into 12 anatomic segments for localization of gaps.

RESULTS

A total of 2200 RF applications were analyzed. After PVI we found gaps in 5/331 segments (1%) in HS-G, which is significantly lower than 8/136 segments (6%) in LS-G ($p=0.03$). Gaps were more common in carinal sites than non-carinal sites in both groups (6% vs 1%, $p=0.01$). There were no significant differences among blood impedance, initial LI, ablation time or epicardial connection (9 vs 10%, $p=0.66$) in both groups. But HS-G had higher CF, LI drop (Δ LID) and Δ LID/initial LI ($p<0.001$).

CONCLUSION

Catheter stability leads to acute successful lesion creation during PVI when guided by percentage local impedance drop in HPSD setting.

Soft but strong – Pericardial collection during RVOT VT mapping using Advisor HD Grid catheter

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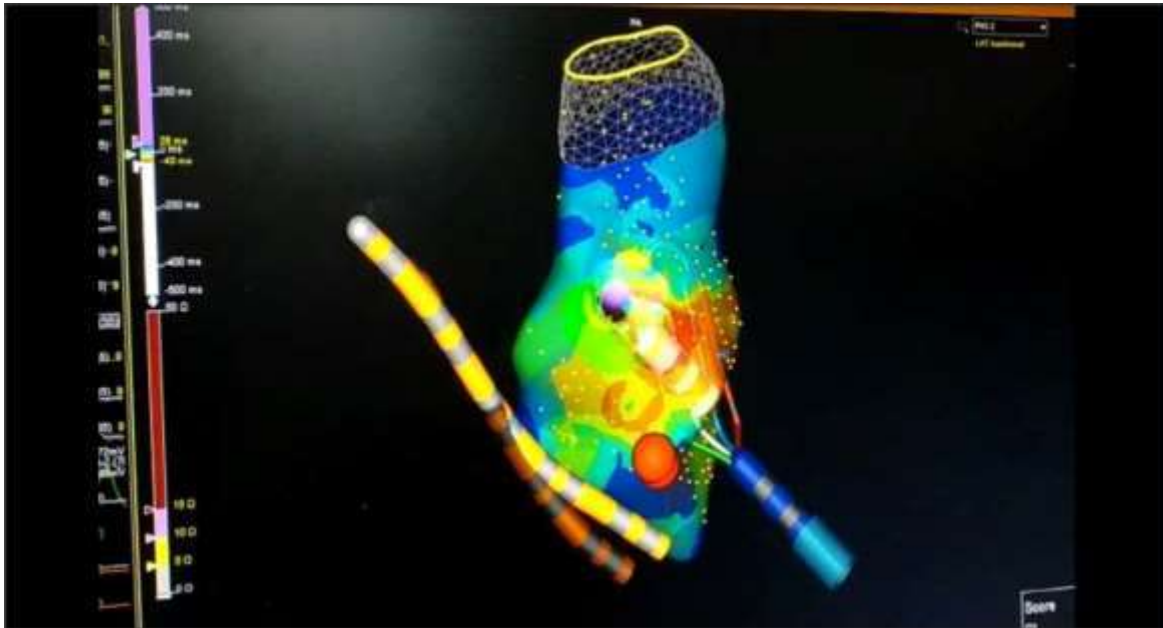
Objective: The Advisor HD Grid mapping catheter has had a significant impact on the practice of 3D Electroanatomic mapping during Cardiac Electrophysiological studies. The catheter is soft, flexible and atraumatic designed allowing better maneuverability in difficult anatomical sites. However it can be potentially traumatic in areas of reduced thickness.

Methodology: We are describing a case of a 60 year old female with frequent ill sustained wide complex tachycardia having LBBB morphology and inferior axis on surface ECG. The region of earliest activation could be mapped using HD Advisor Grid catheter at Right anterolateral free wall of RVOT. Post mapping she developed early features of cardiac tamponade. After pericardiocentesis, repeated attempts at ablation at that site failed to terminate the tachycardia. Hence the Epicardial surface of RVOT was mapped via Intrapericardial Access using the ablation catheter. Burst of RF applied at the point of earliest activation on the epicardial surface of RVOT, carefully monitoring the left coronary system, resulted in termination of tachycardia. Pericardial Drainage catheter was left in situ.

Results: RVOT VT was successfully ablated via epicardial approach. 105ml of pericardial fluid was drained in a period of 72 hours post procedure. The pericardial drainage catheter was removed on day 3 post procedure and patient was discharged. She had no recurrence of VT or pericardial effusion at followup.

Conclusion: Although the Advisor HD Grid catheter is having an excellent safety profile, caution is required at areas of reduced thickness in the Heart like the atrial appendage, RV apex and RVOT.

Supporting Documents





Zero-fluoroscopy Ablation for Ventricular Arrhythmias Originating from the Right Ventricular Outflow Tract

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Objectives: Zero-fluoroscopy (ZF) ablations using 3D mapping system applied various types of arrhythmias are trending and practiced in many centers over the world, but rarely done in Vietnam. The objective of this study was to evaluate the efficacy and safety of zero-fluoroscopy ablation for RVOT VAs, compared with conventional fluoroscopy approach.

Methods and results: We conducted a prospective single-center study including 114 patients with RVOT VAs, electrocardiographic features of typical left bundle branch block, inferior axis QRS morphology and a precordial transition $\geq V3$, from May 2020 to July 2022. The patients were assigned to 2 different approaches of either ZF or fluoroscopy (F) group in a 1:1 ratio. After the period of follow-up for 2 groups of patients of ZF and F approach 5.0 ± 4.9 (months) and 6.9 ± 9.3 (months), respectively, the results showed a higher success rate in the conventional fluoroscopy approach group than in the complete zero-fluoroscopy group (87.3% versus 86.8%), but the difference was not statistically significant. No major complication was noted in both groups.

Conclusion: ZF ablation for RVOT VAs can be done safely and effectively by using the 3D electroanatomic mapping system. The results of ZF approach are comparable to that of the conventional F approach.

Supporting Documents

Table 1. Demographic and clinical characteristics of the study population.

Baseline characteristics of patients	ZF (n= 53)	F (n= 55)	P value
Age (mean $\pm$ sd)	52.6 $\pm$ 13.4	48.8 $\pm$ 14.1	0.15
Female (%)	73.6%	80.0%	0.43
Symptoms			

Chest pain (%)	60.4%	51.9%	0.39
Dyspnea (%)	39.6%	40.4%	0.93
Palpitation (%)	72.9%	76.9%	0.64
Syncope/near-syncope (%)	13.2%	20.4%	0.32
Holter recordings			
PVC only (%)	77.4%	70.4%	0.41
Nonsustained VT (%)	15.7%	26.4%	0.18
Sustained VT (%)	0.0%	5.5%	0.09
PVC/24h (mean $\pm$ sd)	23849.3 $\pm$ 12551.7	22481.0 $\pm$ 10414.5	0.55
Echo findings			
LVEF (%)	63.4 $\pm$ 10.2	64.7 $\pm$ 9.4	0.48

ZF = zero-fluoroscopy, F = fluoroscopy, PVC = premature ventricular complex, VT = ventricular tachycardia, LVEF = left ventricular ejection fraction

Table 2. Procedural parameters and ablation outcomes

<i>Characteristics</i>	<i>ZF (n=53)</i>	<i>F (n=55)</i>	<i>P value</i>
Ablation catheter			
Irrigated (n, %)	(27/53) 50.9%	(27/55) 49.1%	0.85
Procedural results			
Total procedure time (minutes) (mean $\pm$ sd)	67.9 $\pm$ 22.2	62.9 $\pm$ 31.1	0.34

Fluoroscopy time (minutes) (mean±sd)	00.0 ± 00.0	718.5 ± 465.1	0.000
DAP (mean ± sd)	00.0 ± 00.0	26493.6 ± 69499.1	0.007
Total RF ablation time (seconds) (mean±sd)	503.4 ± 263.5	656.0 ± 465.8	0.01
Number of lesions (mean±sd)	6.2 ± 3.6	8.7 ± 6.0	0.012
Local EAT (ms) (mean±sd)	28.8 ± 6.4	24.8 ± 4.4	0.000
Major complication (n, %)	0 (0.00%)	0 (0.00%)	-
Period of follow up (month) (mean±sd)	5.0 ± 4.9	6.9 ± 9.3	0.21
Acute success rate (%)	(53/53) 100%	(54/55) 98.2%	0.32
Success rate (%)	(46/53) 86.8%	(48/55) 87.3%	0.94

ZF = zero-fluoroscopy, F = fluoroscopy, DAP = dose area product, RF = radio-frequency, EAT = earliest activation time

Table 3: Parameter of zero-fluoroscopy procedure with different arrhythmogenic foci in the RVOT

<i>Sites of foci in the RVOT</i>	<i>No. patients</i>	<i>Procedure time(minutes)</i>	<i>RF ablation time(seconds)</i>	<i>Recurrence rate (%)</i>
(1) Free-wall, right, and proximal side (n, %)	6 (11.3%)	76.67 ± 24.8	476.0 ± 226.9	(1/6) 16.7%
(2) Free-wall, right, and distal side (n, %)	3 (5.7%)	55.0 ± 8.66	444.0 ± 56.7	(0/3) 0%

(3) Free-wall, left, and proximal side (n, %)	8 (15.1%)	68.8 ± 23.6	567.3 ± 281.2	(1/8) 12.5%
(4) Free-wall, left, and distal side (n, %)	2 (3.8%)	87.5 ± 46.0	382.5 ± 81.3	(0/2) 0%
(5) Septal, right, and proximal side (n, %)	3 (5.7%)	55.0 ± 20.0	435.0 ± 117.3	(2/3) 66.7%
(6) Septal, right, and distal side (n, %)	4 (7.5%)	62.5 ± 29.6	516.0 ± 341.7	(1/4) 25%
(7) Septal, left, and proximal side (n, %)	20 (37.7%)	68.8 ± 17.1	495.7 ± 309.0	(0/20) 0%
(8) Septal, left, and distal side (n, %)	7 (13.2%)	65.4 ± 28.9	558.1 ± 283.3	(2/7) 28.6%

RVOT = right ventricular outflow tract

Figure legends:

Figure 1: Utility of non-steerable decapolar catheter for activation mapping of RVOT VAs

Figure 2. The acute success rate and follow-up outcomes

Figure 3: The learning curve for zero-fluoroscopy procedure

Figure 1: Utility of non-steerable decapolar catheter for activation mapping of RVOT VAs



Figure 2. The acute success rate and follow-up outcomes

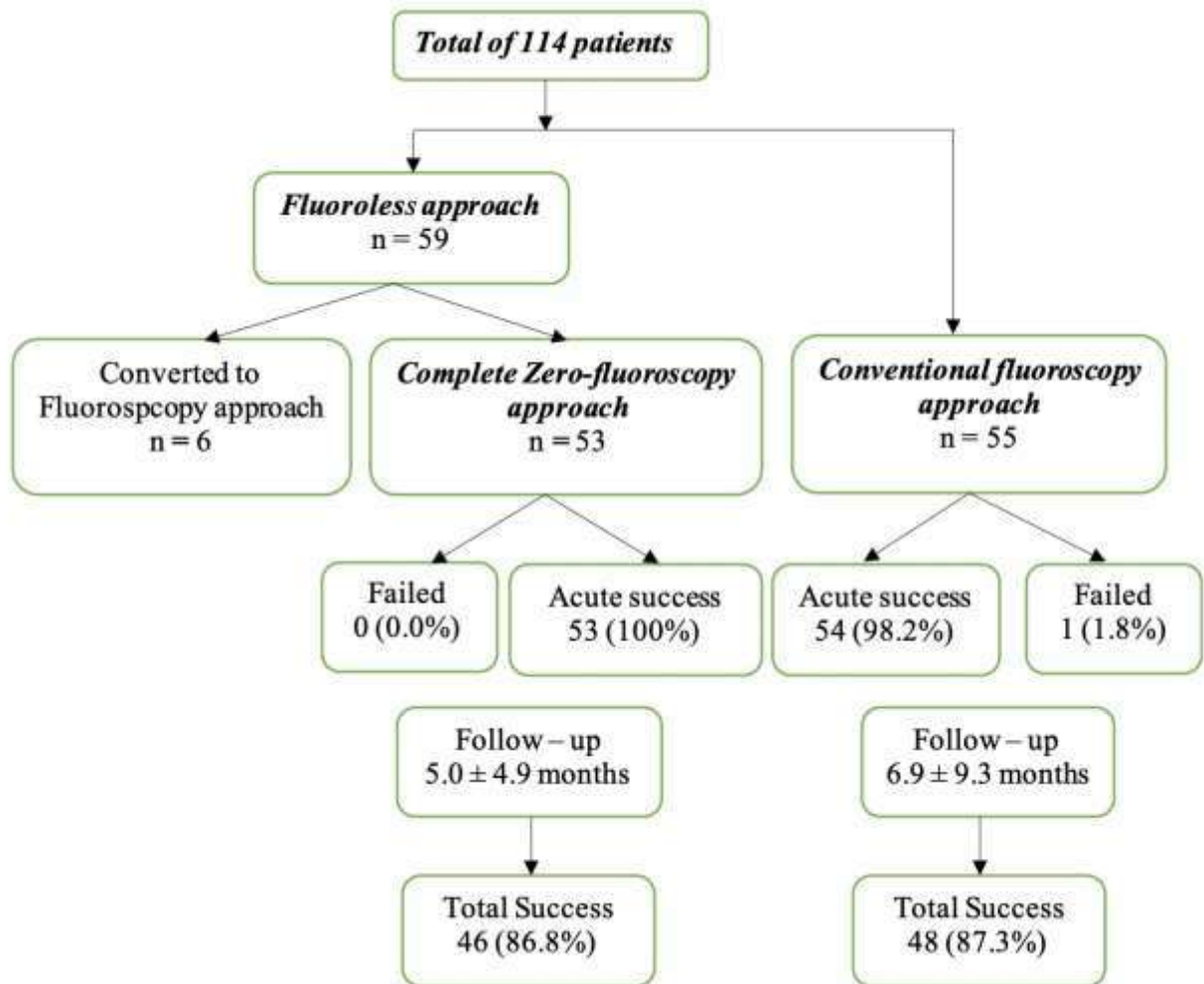
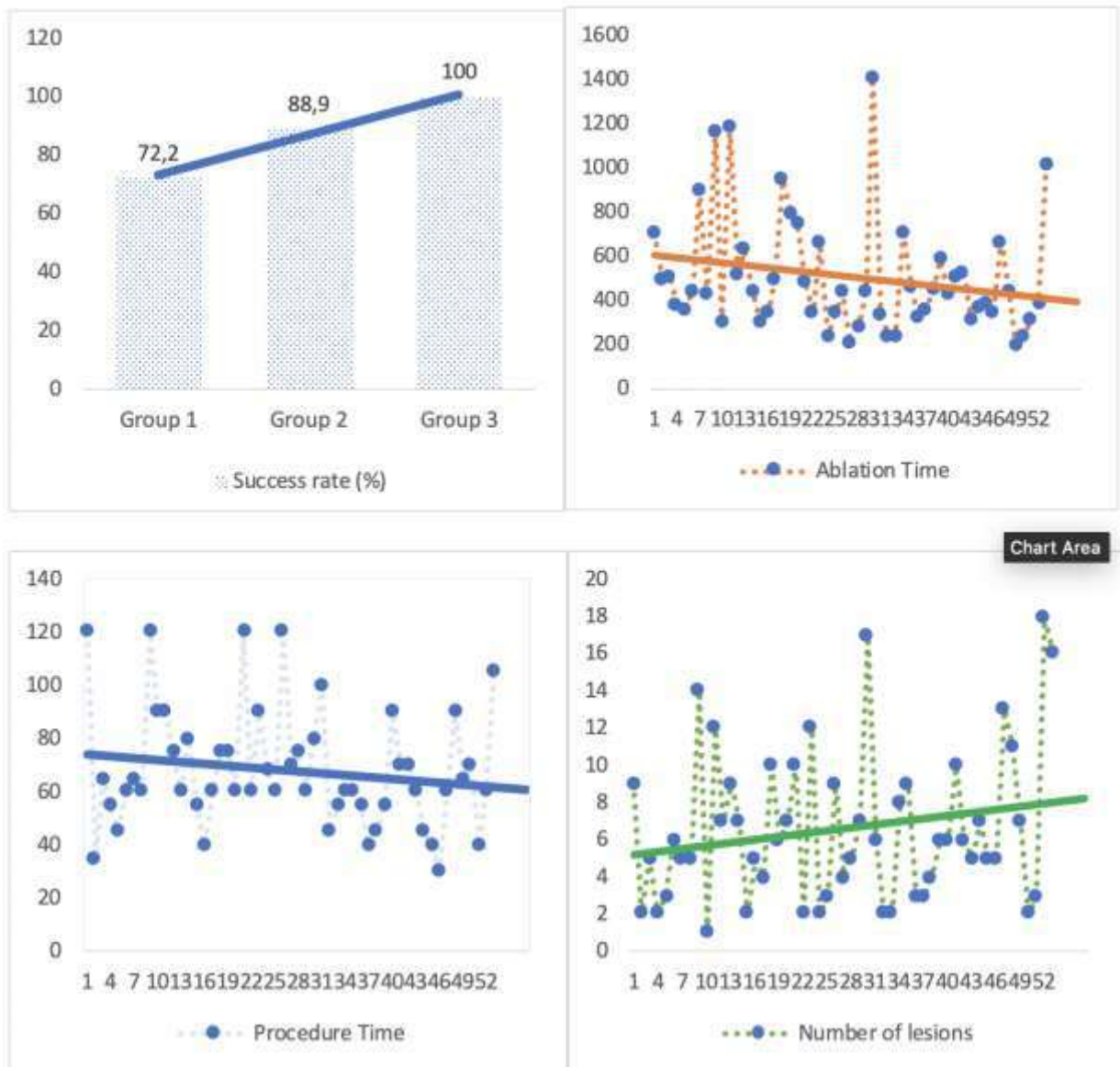


Figure 3: The learning curve for zero-fluoroscopy procedure



Comparison of 3D Ablation With Conventional Ablation on the Duration of Fluoroscopy and Radiation Dose

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OBJECTIVES

Radiofrequency catheter ablation is a widely used procedure for cardiac arrhythmias. This procedure has been traditionally performed under fluoroscopy guidance and requires high radiation exposure for patients and medical staff. Nowadays, this issue becomes increasingly important, even the ALARA principles is an routine in cathlab. Therefore, 3D navigation mapping has developed and this technology will reduce the procedure time and use of fluoroscopy. This study investigated whether ablation with a 3D mapping system has any impact on radiation exposure to the patients and medical staff.

MATERIALS AND METHODS

Twenty-two (47.7 ± 13.3 years ; 4 male and 18 female) consecutive patients who underwent ablation in General Regional Hospital Pasar Rebo between January 2021 and June 2022 were included. The design study is a retrospective cohort. Variable is presented as Total Dose Area Product (DAP) dan fluoroscopy time.

RESULTS

Twenty – two ablation were performed. 13 patients underwent conventional ablation and 9 patients underwent 3D ablation. There was a difference between the meantime of fluoroscopy and total DAP between 3D ablation and conventional ablation. 3D ablation has a lower fluoroscopy time (17.28 ± 17.47 vs 39.93 ± 33.70 minutes ; $p = 0.021$) and lower total DAP (41.41 ± 46.90 vs 67.59 ± 40.37 mGycm² ; $p = 0.036$) compared to conventional ablation.

CONCLUSION

This study shows that statistically, 3D ablation is an option to reduce radiation exposure to patients and medical staff, due to the lower total DAP and fluoroscopy time compared to conventional ablation.

Safety And Efficacy Of Intracoronary Chilled-saline Infusion During Epicardial Ablation In The Left Ventricular Summit

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Introduction: Catheter ablation in the left ventricular summit(LVS) is challenging owing to its intimate relationship with the proximal coronaries.

Objectives: To determine the safety and efficacy of intracoronary chilled saline infusion during ablation in the LVS.

Methods: Patients with symptomatic PVC from the LVS formed the study population. Patients with significant coronary artery disease (coronary stenosis >50%) were excluded from the study. Irrigated ablation was performed in the epicardium either percutaneously or transvenously via the distal great cardiac vein (GCV). Chilled saline (5-10 degrees Celsius) was administered into the left main coronary artery (LMCA) at 50 ml/min throughout the entire duration of ablation. A coronary angiogram was always performed to delineate the distance of the ablation catheter from the proximal coronaries before and after ablation.

Results: Between January 2020 and October 2021, 27 patients (mean age 46.2±10.8 years; 14 females; mean LVEF 46.6±7.9%) underwent epicardial ablation in the LVS. Fourteen patients had LVEF<50% (PVC-induced cardiomyopathy). Epicardial ablation was percutaneously achieved in six patients, whereas in 21 patients, it was performed transvenously in the distal GCV. Chilled saline was infused into the LMCA throughout the entire duration of RFA in all the patients without any untoward effect. Acute procedural success was achieved in 25 out of the 27 patients(92.6%). At a mean follow-up of 19±7.9 months, 24 patients (88.9%) were asymptomatic and free from clinical arrhythmia.

Conclusions: Intracoronary chilled saline administered during epicardial ablation in the LV summit is safe and effective in preventing collateral damage to the proximal coronaries.

Temporal Influence of Operator Fatigue on Atrial Fibrillation Ablations: A Single-Center Analysis with Cartonet Data

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Supporting Documents

Background

The relationship between procedure time-of-day and operator fatigue has yet to be determined. Therefore, we sought to utilize the data from the Cartonet system to understand the temporal influence on catheter stability and lesion characteristics during the procedure, which could be a surrogate for operator fatigue.

Methods

We performed a retrospective analysis of early (before 12 pm) versus late (after 3 pm) CAAF for the outcome of catheter stability and ablation lesion characteristics compared using a two-sided t-test.

Results

Of 162 ablations, the mean age of patients was 71.3 ± 10.2 years; 67% were male, 33% were female, 17% (n=28) were late, and 83% (n=134) were early. The primary outcome of mean catheter stability in the early group was 0.96 ± 0.64 mm vs. 0.80 ± 0.57 mm in the late group ($p=0.62$). Early vs late metrics for secondary outcomes demonstrated; average ablation time 31.3 ± 10.5 minutes vs 28.2 ± 11.6 minutes ($p=0.22$), average number of ablations per procedure of 145 ± 52 vs 132 ± 44 ($p=0.19$), average ablation index 355 ± 59 vs 345 ± 104 ($p=0.66$); average impedance drop $-622 \pm 430 \Omega$ vs $-788 \pm 485 \Omega$ ($p=0.12$); average maximum power 40.0 ± 3.7 W vs 41.5 ± 3.9 W ($p=0.10$) and mean average force 11.1 ± 6.3 g vs 9.5 ± 15.5 g ($p=0.62$).

Conclusion

Our retrospective analysis demonstrated no difference in catheter stability, a surrogate for operator fatigue, compared to late-in-day procedures. Ablation lesion characteristics are thus likely independent of the time the procedures are performed in a day. However, future data from prospective studies should define the temporal impact of the procedure start time on the ablation lesions.

Outcome Analyzed	Early	Late	P-value
<i>Catheter Stability</i>	0.96 $\pm$ 0.64 mm	0.80 $\pm$ 1.57mm	0.62
Ablation Time	31.3 $\pm$ 10.5 minutes	28.2 $\pm$ 11.6 minutes	0.22
Number of Ablations	145 $\pm$ 52	132 $\pm$ 44	0.19
Ablation Index	355 $\pm$ 59	345 $\pm$ 104	0.66
Impedance Drop	-622 $\pm$ 430 Ω	-788 $\pm$ 485 Ω	0.12
Max Power	40.0 $\pm$ 3.7 W	41.5 $\pm$ 3.9 W	0.10
Force	11.1 $\pm$ 6.3 g	9.5 $\pm$ 15.5g	0.62

Table 1 Primary outcome and secondary outcomes from Cartonet data comparing early versus late-in-day procedures.

Novel approach for PVI utilizing the third generation laser-balloon system in patients with atrial fibrillation.

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Abstract:

Background: The visually guided laser balloon ablation system (LB) offers a unique technology for PVI. The novel third-generation LB (LB3) provides a new feature. The rapid mode offers the possibility to apply an automated continuous 360° lesion, which enables effective and fast PVI. After a learning curve of 15 cases, we implemented a novel approach utilizing a single transseptal puncture.

Methods: A total of 30 consecutive patients with symptomatic AF were enrolled. 15 patients were treated via a conventional approach with two transseptal punctures and 3D mapping (control). Patients 16-30 were treated utilizing a slenderer approach (Fast).

Results: All patients underwent PVI, using the LB3 ablation system. All 114 (100%) pulmonary veins could be successfully isolated. The median procedure time was 60.5 (IQR 53, 77) min (control: 77 (IQR 68, 87) min, fast: 52 (IQR 43, 60) min, $p < 0.001$. Percentage of rapid mode was 98 (IQR 94, 100) % (control: 97 (IQR 91, 99) min, fast: 100 (IQR 95, 100) min, $p = 0.134$. Rapid mode only was achieved in 54% of PVs. Single sweep PVI was achieved in 40% of PVs. Severe adverse events occurred in a total of 1 out of 30 patients (3%): one case of pericardial tamponade requiring pericardiocentesis, which was successfully performed. This occurred during the 6th case.

Conclusion: The fast PVI approach utilizing the LB3 offers an effective and safe as well as significantly faster PVI compared to the standard approach.

Epicardial Fat Volume and Outcomes of Posterior Wall Isolation in Patients With Persistent Atrial Fibrillation

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¹*Yonsei University College Of Medicine, South Korea*

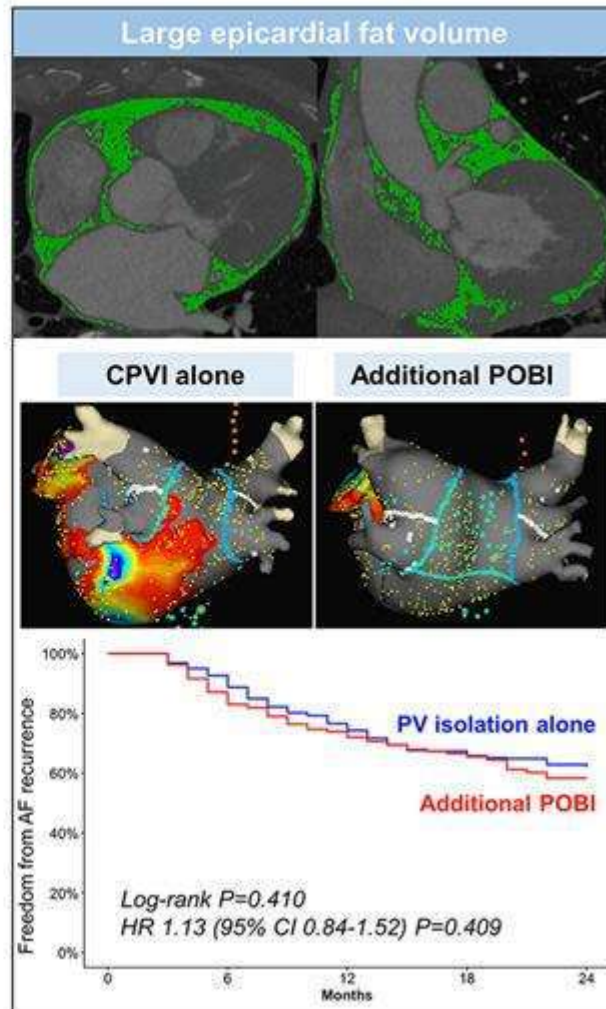
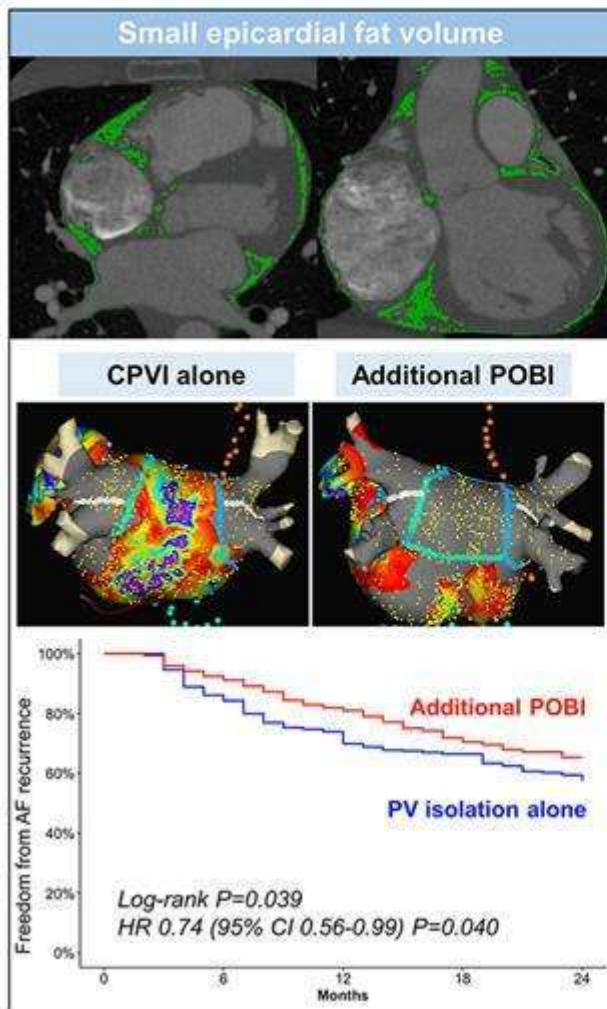
Objectives: Increased epicardial adipose tissue (EAT) is associated with higher recurrences after atrial fibrillation catheter ablation (AFCA). We investigated the effects of posterior wall box isolation (POBI) in addition to circumferential pulmonary vein isolation (CPVI) on rhythm outcomes with varying epicardial adipose tissue (EAT) volumes in patients with persistent atrial fibrillation (PeAF).

Materials and Methods: We included 1,187 patients with PeAF undergoing a de novo AFCA including those receiving CPVI alone (n=687) and those receiving additional POBI (n=500). The rhythm outcomes at two years post-AFCA were compared in subgroups stratified by the EAT volume using propensity overlap weighting.

Results: A reduced EAT volume was linearly associated with more favorable rhythm outcomes for additional POBI than for CPVI alone (P for interaction=0.002). Among the patients with smaller EAT volumes (≤ 116.23 ml, the median value, n=594), additional POBI was associated with a reduced AF recurrence risk as compared to CPVI only (weighted HR [hazard ratio] 0.74, 95% CI [confidence interval] 0.56–0.99). In contrast, among the remaining 593 patients with greater EAT volumes (> 116.23 mL), there was no difference in the recurrence risk between the additional POBI and CPVI alone groups (weighted HR 1.13, 95% CI 0.84–1.52). Among 205 patients with repeat ablations, the POBI reconnection rate was significantly higher in the large EAT group (77.4%) than in the small EAT group (56.7%, P=0.034).

Conclusion: While PeAF patients with a smaller EAT volume averted AF recurrence by additional POBI after CPVI, no benefit of the POBI was observed in those with a greater EAT volume.

Supporting Documents



First Experience of Pulse Field Ablation for AF Ablation in Singapore

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Pulsed field ablation (PFA) using the Farapulse system was introduced in September 2022 to Singapore. We describe here this initial experience.

Methods: Patients with paroxysmal or persistent atrial fibrillation were included, but only PFA pulmonary vein isolation was allowed. Procedures were performed under conscious sedation, with or without intracardiac echocardiography / CT coronary angiography / pulmonary vein angiography / pre- or post-ablation electroanatomic mapping at the operators discretion. Ablation protocol mandated 8 ablation lesions per vein (2.5s pulses, 4 in basket configuration, 4 in flower configuration), as per manufacturer recommendations.

Results: 10 patients underwent PFA for AF by 6 different operators (9 paroxysmal, 1 persistent, all de-novo procedures). Mean procedure time was 141 minutes. Mean time from insertion of the Farawave catheter to completion of PVI was 56 minutes. Post-ablation mapping was performed in 6 cases (4 with Rhythmia Orion, 2 with Ensite X HD Grid). All mapped veins were confirmed acutely isolated at the antral level. Conscious sedation with midazolam, fentanyl and propofol was used (9 continuous, 1 bolus; 0.7mg, mean dose of 127mcg and 323mg respectively). Mean and median post-procedure day 1 pain score recalled by patient was 2.75 and 2 out of 10 respectively. There were no acute complications during the case or at post-op day 1.

Conclusion: PFA was effective for pulmonary vein isolation in paroxysmal AF patients. Time for completion of PVI was low even for new operators. Significant pain occurs during PFA—conscious sedation using propofol and fentanyl was successful in dealing with PFA-induced pain.

Wave Speed Mapping for Rapid Termination of Atrial Flutter With New Omnipolar Technology

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Background: Omnipolar Technology (OT) provides information on conduction velocity, activation direction and voltage irrespective of catheter orientation by leveraging unipolar and bipolar signals measured from Advisor™ HD Grid (HD Grid, Abbott) mapping catheter. Whether conduction velocity aids in characterization of atrial flutter (AFL) circuits is currently unknown.

Objective: To assess the use of OT Wave Speed (WS) in delineating areas of AFL critical isthmuses as compared to traditional local activation time (LAT) mapping.

Methods: We report 18 cases (15 atypical, 3 typical; mean age: 70.5±9 years) presenting with symptomatic AFL. Patients underwent atrial mapping with HD Grid. We compared LAT maps of critical isthmus to slowest conduction zone identified by WS; 12 retrospective on EnSite Precision™ system and 6 prospective on EnSite™ X system. WS values of 0.9±0.6 mm/ms were found to discriminate critical areas of AFL circuit. Continuous variables were checked for normality with Shapiro-Wilk test, and statistical comparisons were made with t or Wilcoxon rank-sum tests.

Results: Slowest conduction area identified by WS was significantly smaller than that identified by LAT (0.4 cm² and 1.2 cm², respectively; p=0.02). In Figures A and B below, a single radiofrequency delivery at this latter point corresponded to arrhythmia termination. In data set, slow WS areas correlated to termination in 100% of patients.

Conclusion: Identifying smaller areas of interest with WS mapping could facilitate understanding of AFL circuitry and drive more specificity in CA. WS mapping is a promising tool that should further explored.

Supporting Documents

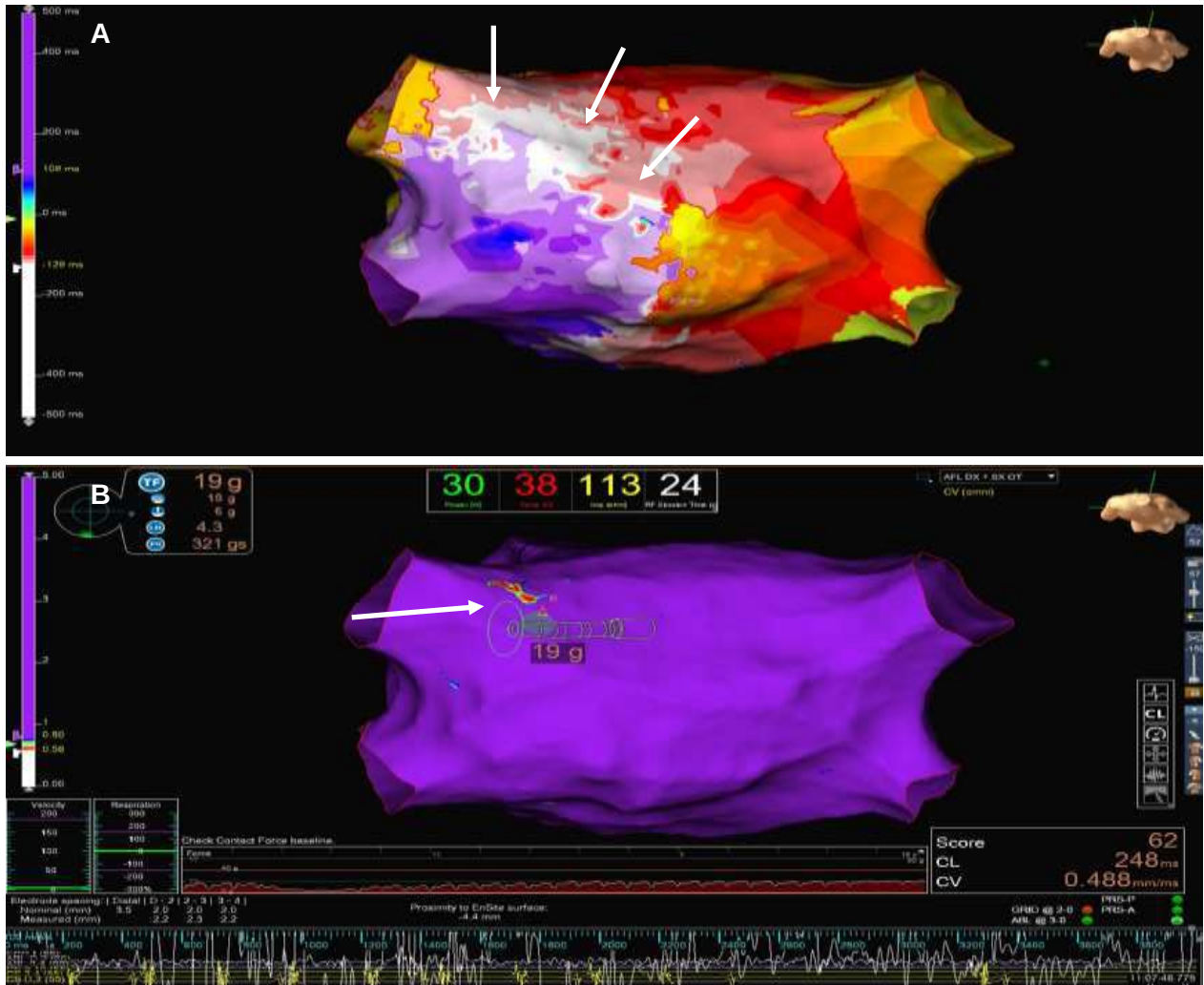


Figure: (A) Standard LAT map of atrial flutter circuit, (B) Wave speed map of atrial flutter circuit.

Impact of PV isolation with Third Generation Laser Balloon Ablation System combined with Coated Balloon

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Supporting Documents

OBJECTIVES

The third generation laser balloon ablation system (X3) with automated laser rotation mechanism, namely RAPID mode has been widely introduced for pulmonary vein (PV) isolation as a safe and effective treatment tool of atrial fibrillation (AF). However, pinholes due to conductive heating was to be improved to maximize the benefit of RAPID mode. In this study, the acute X3 procedural results with newly developed robust coated balloon were analyzed.

MATERIALS AND METHODS

We analyzed 148 patients from 4 EU centers treated with coated-balloon X3. LA procedure was limited to PV isolation and PVs were checked with multielectrode ring catheter. Procedure time and % of RAPID mode ablation were all measured.

RESULTS

The average patient age was 66+/-11 years old, 40.5% (60/148) were female, and 66.9% (99/148) were paroxysmal AF. All patients underwent PV isolation with X3 without RF touch up. The mean skin-to-skin procedure time was 57.8+/-17.6 min, the LA dwell time including PV isolation was 44.8+/-16.0 min, and fluoroscopy time was 5.3+/-4.3 min. RAPID mode was utilized in all of the treated PVs and 80.7% of the total ablation time per vein. Of all the treated PVs, 207 out of 574 veins (36.1%) were isolated in a single sweep with RAPID Mode. The first pass PV isolation was achieved in 96.5% (553/573 veins). No pinholes were reported and only one transient phrenic nerve palsy was observed.

CONCLUSION

Newly established X3 with coated balloon demonstrated safety profile and short procedure time to maximize RAPID mode laser balloon ablation.

WPW Syndrome and Preexcitation-Induced Cardiomyopathy: Is It a Causal or Casual Relationship?

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Supporting Documents

Background: Patients with Wolff-Parkinson-White (WPW) syndrome, presence of an accessory pathway (AP), results in palpitation symptom most commonly due to Atrioventricular Reentrant Tachycardia (AVRT). The mechanism for the development of left ventricular dysfunction in patients with pre-excitation syndrome has not yet been fully elucidated, and its prevalency in Indonesia is not well known. The eccentric ventricular activation via AP, may arise in right-sided AP, could result in an asynchronous spread of ventricular depolarization, then leads to LV dyssynchrony and worsening LV dysfunction, defines as Preexcitation-Induced Cardiomyopathy (PIC).

Objective: To review the magnitude of impact of Right AP of Pre-excitation Syndrome resulting in PIC and to discuss the result of successful Right AP ablation for LV systolic function improvement of our patient in NCCHK.

Case Illustration: A 12-year-old female patient with WPW Syndrome and congestive heart failure due to Non-Ischaemic Cardiomyopathy with 18% of LV ejection fraction (EF). During the radiofrequency ablation (RFA), the AP was found in the right anterior location, in accordance with the 12-lead ECG analysis. The RFA for AP procedure was done successfully. Six month after successful AP ablation, her LVEF was increased significantly to 35%.

Summary: The cardiomyopathy in this patient was presumably due to LV dyssynchrony from marked ventricular preexcitation. The right anterior AP of the patient had successfully ablated, and no more complaints of palpitations were recognized by the patient. Long-term follow-up, especially on clinical and echocardiographic results, still needs to be done. By far, her LVEF's improvement has been excellent without remaining symptoms.

Comparison of Omnipolar Voltage by Omnipolar Technology and Conventional Bipolar Voltage

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OBJECTIVE:

We compared the Omnipolar voltage detected using EnSite™ Omnipolar Technology (OT), which improves underestimation of voltage due to mismatch between potential direction and catheter placement direction, with the conventional Bipolar voltage.

METHOD:

In 18 patients with atrial fibrillation ablation, left atrial mapping was performed with Advisor™ HD Grid Mapping Catheter under atrial pacing after pulmonary vein isolation. The voltage within a 1 cm diameter circle was measured at each site (Roof, Anterior, Posterior, Septal, Lateral) and evaluated by two methods.

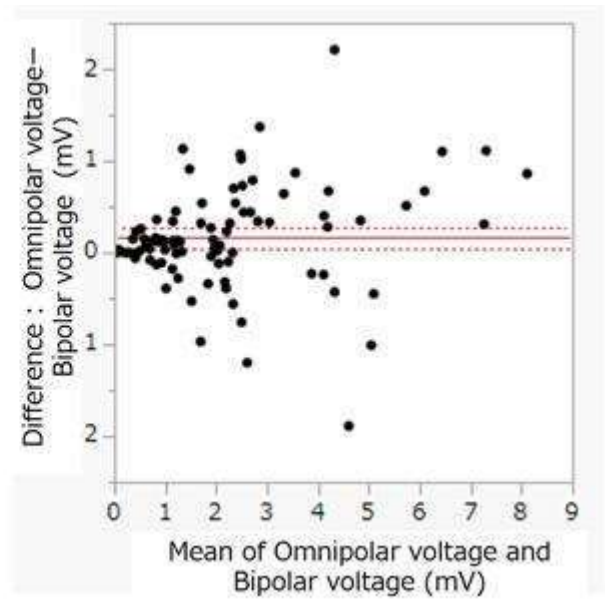
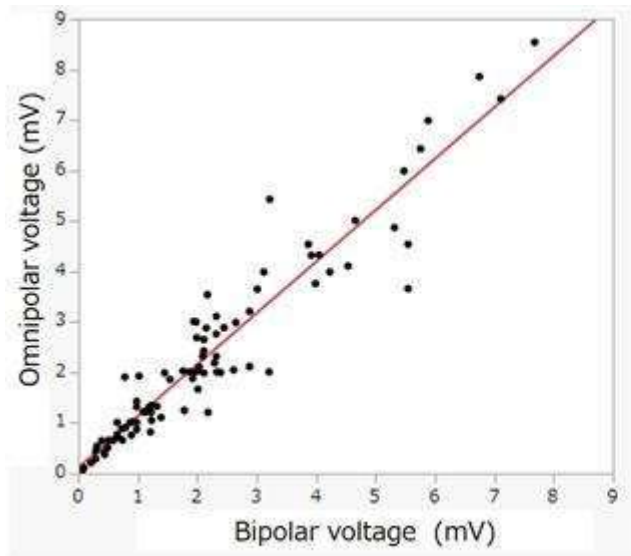
RESULT:

The Omnipolar voltage was higher than the bipolar voltage in the entire left atrium (2.32 ± 1.84 vs. 2.16 ± 1.72 mV, $P=0.0080$), meanwhile the bipolar potential was more elevated in some regions (Figure).

CONCLUSION:

The Omnipolar voltage is not always higher than the Bipolar potential, and Further attention should be paid to its evaluation.

Supporting Documents



Clinical Outcomes of Taiwan Patients with Atrial Fibrillation Treated with Edoxaban in Global ETNA-AF Program

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OBJECTIVES

The direct oral anticoagulant, edoxaban, is now available in many Asian countries. Nonetheless, data about the use of edoxaban in the routine clinical practice in Taiwan is still limited. This analysis describes the baseline and one-year clinical outcomes from the ETNA-AF Global database to better understand edoxaban therapy in Taiwan patients with atrial fibrillation (AF) compared to those in Japan and Europe.

MATERIALS AND METHODS

The ongoing ETNA-AF Global program integrates the data about baseline characteristics, treatments, and clinical outcomes of over 30,000 AF patients treated with edoxaban enrolled from Europe, Japan, and East Asian countries into a single database. In this analysis, AF patients treated with edoxaban in Taiwan (N=983), were compared with those from Europe and Japan regarding the baseline characteristics and 1-year risks of clinical outcomes.

RESULTS

More patients in Taiwan were older than 75 years old and had an eGFR<50 ml/min than those in Japan and Europe. The prescription rates of recommended 60mg and recommended 30mg edoxaban in Taiwan were 32.0% and 37.9%, respectively. The prescriptions of non-recommended 30mg (18.1%) and 60mg (18.1%) doses were more common in Taiwan than in Japan and Europe. The 1-year risk of all-cause mortality (2.19%) was numerically lower, while the risk of major bleeding (1.37%) was higher for Taiwan AF patients compared to those in Japan and Europe.

CONCLUSION

Although some differences about baseline characteristics and dosing patterns were noted between Taiwan and Europe, the ETNA-AF data support the effectiveness and safety of edoxaban for Taiwan AF patients.

Supporting Documents

DEMOGRAPHICS AND OTHER BASELINE CHARACTERISTICS			
No. (annual incidence,%)	EU	Japan	Taiwan
	Total [N=13133]	Total [N=11330]	Total [N=983]
Age [years], n (%)			
< 65	1995 (15.2)	1666 (14.7)	159 (16.2)
[65, 74)	4449 (33.9)	3710 (32.7)	381 (38.8)
[75, 84)	5313 (40.5)	4354 (38.4)	312 (31.7)
≥ 85	1375 (10.5)	1600 (14.1)	131 (13.3)
Recalc. eGFR (CG formula) [ml/min/1.73m ²], n (%)			
≥ 80	4127 (36.1)	2417 (21.9)	156 (16.6)
(50; 79)	4914 (43.0)	5072 (46.0)	439 (46.9)
[30; 49]	2107 (18.4)	2990 (27.1)	244 (26.0)
[15; 29)	289 (2.5)	542 (4.9)	97 (10.4)
< 15	3 (0.0)	6 (0.1)	1 (0.1)
Edoxaban dose at baseline, n (%)			
60 mg	10036 (76.4)	3123 (27.6)	432 (43.9)
Recommended	8916 (67.9)	2866 (25.3)	315 (32.0)
Non-Recommended	1120 (8.5)	257 (2.3)	117 (11.9)
30 mg	3097 (23.6)	8207 (72.4)	551 (56.1)
Recommended	1992 (15.2)	6777 (59.8)	373 (37.9)
Non-recommended	1105 (8.4)	1430 (12.6)	178 (18.1)
COMPARISON WITH 1-YEAR OUTCOME FOR EU, JAPAN AND TAIWAN			
No. (annual incidence,%)	EU	Japan	Taiwan
All-cause mortality	464 (3.62) [3.30; 3.96]	277 (2.85) [2.54; 3.21]	21 (2.19) [1.43; 3.36]
Major bleeding	135 (1.06) [0.89; 1.25]	123 (1.27) [1.06; 1.52]	13 (1.37) [0.79; 2.35]
Intracranial haemorrhage (ICH)	31 (0.24) [0.21; 0.65]	38 (0.39) [0.29; 0.54]	4 (0.42) [0.16; 1.11]
Major GI bleeding	53 (0.41) [0.32; 0.54]	85 (0.88) [0.71; 1.09]	5 (0.52) [0.22; 1.26]
Any stroke	92 (0.72) [0.59; 0.88]	156 (1.61) [1.38; 1.89]	13 (1.37) [0.79; 2.35]
Stroke (ischemic)	70 (0.55) [0.43; 0.69]	121 (1.25) [1.05; 1.49]	11 (1.16) [0.64; 2.09]

Update of Outcomes in Edoxaban Treated Asian Atrial Fibrillation Patients in the Global ETNA-AF Program

Dr Chun Chieh Wang¹

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OBJECTIVES

Direct anticoagulant edoxaban is available in many Asian countries. Nonetheless, routine clinical use evidence is still scant. This analysis updates clinical outcomes from the ETNA-AF Global database to better understand edoxaban therapy in patients of 4 Asian countries (South Korea, Taiwan, Hong Kong, and Thailand).

MATERIALS AND METHODS

A total of 3,359 patients from South Korea (1,887), Taiwan (983), Thailand (299), and Hong Kong (190) were enrolled and followed for 2 years until April 2022. Baseline characteristics and 2-year clinical outcomes were analyzed and compared with the European and Japanese populations.

RESULTS

Baseline patient body weights were lower in the 4 Asian countries than in Europe. The patient ratio of those ≥ 85 years was lower in 4 countries than in Japan and Europe. The patient ratio of eGFR ≥ 80 mL/min was lower in the 4 countries and Japan than in Europe. The patient ratio of recommended 60 mg and 30mg edoxaban doses in 4 countries were 38.5% and 32.4%, respectively. The non-recommended 30mg and 60 mg doses were higher in 4 countries than in Europe and Japan. At the Congress, the 2-year clinical outcomes data will be presented, including ischemic stroke, major bleeding, intracranial hemorrhage, and total mortality.

CONCLUSION

The 2-year large size prospective follow-up is expected to provide valuable information to understand better the effectiveness and safety of edoxaban in the real-world setting for the Asian population per se and the perspective of other regions.

Supporting Documents

DEMOGRAPHICS AND OTHER BASELINE CHARACTERISTICS			
	EU	Japan	4 Countries (KR/TW/HK/TH)
	Total [N=13,133]	Total [N=11,330]	Total [N=3,359]
Weight [kg], mean (SD)	81.0 ± 17.3	60.0 ± 12.8	65.9 ± 12.4
Age [years], mean (SD)	73.6 ± 9.5	74.2 ± 10.1	71.7 ± 9.6
Age [years], n (%)			
< 65	1995 (15.2)	1666 (14.7)	678 (20.2)
[65, 74)	4449 (33.9)	3710 (32.7)	1296 (38.6)
[75, 84)	5313 (40.5)	4354 (38.4)	1122 (33.4)
≥ 85	1375 (10.5)	1600 (14.1)	263 (7.8)
Calc. eGFR (CG formula) [ml/min/1.73m ²], n (%)			
≥ 80	4127 (36.1)	2417 (21.9)	621 (20.7)
(50; 79)	4914 (43.0)	5072 (46.0)	1435 (47.8)
[30; 49]	2107 (18.4)	2990 (27.1)	755 (25.1)
[15; 29)	289 (2.5)	542 (4.9)	190 (6.3)
< 15	3 (0.0)	6 (0.1)	2 (0.1)
Edoxaban dose at baseline, n (%)			
60 mg			
Recommended	10036 (76.4)	3123 (27.6)	1670 (49.7)
Non-Recommended	8916 (67.9)	2866 (25.3)	1293 (38.5)
30 mg	1120 (8.5)	257 (2.3)	377 (11.2)
Recommended	3097 (23.6)	8207 (72.4)	1689 (50.3)
Non-recommended	1992 (15.2)	6777 (59.8)	1088 (32.4)
	1105 (8.4)	1430 (12.6)	601 (17.9)

Calc, calculated; CG, Cockcroft Gault; eGFR, estimated glomerular filtration rate; EU, Europe; HK, Hong Kong; n, number; TH, Thailand; TW, Taiwan; SD, standard deviation.

Real-world sex differences in healthcare utilization after cryoballoon ablation: 2-year outcomes from Cryo Global Registry

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Objective(s): For patients with atrial fibrillation (AF), females have been underrepresented in larger randomized trials evaluating cryoballoon ablation (CBA). This real-world analysis aims to describe healthcare utilization of female versus male patients after CBA.

Materials and Methods: This registry is an ongoing, global evaluation of CBA procedures in standard-of-care practice. Females undergoing CBA were compared to males at baseline, 12, and 24 months post-ablation. Healthcare utilization was assessed by freedom from repeat ablation, hospitalization, and rate of cardioversion.

Result(s): Of 3089 patients with 12-month follow-up, 1136 (36.8%) were female; a subset of 1105 patients were followed through 24 months. Females were on average older than males (64 vs. 59 years, $p<0.01$), more often presented with paroxysmal AF (84.4% vs. 80.0%, $p<0.01$), and more often experienced ≥ 1 symptom(s) (94.5% vs. 87.4%, $p<0.01$) at baseline. The rate of serious procedure-related adverse events was low overall in females (3.9%) and males (2.7%, $p=0.06$). After 24-months of follow-up, there was not a statistical difference between females and males in rate of atrial arrhythmias (25.0% vs. 22.1%, $p=0.38$), repeat ablations (10.7% vs. 9.9%, $p=0.75$), and cardioversions (6.0% vs. 4.1%, $p=0.12$). However, females versus males had a significantly higher rate of all-cause (20.8% vs. 16.2%, $p<0.01$) and cardiovascular-related (18.1% vs. 14.0%, $p<0.01$) hospitalizations at 24-months.

Conclusion: CBA is a safe and effective in both sexes, but females had a higher risk of being hospitalized within 24 months after CBA. Reasons for more hospitalizations might be the higher symptom burden, older age and more co-morbidities in females.

Outcomes of On-Label Reduced-Dose Edoxaban in Patients with Atrial Fibrillation: The LEDIOS Registry

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Background

Non-vitamin K antagonist oral anticoagulants (NOACs) are effective in preventing thromboembolisms and reduce the risk of bleeding compared with warfarin. There are few reports on the outcomes of on-label reduced-dose NOACs. The aim of this study was to assess the safety and efficacy of on-label reduced-dose edoxaban in patients with atrial fibrillation (AF).

Methods

This study is a multi-center, prospective, non-interventional study to evaluate the safety and efficacy of on-label reduced-dose edoxaban in patients with AF. We evaluated outcomes of major bleeding, stroke or systemic embolism, all-cause death, and composite clinical outcomes.

Results

A total of 2448 patients (mean age 75.0±8.3 years, 801 [32.7%] males) was included in the present study. The mean CHA2DS2-VASc score was 3.7±1.5. Major bleeding events occurred at a rate of 1.34%/yr. The event rate of strokes and systemic embolisms was 1.13%/yr. The overall net clinical outcomes occurred at a rate of 3.19%/yr. There were no significant differences according to the number of dose reduction criteria, renal dysfunction, or body weight. Higher HAS-BLED score and higher combination of CHA2DS2-VASc and HAS-BLED score was associated with an increased risk of composite clinical outcomes compared to the lower score groups.

Conclusions

This study was the largest prospective real-world study to investigate the safety and efficacy of on-label low-dose edoxaban in an Asian population. Reduced-dose edoxaban can be used safely in patients with severe renal dysfunction or extremely low body weight. Our observation suggests that physicians should consider bleeding risk even in a low-dose regimen.

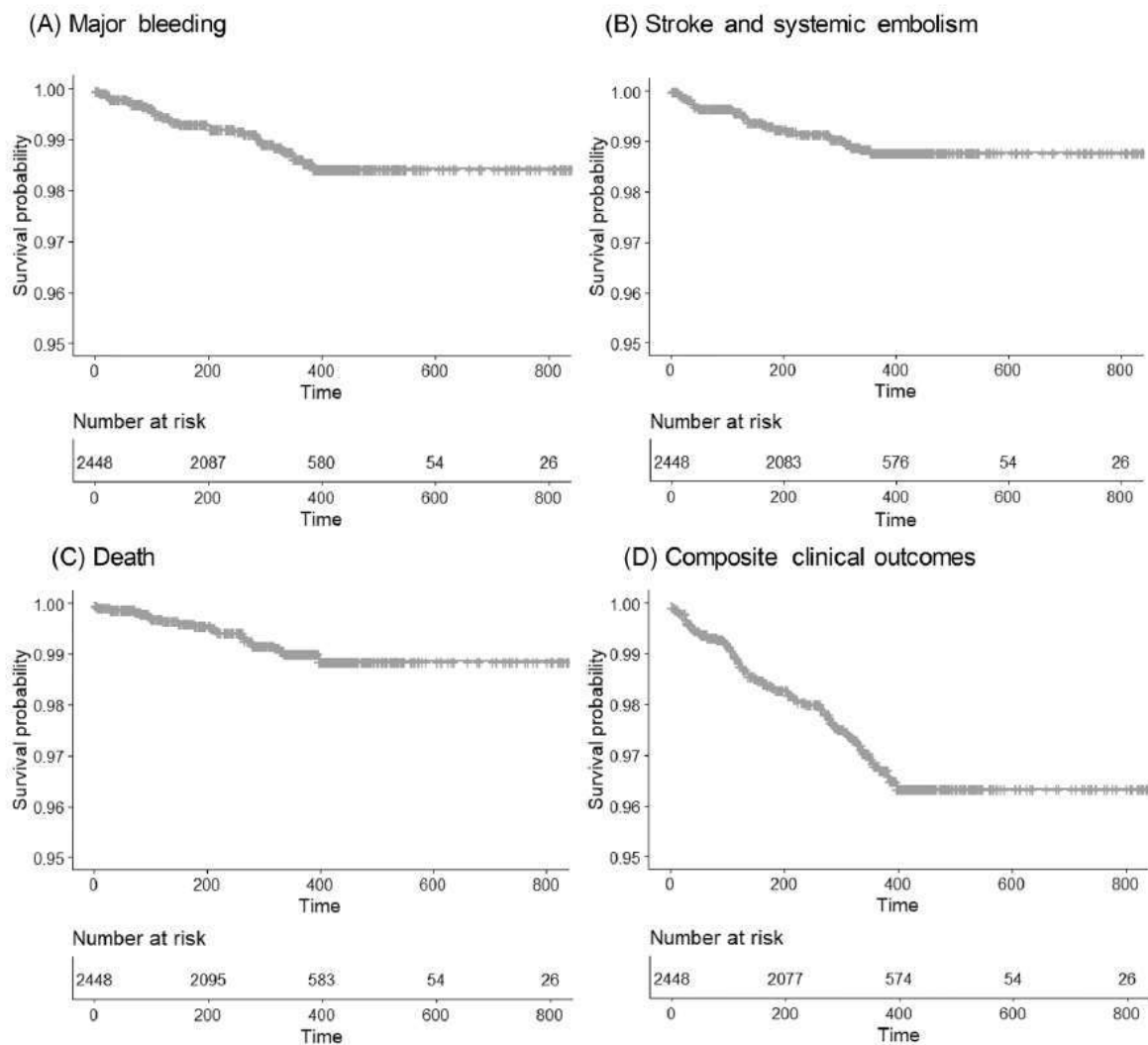
Supporting Documents

Keywords

Atrial fibrillation, reduced dose, oral anticoagulants, safety, efficacy

Figure legends

Figure 1. Kaplan-Meier Curves of the primary outcome. (A) Freedom from major bleeding, (B) Freedom from ischemic strokes or systemic embolisms, (C) Freedom from all cause death, and (D) Freedom from composite clinical outcomes.



Tables

Table 1. Baseline Characteristics

	Total (n=2448)	Criteria=1 (n=1520)	Criteria>=2 (n=928)	p-value
Age [years], mean(SD)	75.0 ± 8.3	72.7 ± 8.4	78.9 ± 6.6	<.001
Gender, male (%)	801(32.7)	542(35.7)	259(27.9)	<.001
Body weight [kg], mean(SD)	55.4 ± 8.2	57.7 ± 8.4	51.7 ± 6.1	<.001
BMI, mean (SD)	22.9 ± 3.0	23.5 ± 3.0	21.9 ± 2.7	<.001
CrCl [mL/min], mean(SD)	51.4 ± 18.8	59.1 ± 18.5	39.1 ± 11.3	<.001
CHA ₂ DS ₂ -VASc, mean(SD)	3.7 ± 1.5	3.4 ± 1.4	4.2 ± 1.4	<.001
HAS-BLED, mean (SD)	2.1 ± 1.0	2.0 ± 1.0	2.3 ± 1.0	<.001
Medical history, n(%)				
Hypertension	1757(71.8)	1070(70.4)	687(74.0)	0.053
Stroke	272(11.1)	144(9.5)	128(13.8)	0.001
Diabetes	649(26.5)	387(25.5)	262(28.2)	0.143
Heart failure	647(26.4)	342(22.5)	305(32.9)	<.001
Dose reduction criteria, n(%)				
Body weight≤60 kg	2095(85.6)	1170(77.0)	925(99.7)	<.001
CrCl 15-50 mL/min	1171(47.8)	284(18.7)	887(95.6)	<.001
Concomitant use of P-gp inhibitors	128(5.2)	66(4.3)	62(6.7)	0.015
Number of dose reduction criteria=1	1520(62.1)			
Number of dose reduction criteria=2	914(37.3)			

Number of dose reduction
criteria=3

14(0.6)

BMI: body mass index, CrCl: creatinine clearance, P-gp: P-glycoprotein

Table 2. Event rates according to dose reduction criteria.

Outcomes	Event rate per 100 person-years		
	Total	Weight ≤60	CrCl 30-50 ml/min
	(n=2448)	(n=2095)	(n=1171)
Stroke/SEE	1.13	0.96	1.84
Major bleeding	1.34	1.47	1.28
All-cause mortality	1.00	1.01	1.28
Composite clinical outcomes	3.19	3.11	3.78

CrCl: creatinine clearance, SEE: systemic embolic event

OP-033-1-AF (TRACK 6 - AF 1)

Development and Qualitative Validation of a Patient Reported Outcome Measure for AF Specific Health Literacy

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Background: The health literacy of people living with AF is thus a key enabler of effective behavioural modification to slow or prevent complications and AF progression. There are currently no clinical and research patient reported outcome measures (PROM) to assess AF specific health literacy that incorporates knowledge on risk factors of AF. We discuss the development and qualitative validation of the Atrial Fibrillation Health Literacy Questionnaire (AFHLQ), an AF specific PROM of interactive and critical health literacy of people living with AF.

Methods: This was a qualitative research design to develop and validate the AFHLQ. A 47-item questionnaire was developed through expert consensus. The questionnaire consists of 5 domains: (1) what is AF, (2) what are the symptoms of AF, (3) why do people get AF, (4) management of AF, and (5) what measures can slow or prevent the progression of AF? This was then qualitatively validated through clinical expert and consumer opinion.

Results: Seven clinical experts and seven consumers participated in separate advisory groups. Recommendations resulted in several changes to the original 47 item list during the qualitative validation process: 13 original items were removed, and 13 new items were added. The response categories were also simplified from a Likert scale to “yes”, “no”, or “unsure”.

Conclusion: A 47-item AFHLQ instrument was developed and validated with modifications made through clinical expert and consumer opinion. This tool can be used to evaluate and guide interventions at a clinical and population level to improve AF health literacy and outcomes

Posterior Wall Isolation in Persistent Atrial Fibrillation and Heart Failure With Reduced Ejection Fraction (HFrEF)

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OBJECTIVES

Catheter ablation(CA) in AF and heart failure with reduced ejection fraction(HFrEF) is associated with improved left ventricular ejection fraction(LVEF) and survival compared with medical therapy. Previous non-randomised studies have shown high success rates with posterior wall isolation(PWI). The objective of this randomised study is to examine differences in outcomes between pulmonary vein isolation (PVI) alone and PVI with PWI.

MATERIALS AND METHODS

CAPLA was a multi-centre, prospective, randomized trial involving PsAF patients assigned to PVI alone or PVI with PWI. This substudy included patients with HFrEF(LVEF<50%). The primary endpoint was freedom from any documented atrial arrhythmia of>30 seconds, after a single ablation procedure, off anti-arrhythmic therapy(AAD) at 12 months.

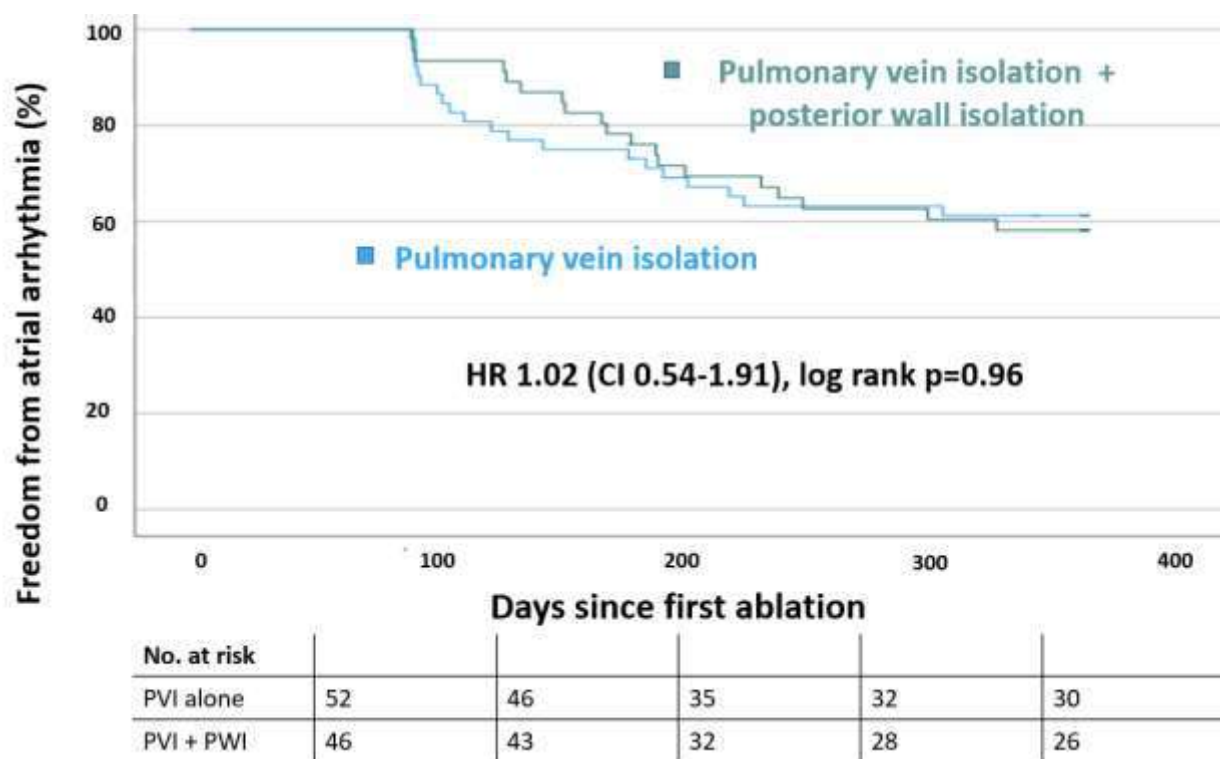
RESULTS

98 patients with PsAF and HFrEF(mean age 62.1+/-9.8 years, 79.5% males, median LVEF 35+/-13%). 46.9% underwent PVI with PWI. After 12 months, 61.5% of patients with PVI alone were free from recurrent atrial arrhythmia off AAD vs 58.7% with PVI and PWI (HR1.02, CI0.54-1.91, p=0.96). There were no significant differences in freedom from atrial arrhythmia on/off AAD after multiple procedures (PVI 65.4% vs PVI with PWI 60.9%, p=0.73) or AF burden (median 0%, p=0.78). Median LVEF improved in PVI alone (Δ LVEF 18.2+/-14%, p<0.01), and PVI with PWI(19.3+/-12.9%,p<0.01), with no difference between groups(p=0.71). Normalisation of LV function($\geq$ 50%) occurred in 59.1% with PVI alone, and 71.4% in PVI with PWI (p=0.26).

CONCLUSIONS

CA is associated with significant LVEF improvements in PsAF and HFrEF. However adding PWI to PVI did not improve freedom from arrhythmia recurrence nor recovery of LVEF.

SUPPORTING DOCUMENTS



Long-term Results of MCG Map-Guide AF Surgery in Long-Standing Persistent AF and Structural Heart Disease

Dr Doosang Kim¹

¹*Veterans Health Service Medical Center, Seoul, South Korea*

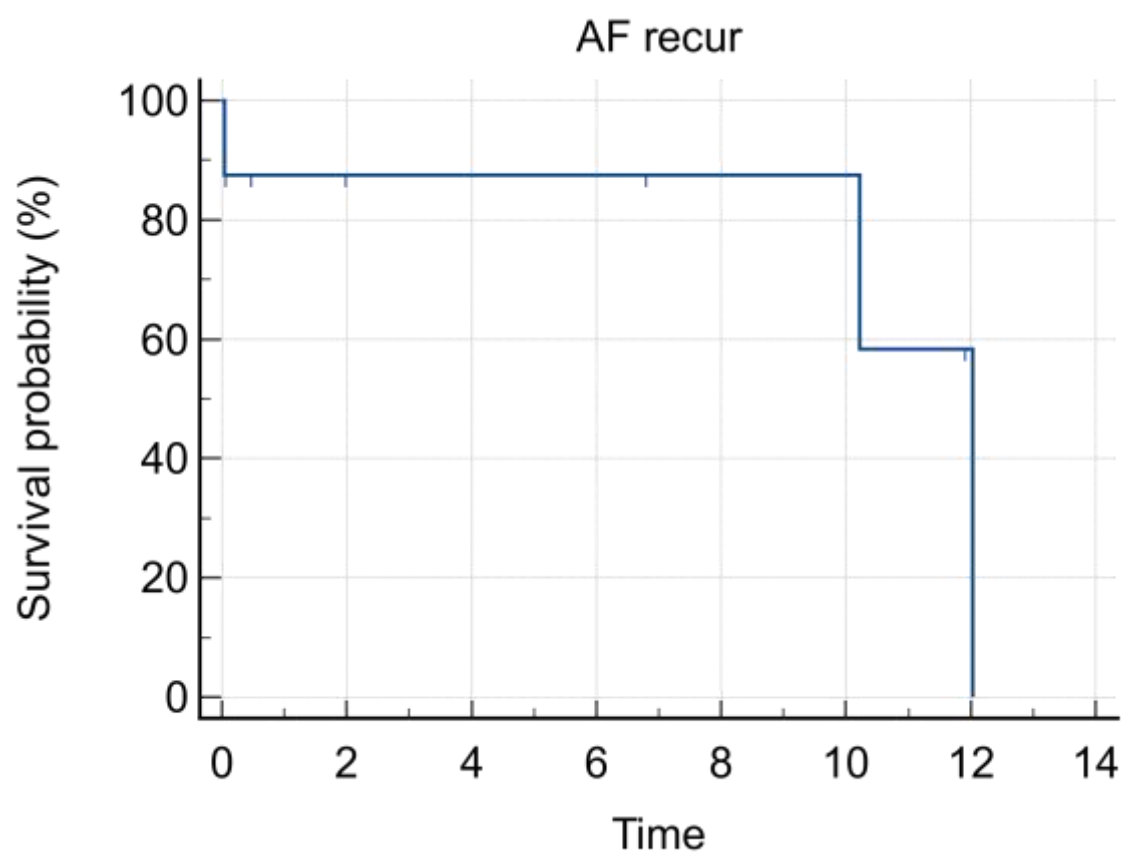
Objective: To report the long-term (more than 10 years) follow-up results of feasibility study of magnetocardiography action potential activity map-guide minimal AF surgery in the patients who having long-standing persistent AF and structural heart diseases.

Materials and Methods: From June 2006 to June 2008, 8 patients had been enrolled. Mean age is 63 years old and AF burden is 1.0. Their LA size is 60mm. MCG AMAP were prepared and underwent concomitant structural heart surgery with MCG map-guide minimal AF lesion set. AF recurrence was defined any single episode in ECG follow-up (not 30 seconds rule).

Results: There were no sick sinus syndrome and no permanent pacemaker insertion. Median AF recur-free time is 12.030 years and 10-year AF free rate is 87.5%. Mean AF free time is 10.003 years (95% C.I. 6.644 to 13.363).

Conclusion: We report the long-term results of the feasibility study of MCG map-guide minimal AF surgery and its results are acceptable.

SUPPORTING DOCUMENTS



Silent Cerebral Embolism After Surgical and Percutaneous Left Atrial Appendage Intervention

Dr Kexin Wang¹

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SUPPORTING DOCUMENTS

Objective(s): Left atrial appendage (LAA) intervention is an alternative to oral anticoagulation therapy for thromboprophylaxis in atrial fibrillation (AF). There is limited data on procedure-related silent cerebral embolisms (SCE) among different LAA interventions. The aim of our study is to assess the incidence and risk factors of the new SCE after percutaneous LAA occlusion (LAAO) and mini-invasive thoracoscopic LAA excision (LAAE) in AF patients.

Materials and Methods: Consecutive AF patients referred for either LAAO or LAAE between September 2018 and December 2020 were included. All patients underwent cerebral magnetic resonance imaging before and within 7 days after the procedure. The incidence, size and location of SCE, as well as risk factors were analyzed.

Result(s): Out of 74 patients who met the analyzing criteria (42 males, aged 68.4 ± 7.4 years), 42 underwent LAAO and 32 LAAE. A significantly higher incidence of new SCE was seen in LAAO group compared to LAAE (54.8% vs. 6.3%, $p < 0.001$). 71.4% of SCE located in the cortex. In the LAAO group, patients developing SCE had significantly higher CHA2DS2-VASc scores (OR 2.172; 95% CI 1.149–4.104; $p = 0.017$), longer LAAO placement time (OR 1.067; 95% CI 1.018–1.118; $p = 0.006$), and lower peak activated clotting time (ACT) level (OR 0.976; 95% CI 0.954–0.998; $p = 0.035$).

Conclusions: The incidence of procedure-related SCE was much higher in patients with percutaneous LAAO than in LAAE patients. More cardiovascular co-morbidities, longer LAAO placement time and lower ACT level were significantly associated with the development of SCE during LAAO procedure.

High Density or Circular Catheter for Vein Reconnection in Redo Atrial Fibrillation After Index Procedure.

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OBJECTIVES

Despite the use of contact force (CF) sensing catheter, the creation of durable transmural lesion in the left atrium (LA) remains a main challenge in atrial fibrillation ablation (AF) procedures. We aimed to evaluate pulmonary vein (PV) reconnection in redo AF procedures after index PV isolation (PVI) with spring-based CF radiofrequency (RF) ablation

METHODS

We retrospectively enrolled 28 patients who received redo AF ablation procedure between 2016 and 2021. All patients underwent index PVI procedure by means of RF spring-based CF ablation technology between 2012 and 2020. At redo procedure PV conduction gaps were mapped either with circular mapping catheter Advisor FLTM (CMC) or AdvisorTM HD Grid (HDG) (Abbott, Minneapolis, MN). Ablation was performed with fiberoptic CF RF ablation catheter.

RESULTS

A total of 28 patients (age: 60 [54-65] years, 21 male) received redo procedure at 36 [12-69] months after index procedure. All patients had PV reconnected (average of 2.75). The number of reconnected PV (77/112, 69%) was driven by significantly more reconnected left (89%) and right (68%) superior PV. Reconnection rate was higher with HDG (54/72, 75%) compared to CMC (23/40, 58%) on a comparable patient population. HDG mapping identified more reconnection sites in left inferior (61% vs 10%) and right superior (50% vs 20%) anterior vein segments.

CONCLUSION

After median 3 year after index PVI procedure no patients had no reconnected PV. Most reconnected veins were superior veins. HD Grid mapping revealed higher rate of conduction gap in redo PVI procedure if compared with CMC mapping.

SUPPORTING DOCUMENTS

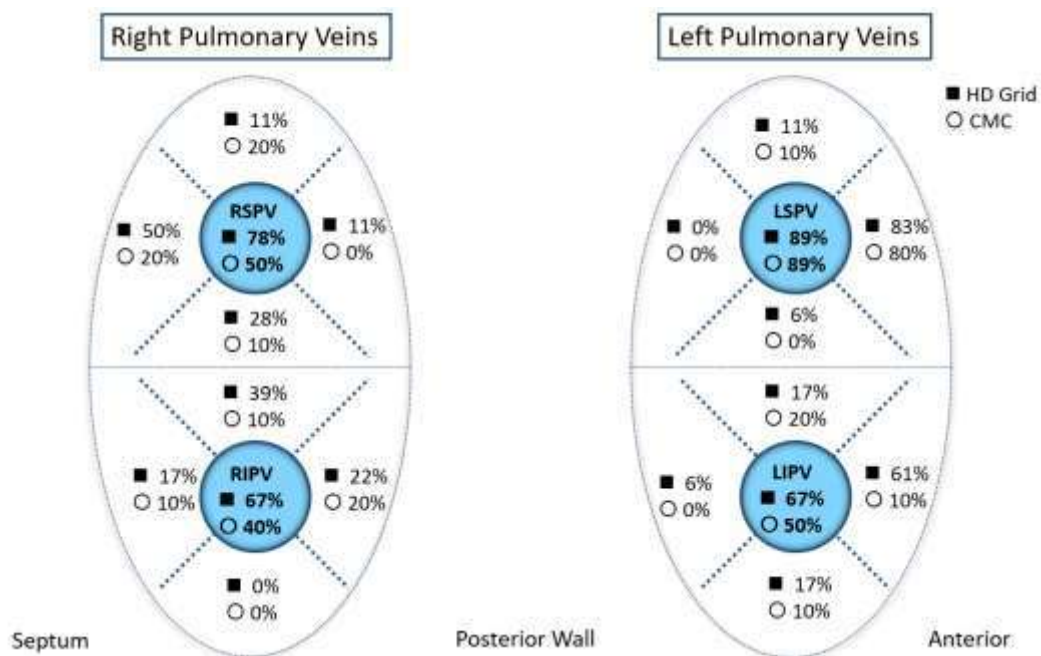


Figure 1: regional distribution of pulmonary vein reconnection. A comparison between high density mapping catheter (HDM) and circular mapping catheter (CMC)

Stroke Risk Stratification for Atrial Fibrillation: Evaluating Left Atrial Appendage With Fluid-structure Interaction Analysis

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Objectives and Methods: The majority of cardioembolic strokes in patients with non-valvular atrial fibrillation (NVAF) are resulted from clot formation in the left atrial appendage (LAA). Current stroke risk stratification is based on the overall risks estimated from demographic and clinical profiles but not on individual anatomy or physiology. We aim to explore the differences in LAA morphological and hemodynamic parameters by comparing patients with and without a stroke history.

Results: Thirty-nine patients with persistent NVAF were included. Of these, 17 patients without a stroke history (non-stroke group) were compared with 22 patients with a history of stroke (stroke group). Their LAA geometric models were first reconstructed, and the morphological parameters were then measured. Furthermore, their LAA hemodynamic parameters were calculated with fluid-structure interaction analysis. Moreover, particle residual rates (PRR) and blood renewal rates (BRR) analyses were employed to characterize the thrombogenesis dynamics. Compared to the non-stroke group, the stroke group had significant smaller LAA tortuosity and LAA orifice area. The hemodynamic analysis shows that the stroke group had significantly lower LAA orifice velocities (0.30 ± 0.13 vs 0.39 ± 0.14 cm/s; $p=0.044$), but higher PRR (14.58 ± 9.43 vs 9.25 ± 4.67 ; $p=0.040$) and BRR (52.41 ± 18.11 vs 38.36 ± 24.07 ; $p=0.044$), than the non-stroke group.

Conclusion: These LAA morphological and hemodynamic parameters may be used to assess stroke risk in patients with NVAF.

SUPPORTING DOCUMENTS

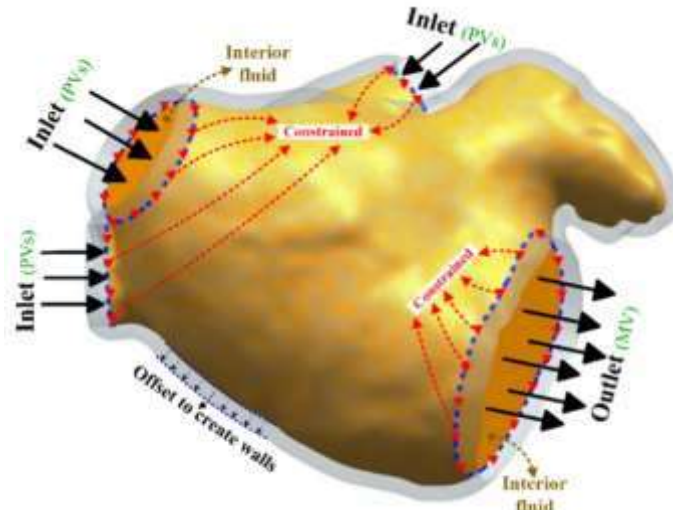


Figure 1: Fluid–structure model and boundary conditions in simulation

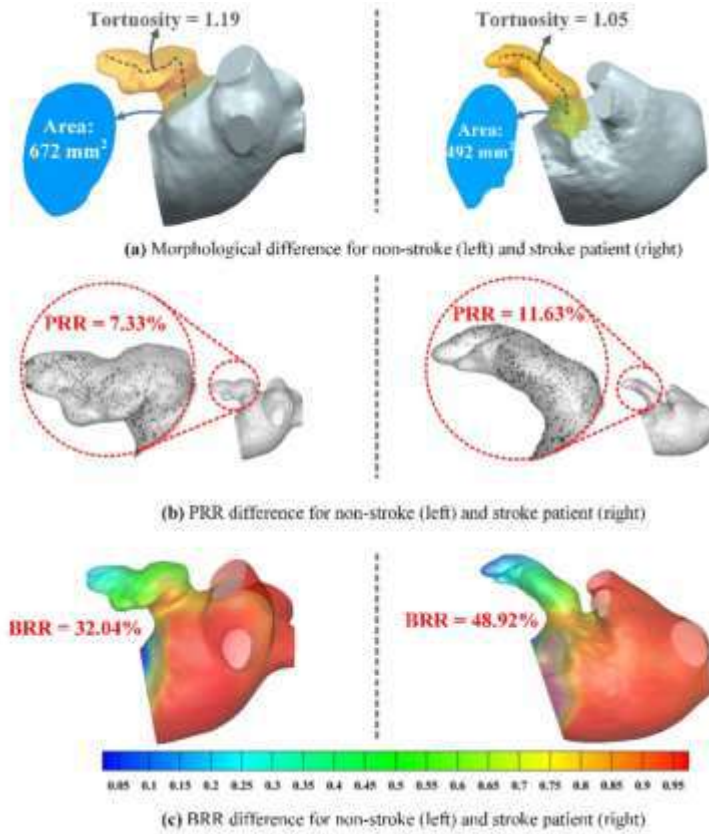


Figure 2: Example of the difference in morphology (a), particle residence rate (PRR) (b) and blood renewal rate (BRR) (c).

Atrial fibrillation registry in tertiary heart centre in Malaysia

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OBJECTIVE:

To study the demographic data of patients with atrial fibrillation (AF) in Serdang Hospital Malaysia (HSDG), assess their cardiovascular (CV), bleeding and mortality outcomes in 1-year, and determine the associated factors.

MATERIALS AND METHODS:

This retrospective cohort study included patients aged ≥ 18 years and diagnosed with AF between 01/01/2018 and 31/12/2020. Patient's data were collected from electronic hospital records. CV events (acute coronary syndrome and stroke), bleeding events (major and minor bleeding), and overall mortality outcome were assessed at 1-year.

RESULTS:

1006 patients were included (59.2% male, median age 66.0 ± 15.0 years). Race distributions were primarily Malays (51.0%), followed by Chinese (41.3%) and Indian (7.1%). 95.3% of patients have at least one comorbidity, commonest being hypertension (70.2%) followed by diabetes mellitus (DM)(39.8%) and ischaemic heart disease (IHD)(27.6%). Majority were on anticoagulant (83.7%), mostly warfarin (45.9%) and dabigatran (25.2%). Bisoprolol was the commonest rate-control therapy (61.2%) followed by digoxin (10.2%). The median CHA2DS2-VASc score was 3.00 ± 2.00 and HAS-BLED score was 1.00 ± 1.00 . Occurrence of the CV, bleeding and death events at 1-year were 11.6%, 7.1% and 2.8% respectively. IHD independently predicted CV outcomes (RR 3.8;95% CI, 1.3-

11.1; $p=0.015$). Associations with 1-year mortality was seen in diabetics (RR 2.7;95% CI, 1.2-5.7; $p=0.014$) and age-group 65-74 years (RR 0.3.8;95% CI, 0.1-0.78; $p=0.015$).

CONCLUSION:

Amongst AF patients in HSDG, IHD was an independent predictor for CV events. At 1-year follow up, patients with DM has greater rate of death whilst age-group of 65-74 years has better chance of survival.

Age Does Not Impact AF Recurrence or LV Recovery Following Catheter Ablation in AF-mediated Cardiomyopathy

Dr Louise Segan^{1,2,3}, Dr David Chieng^{1,2,3}, Dr Hariharan Sugumar^{1,2,3}, A/Professor Aleksandr Voskoboinik^{1,2,3,4}, A/Professor Han-Liang Ling^{1,2,3}, Professor Andrew Taylor^{1,2}, Dr Shane Nanayakkara^{1,2}, Dr Ahmed Al-Kaisey^{3,5}, Dr Joshua Hawson^{3,5}, Dr Manuja Premaratne⁶, Dr Stephen Joseph⁴, A/Professor Geoffrey Lee^{3,5}, Dr Ramanathan Parameswaran^{5,7}, Dr Benedict Costello^{1,2,4}, Professor Jonathan Kalman^{3,5}, Professor Peter Kistler^{1,2,3}, A/Professor Sandeep Prabhu^{1,2,3}

¹Alfred Health, Prahran, Australia, ²Baker Heart and Diabetes Institute, Melbourne, Australia, ³University of Melbourne, Melbourne, Australia, ⁴Western Health, Melbourne, Australia, ⁵Royal Melbourne Hospital, Melbourne, Australia, ⁶Peninsula Health, Frankston, Australia, ⁷University Hospital Geelong, Geelong, Australia

OBJECTIVES

The absence of ventricular scar in patients with AF and systolic HF predicts left ventricular (LV) recovery following AF ablation. It is unknown whether age impacts the degree of LV recovery.

MATERIALS AND METHODS

Consecutive patients undergoing catheter ablation (CA) between 2013- 2021 with LVEF<45% and absence of LV fibrosis on baseline cardiac MRI (CMR) were stratified by age (<65 vs >65 years) and underwent repeat CMR at >6 months with rhythm monitoring using daily single lead ECGs.

RESULTS

Sixty patients met inclusion criteria (11.7% female, mean LVEF 33±9%), 67% (n=40) were <65 years (53.5±8 vs 70.3±3 years in age>65 group). Baseline comorbidities, left ventricular ejection fraction (LVEF 33±9 vs 32 ±9 >65 years, p=0.761), atrial and ventricular dimensions (LAVI 57±21 vs 57±15 mL/m² age>65, p=0.994; LVEDVi 110±41 vs 101±25 mL/m², p=0.366), pharmacotherapy and ablation strategy (PVI in all; PWI in 30% vs 20% age>65 cohort, p=0.409; CTI 10% both groups) were comparable (all p>0.05) albeit a higher CHADS₂VASc score in the older cohort (2.8±0.9 vs 1.6±0.6 age<65, p<0.001).

Following 13±12 months, there was no significant difference in LV recovery (ΔLVEF 21.7±14% in younger vs 18.7±17% in older, p=0.466), symptoms (SF-36 ΔPCS p=0.483/ΔMCS, p=0.841), NYHA

class ($p=0.759$), BNP (Δ BNP -179 ± 348 vs -170 ± 177 age >65 , $p=0.922$), 6-minute-walk-distance (Δ 6MWD 49.8 ± 63 vs 101.7 ± 150.2 metres in age >65 , $p=0.064$) and AF recurrence (32.5% vs 35% age >65 , $p=0.850$; AF burden $6\pm18\%$ vs $5\pm13\%$, $p=0.733$).

CONCLUSION

In patients undergoing CA for AF with systolic HF in the absence of ventricular scar, comparable improvements in ventricular function, symptoms and freedom from AF are achieved irrespective of age.

Clinical Risk Prediction for Left Atrial Appendage Thrombus Among Patients With Atrial Fibrillation

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¹Alfred Health, Prahran, Australia, ²Baker Heart and Diabetes Institute, Melbourne, Australia, ³University of Melbourne, Melbourne, Australia, ⁴Monash Health, Melbourne, Australia, ⁵Royal Melbourne Hospital, Melbourne, Australia

Objectives: Left atrial appendage thrombus (LAAT) risk factors in atrial fibrillation/flutter (AF/AFL) patients undergoing direct cardioversion (DCR) or catheter ablation (CA) remain poorly defined. We evaluated LAAT predictors in this population.

Materials and Methods: We evaluated available clinical and transthoracic echocardiographic (TTE) parameters in patients undergoing TOE prior to DCR or CA between 1999-2022 in our institution. Regression analysis identified LAAT predictors and a weighted risk-score was developed in the derivation cohort (70%) and validated in the remaining (30%) test cohort.

Results: Of 627 patients (age 62±12 years, 27% female, AF 84%, AFL 16%, left ventricular ejection fraction (LVEF) 44±20%), 24% had LAAT and 13.8% dense spontaneous echo contrast precluding DCR/CA. Anticoagulation was NOAC 56.5%, warfarin 32.1% and none in 11.4%.

Diabetes (p=0.004), prior stroke (p=0.009), coronary disease (p=0.015), renal impairment (p<0.001) and CHADS2VASc>2 (73% vs. 55%, p<0.001) were higher in the LAAT cohort.

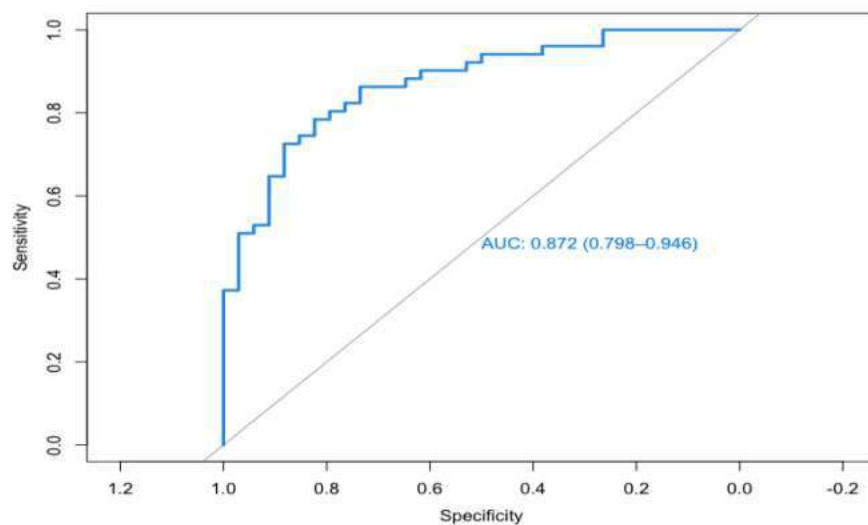
Age (p=0.093), gender (p=0.689), BMI (p=0.828), anticoagulant type (p=0.316) and diabetes (p=0.107) were not univariate predictors, whereas anticoagulation duration (<30 days), creatinine and TTE markers of remodeling (LVEF, LAVI, RVSP and TAPSE) were independent predictors on univariate and multivariate regression; CHADS2VASc was not significant after adjustment (p=0.090).

The weighted risk model included continuous (age, creatinine, LVEF, LAVI, TAPSE and RVSP) and categorical (anticoagulation duration) variables with excellent predictive performance: AUC 0.872(95%CI 0.798-0.946),PPV 91%,NPV 70% and accuracy 80%.

In the LAAT cohort, thrombus resolution occurred in 39% on serial TOE imaging with median time to resolution 131 days(IQR 54-398).

Conclusion: A novel LAAT risk model comprising non-invasive clinical and echocardiographic parameters enhances risk prediction over CHADS2VASc in AF/AFL and may guide the need for pre-procedural TOE imaging.

SUPPORTING DOCUMENTS



Shorter Duration Of Anticoagulation Is Safe In Low-risk Patients Undergoing Atrial Fibrillation Ablation With Cryoballoon

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OBJECTIVE: The duration of anticoagulation (OAC) after atrial fibrillation (AF) ablation remains unclear. Current guidelines recommend 2 months of OAC after AF ablation, even among low risk patients. AF ablation with Cryoballoon (CB) may cause less endothelial damage compared with radiofrequency and thus may require a shorter duration of anticoagulation. We evaluated the safety of a shorter duration (1 month) of OAC after AF ablation with CB in a low-risk subset of male patients with CHA2DS2-VASc score 0 and female patients with CHA2DS2-VASc score 1.

METHODS: This was a multi-center prospective observational study. 27 consecutive patients with CHA2DS2-VASc score 0 (male) and 1 (female) undergoing AF ablation with CB were treated with one month of OAC, followed by aspirin 81mg. Baseline neurologic function was assessed pre-procedure, and at 1, 3 and 6 months post procedure. Complications, including transient ischemic attack and strokes were recorded.

RESULTS: Mean age and BMI were 52.0 +/- 8.7 years and 28.2 +/- 4.9 kg/m², respectively. 4 patients (15%) were female with CHA2DS2-VASc score 1. Mean LVEF and LA volume index were 58 +/- 6 % and 26.7 +/- 7.3 ml/m², respectively. OAC was discontinued at one month in all 27 patients. At 1, 3 and 6 month follow up, there were no clinical neurological events noted.

CONCLUSION: A shorter duration (1 month) of oral anticoagulation may be safe in a low-risk subset of patients with CHA2DS2-VASc score 0 (male) or 1 (female) undergoing AF ablation with CB. Future studies are warranted to confirm this finding.

Role of Heart Rate Variability in Predicting New-onset Atrial Fibrillation After Coronary Artery Bypass Graft

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¹108 Military Central Hospital, Hanoi, Vietnam, ²Hanoi Heart Hospital, Hanoi, Vietnam

OBJECTIVES

To investigate the association between heart rate variability (HRV) and new-onset atrial fibrillation (AF) in patients undergoing coronary artery bypass graft (CABG) during a 6-month follow-up.

MATERIALS AND METHODS

This cross-sectional study involved 119 consecutive patients undergoing off-pump CABG. All patients were assessed with 24-hour Holter recordings 2 days before CABG and 1 week, 3 months, and 6 months postoperatively. HRV was analyzed, and AF was detected from its recordings.

RESULTS

In patients undergoing CABG, New York Heart Association $\geq$ III increased the AF rate at 7 days, and advanced age and diabetes were associated with AF at 6 months postoperatively. A reduction in time-domain measurements before surgery was significantly associated with a higher risk of developing AF at 7 days postoperatively, no association between preoperative HRV and AF was found at 6 months. Reduced preoperative HRV (SDNN < 50ms) was the independent predictor of AF at 3 months (AUC = 0.65) and 6 months (AUC = 0.62) following surgery.

CONCLUSION

A reduction in time domain before CABG was associated with a higher risk of new-onset AF at 7 days postoperatively but not at 6 months. SDNN < 50ms was an independent predictor of higher incidence of AF at 3 and 6 months after surgery.

SUPPORTING DOCUMENTS

Table 1. Univariate variables comparisons between patients with and without postoperative AF during follow-up.

Timing Variables		AF at 7 days		P	AF at 3 months		P	AF at 6 months		p
		Yes (n=16)	No (n=101)		Yes (n=16)	No (n=100)		Yes (n=20)	No (n=96)	
Age		65.94 ± 10.45	64.62 ± 6.77	> 0.05	67.50 ± 8.53	64.27 ± 7.04	> 0,05	68.35 ± 7.10	63.96 ± 7.15	<0.05 *
BMI		23,41 ± 3.23	22.94 ± 2.83	>0.05	23.63 ± 3.21	22.90 ± 2.84	> 0.05	23.49 ± 2.68	22.90 ± 2.93	>0.05
eGFR		67.88 ± 22.40	63.30 ± 18.82	> 0.05	64.19 ± 28.40	64.34 ± 17,11	> 0.05	57.85 ± 16.53	65.67 ± 19.16	>0.05
Sex	Male	13 (13.4)	84 (86.6)	>0.05	13 (13.4)	84 (86.6)	> 0,05	18 (18.6)	79 (81.4)	> 0.05
	Female	3 (15.0)	17 (85.0)		3 (15.8)	16 (84.2)		2 (10.5)	17 (89.5)	
Diabetes	Yes	3 (7.7)	36 (92.3)	>0.05	4 (10.5)	34 (89.5)	> 0.05	2 (5.3)	36 (94.7)	<0.05 *
	No	13 (16.7)	65 (83.3)		12 (15.4)	66 (84.6)		18 (23.1)	60 (76.9)	
Smoking	Yes	8 (14.8)	46 (85.2)	>0.05	7 (13.0)	47 (87)	> 0.05	7 (13.0)	47 (87.0)	> 0.05
	No	8 (12.7)	55 (87.3)		9 (14.5)	53 (85.5)		13 (21.0)	49 (79.0)	
Hyperten sion	Yes	14 (14)	87 (86.1)	> 0.05	14 (14.0)	86 (86)	>0.05	19 (19.0)	81 (81.0)	>0.05
	No	2 (12.5)	14 (87.5)		2 (12.5)	14 (87.5)		1 (6.2)	15 (93.8)	
PAD	Yes	3 (21.4)	11 (78.6)	> 0.05	2 (14.3)	12 (85.7)	>0.05	3 (21.4)	11 (78.6)	>0.05
	No	13 (12.6)	90 (87.4)		14 (13.7)	88 (86.3)		17 (16.7)	85 (83.3)	
Previous MI	Yes	0 (0.0)	10 (100)	>0.05	1 (10,0)	9 (90)	> 0.05	2 (20.0)	8 (80.0)	> 0.05
	No	16 (15.0)	91 (85.0)		15 (14.2)	91 (85.8)		18 (17.0)	88 (83.0)	
NYHA (≥ 3)	Yes	3 (42.9)	4 (57.1)	<0.05*	3 (42.9)	4 (57.1)	>0.05	1 (14.3)	6 (85.7)	>0.05
	No	12 (11.0)	97 (89.0)		13 (11.9)	96 (88.1)		19 (17.4)	90 (82.6)	
Chronic kidney		6 (10.7)	50 (89.3)	> 0.05	9 (16.4)	46 (83.6)	>0.05	12 (21.8)	43 (78.2)	> 0.05

Timing Variables		AF at 7 days		P	AF at 3 months		P	AF at 6 months		p
		Yes (n=16)	No (n=101)		Yes (n=16)	No (n=100)		Yes (n=20)	No (n=96)	
failure ≥stage 4	No	10 (16.4)	51 (83.6)		7 (11.5)	54 (88.5)		8 (13.1)	53 (86.9)	
Euro score ≥ 3%	Yes	2 (28.6)	5(71.4)	>0.05	4 (57.1)	3 (42.9)	>0.05	3 (42.9)	4 (57.1)	>0.05
	No	14 (12.7)	96 (87.3)		12 (11.0)	97 (89.0)		17 (15.6)	92 (84.4)	
Preoperative EF		66.75 ± 8.31	63.38 ± 12.05	>0.05	65.56 ± 10.56	63.6 ± 11.88	> 0.05	65.2 ± 9.53	63.59 ± 12.11	>0.05
CPB duration (min)		93.15 ± 29.55	94.05 ± 26.25	>0.05	95.25 ± 29.05	94.0 ± 26.15	>0.05	94.25 ± 27.35	94.05 ± 26.5	>0.05
Aortic clamp time (min)		72.05 ± 24.50	74.05 ± 23.45	> 0.05	73.05 ± 25.50	74.05 ± 23.95	>0.05	73.05 ± 24.10	74.05 ± 23.15	>0.05

Entries are mean±SD or numbers of patients. P -values are nominal. AF = atrial fibrillation, BMI = body mass index, GFR: Glomerular Filtration Rate, NYHA: New York Heart Association, PAD: Peripheral artery disease, MI: Myocardial infarction, CPB: Cardiopulmonary bypass. *: Statistically significant difference.

Table 2. Results of preoperative HRV analysis in patients with and without postoperative AF during the follow-up

Timing Preoperative HRV		AF at 7 days postoperatively		P	AF at 3 months postoperatively		P	AF at 6 months postoperatively		P
		Yes (n=16)	No (n=101)		Yes (n=16)	No (n=100)		Yes (n=20)	No (n=96)	
ASDNN (ms)		38.44 ± 25.24	46.27 ± 18.97	>0.05	40.44 ± 30.12	46.27 ± 17.79	>0.05	41.75 ± 25.80	46.24 ± 18.47	>0.05
rMSSD (ms ²)		19.63 ± 8.14	28.02 ± 12.30	<0.05*	24.25 ± 12.35	27.47 ± 12.04	>0.05	23.30 ± 11.43	27.80 ± 12.13	>0.05
pNN 50 (%)		3.23 ± 3.30	7.48 ± 7.57	<0.05*	5.88 ± 6.55	7.13 ± 7.40	>0.05	4.58 ± 5.44	7. ± 7.53	>0.05
SDNN (ms)		85.94 ± 40.95	104.50 ± 32.06	<0.05*	85.13 ± 45.23	105.23 ± 30.66	>0.05	91.50 ± 42.81	104.74 ± 31.05	>0.05
SDANN (ms)		74.00 ± 34.02	90.69 ± 31.02	>0.05	73.31 ± 36.57	91.29 ± 30.28	<0.05*	81.25 ± 39.12	90.38 ± 29.88	>0.05
VLF (ms ²)		23.37 ± 19.32	25.74 ± 10.76	>0.05	23.26 ± 21.63	25.93 ± 9.96	>0.05	23.92 ± 18.23	25.90 ± 10.55	>0.05
LF (ms ²)		15.43 ± 19.53	16.55 ± 10.94	>0.05	15.19 ± 19.77	16.73 ± 10.83	>0.05	16.24 ± 17.48	16.58 ± 11.10	>0.05
HF (ms ²)		9.42 ± 8.74	11.75 ± 6.95	>0.05	10.62 ± 9.15	11.65 ± 6.89	>0.05	10.49 ± 8.40	11.72 ± 6.96	>0.05
LF/HF		1.45 ± 0.55	1.44 ± 0.37	>0.05	1.30 ± 0.51	1.47 ± 0.37	>0.05	1.48 ± 0.53	1.44 ± 0.36	>0.05

Entries are mean±SD, P -values are nominal. Student's unequal variance unpaired t-tests was used. *: Statistically significant difference.

Table 3. Results of reduced pre-operative HRV analysis in patients with and without postoperative AF during the follow-up

Timing Reduced pre-operative HRV		7 days after operation		P (CI)	3 months after operation		P (CI)	6 months after operation		P (CI)
		AF (+) (n =16)	AF (-) (n= 101)		AF (+) (n=16)	AF (-) (n=100)		AF (+) (n= 20)	AF (-) (n=96)	
ASDNN (n,%)	< 30 ms	5 (22.70)	17 (77.30)	> 0.05 (0.69 – 7.29)	8 (38.10)	13 (61.90)	<0,05* (2,14 – 20,92)	7 (33.30)	14 (66.70)	< 0.05* (1.0 – 9.28)
	≥ 30 ms	11 (11.60)	84 (88.40)		8 (8.40)	87 (91.60)		13 (13.70)	82 (86.30)	
rMSSD (n,%)	< 15 ms	7 (41.20)	10 (58.80)	<0.05* (2.16 – 23.12)	5 (31.20)	11 (68.80)	<0,05* (1,07 – 12.56)	4 (25.00)	12 (75.00)	>0.05 (0,50 – 6.11)
	≥ 15 ms	9 (9.00)	91 (91.00)		11 (11.00)	89 (89.00)		16 (16.00)	84 (84.00)	
pNN 50 (n,%)	< 0.75 %	7 (28.00)	18 (72.00)	<0.05* (1.18 – 10.89)	5 (20.80)	19 (79.20)	> 0,05 0.60 – 6.23	6 (25.00)	18 (75.00)	>0.05 (0.62 – 5.49)
	≥ 0.75 %	9 (9.80)	83 (90.2)		11 (12.00)	81 (88.00)		14 (15.20)	78 (84.80)	
SDNN (n,%)	< 50 ms	4 (44.40)	5 (55.60)	<0.05* (1.50 – 27.15)	6 (75.00)	2 (25.00)	< 0,01* (5,22 - 16,4)	4 (50.00)	4 (50.00)	< 0.05* (1.30– 25.36)
	≥ 50 ms	12 (11.1)	96 (88.9)		10 (9.30)	98 (90.70)		16 (14.80)	92 (85.20)	
SDNN (n,%)	≥ 93 ms	11 (20,8)	42 (79,2)	<0.05* (1.0- 9.56)	10 (19,2)	42 (80,8)	>0,05 (0.77- 6.82)	12 (23,1)	40 (76,9)	>0,05 (0.78- 5.60)
	< 93 ms	5 (7,8)	59 (92,2)		6 (9,4)	58 (90,6)		8 (12,5)	56 (87,5)	
SDANN (n,%)	< 40 ms	3 (60.00)	2 (40.00)	<0.05* (1.74 – 74.88)	2 (40.00)	3 (60.00)	>0.05 (0.70 – 30.11)	2 (40.00)	3 (60.00)	>0.05 (0.53 – 2210)
	≥ 40 ms	13 (11.60)	99 (88.40)		14 (12.60)	97 (87.40)		18 (16.20)	93 (83.80)	

Entries are numbers of patients. P -values are nominal. CI: confidence of interval. The cut off for each index of reduced HRV time domain as recommended. * Statistically significant difference.

Table 4. Hazard Ratios for Association Between Variables and Postoperative Atrial Fibrillation

Timing	RR	P (CI)	RR	P (CI)	RR	P (CI)
Reduced HRV	At 7 days		At 3 months		At 6 months	
SDNN ≤ 50 ms	3.502	>0.05 (0.708- 17.322)	30.882	< 0,001 * (4.503- 211.777)	5.404	<0.05 * (1.078- 27.087)

rMSSD $\leq$ 15 ms	3.444	>0.05 (0.987- 12.015)	0.906	> 0.05 (0.170- 4.835)	1.138	> 0.05 (0.304- 4.259)

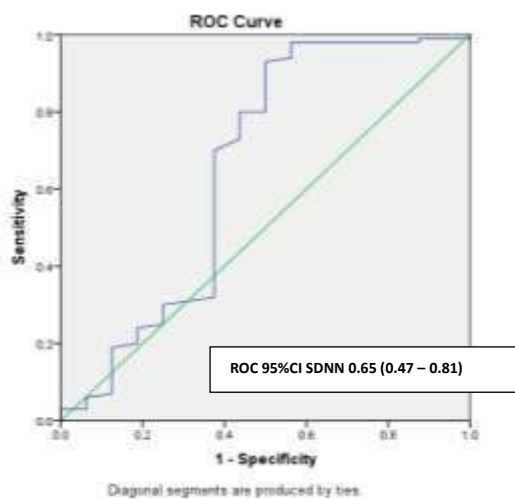
Multivariate was used to find the predictor of postoperative AF, CI: CI: confidence of interval. * Statistically significant difference.

Table 5. Results of HRV analysis at 7 days' post-surgery in patients with and without postoperative AF during the follow-up

Timing HRV at 7 days postoperatively	AF at 3 months		p	AF at 6 months		p
	Yes (n=12)	No (n=97)		Yes (n=16)	No (n=93)	
ASDNN (ms)	29,75 $\pm$ 19,32	35,34 $\pm$ 21,49	> 0.05	35,56 $\pm$ 23,48	34,58 $\pm$ 20,97	> 0.05
rMSSD (ms²)	19,92 $\pm$ 7,93	22,40 $\pm$ 13,37	> 0.05	24,56 $\pm$ 15,92	21,71 $\pm$ 12,34	> 0.05
pNN 50 (%)	3,08 $\pm$ 3,49	5,16 $\pm$ 9,25	> 0.05	7,07 $\pm$ 10,06	4,56 $\pm$ 8,60	> 0.05
SDNN (ms)	66,17 $\pm$ 38,97	78,48 $\pm$ 34,27	> 0.05	80,75 $\pm$ 39,22	76,51 $\pm$ 34,22	> 0.05
SDANN (ms)	58,08 $\pm$ 35,49	65,42 $\pm$ 28,63	>0.05	68,81 $\pm$ 33,84	63,89 $\pm$ 28,67	>0.05
VLF (ms²)	15,66 $\pm$ 12,17	18,81 $\pm$ 11,80	> 0.05	17,69 $\pm$ 13,29	18,60 $\pm$ 11,63	> 0.05
LF (ms²)	10,45 $\pm$ 9,11	13,37 $\pm$ 12,25	>0.05	11,82 $\pm$ 10,84	13,26 $\pm$ 12,17	>0.05
HF (ms²)	7,06 $\pm$ 3,69	8,98 $\pm$ 6,43	> 0.05	9,14 $\pm$ 8,24	8,71 $\pm$ 5,84	> 0.05
LF/HF	1,40 $\pm$ 0,86	1,50 $\pm$ 0,60	>0.05	1,41 $\pm$ 0,74	1,50 $\pm$ 0,61	>0.05

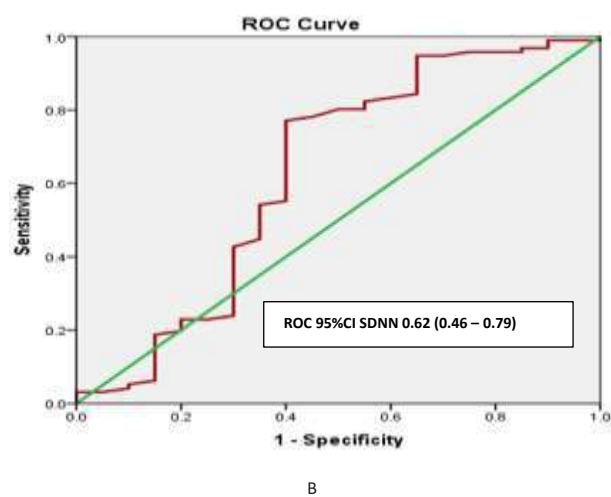
Entries are mean $\pm$ SD, P -values are nominal. Student's unequal variance unpaired t-tests was used. * Statistically significant difference.

Figure 1. New onset AF rate during the follow-up



A

ROC 95%CI SDNN 0.65 (0.47 – 0.81)



B

ROC 95%CI SDNN 0.65 (0.47 – 0.81)

Figure 2. ROC curves for predicting atrial fibrillation at 3 months (A) and 6 months (B) postoperatively. ROC: Receiver operator characteristic; AUC: area under curve; CI: confidence interval.

Prognostic Implication and the Effect of Catheter Ablation between the Type of Atrial Fibrillation

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Objectives: Little is known about the prognostic implication and the efficacy of catheter ablation (CA) by the type of atrial fibrillation (AF).

Methods: We analyzed data from a multicenter registry-based cohort study of patients with AF. Patients were categorized to paroxysmal AF (PAF) or persistent AF (PersAF) according to the duration of AF (lasting less, or more than one week, respectively). The composite of all-cause death, heart failure hospitalization, stroke, and bleeding events during two-year follow-up was compared between the groups. Additionally, propensity score (PS)-matching analysis was performed for each type of AF to compare the clinical outcomes between those who underwent CA or medication alone.

Results: Among 2,788 patients (median age; 69 years, male; 68.4%), there were 1,439 (51.6%) and 1,349 (48.4%) PAF and PersAF patients, respectively. The incidence of primary outcome was higher in patients with PersAF than in those with PAF (12.8% vs. 7.2%, $P<0.001$). After adjustments, PersAF was an independent predictor of adverse outcome (adjusted HR 1.35, 95%CI 1.30-1.78, $P=0.031$). PS-matching analysis showed significantly fewer events in CA group compared with medication group among those with PAF (HR 0.32, 95% CI 0.17-0.61, $P<0.001$). A similar trend was observed in patients with PersAF, although it did not reach statistical significance (HR 0.65, 95% CI 0.36-1.17, $P=0.15$).

Conclusion: PersAF was a strong and independent risk factor for adverse clinical outcomes. CA improved the prognosis of patients with PAF, and also suggested the potential of positive effect toward those with PersAF.

More Effort Might Require to Complete Isolated Lesion in Paroxysmal Atrial Fibrillation Than in Non-paroxysmal.

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Objective:

Left atrial diameter (LAd) is one of simple parameters that can be obtained in virtually all atrial fibrillation (AF) patients. LAd is often larger in chronic atrial fibrillation (CAF) than in paroxysmal atrial fibrillation (PAF), so we should perform PAF ablation more easily than persistent AF (PeAF) and CAF. However, we sometimes have difficulty in ablating PAF more than PeAF and CAF.

Materials and Methods:

We divided into three groups depending on the AF severity and investigated the following parameters stated in the table in 400 patients (PAF: 160, PeAF: 128, CAF: 112) to whom we could perform the first pass Box PVI.

Results:

In the univariate analyses in AF of different severity, there were significant differences in several parameters, including the LAd. On the other hand, in the multivariate analyses, the only TnI on the next day after the ablation and the LAd showed significant differences. In the group of PAF, the LAD was the smallest and the TnI on the next day after the ablation was the largest. On the other hand, in the group of CAF, the LAd was the largest but the TnI on the next day after the ablation was the smallest.

Conclusion:

These results suggested that the atrial myocardium in PAF may require more ablation energy to complete first pass Box PVI than in CAF and PeAF.

SUPPORTING DOCUMENTS

	PAF	PeAF	CAF	Univariate	Multivariate
Number of cases	160	128	112	(P value)	
Age	67.22±9.83	67.05±9.89	67.11±9.91	0.1304	...
Gender (male)	97 (60.6%)	91 (71.1%)	92 (82.1%)	0.0009	...
BMI	23.38±3.55	23.42±3.60	23.41±3.60	0.2646	...
Pre-Ejection Fraction	63.58±10.4	63.13±10.7	63.13±10.7	<0.0001	0.1801
Pre-Left Atrial diameter	39.64±6.69	39.90±6.65	39.94±6.64	<0.0001	<0.0001
Troponin I after ablation	3.261±1.68	3.195±1.69	3.171±1.66	<0.0001	0.0039

Using computed tomogram atrial myocardial thickness maps in high-power short-duration radiofrequency pulmonary vein isolation.

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Introduction

Catheter ablation is the most effective rhythm control strategy for patients with atrial fibrillation (AF), but continuous long-term recurrence is common after the procedure. Pulmonary vein (PV) isolation (PVI) is the cornerstone of AF catheter ablation (AFCA), and PV reconnection is one of the most common mechanisms of AF recurrence after the procedure. PVI durability could be affected by various factors such as the type of catheter, energy source, radiofrequency (RF) power, duration of energy delivery, contact force, and the stability of catheter or objective physical parameters including ablation index or lesion index. In addition, patient-specific atrial wall thickness (WT) may be a factor that must be considered for appropriate transmural lesion generation. The consideration of atrial WT is important in terms of evaluating the safety as well as the efficacy and durability of PVI. The risk of procedure-related complications, including hemopericardium, increases in elderly ladies and patients with malnutrition with relatively thinner PV antrum than healthy young males. Recently, higher-power short-duration (HPSD) RF-PVI has been widely used, and plenty of studies evaluating its efficacy and safety comparative are emerging.

Therefore, we explored the efficacy and safety of PV antral WT-guided HPSD RF-PVI by titrating the duration of 60W energy delivery to each point. Based on our previous studies and experience, 15 seconds of 60W HPSD using FlexAbility was considered the control treatment. We compared the control treatment with the WT-guided ablation, which reduces RF delivery time in the thin LAWT areas, in this prospective single-center randomized clinical trial. We measured and utilized LAWT using automated customized software (AMBER, LaonMed, Korea) in real-time during AFCA procedures.

Methods

Study population and randomization

The study protocol adhered to the Declaration of Helsinki and was approved by the institutional review board of Yonsei University. Written informed consent was obtained from all participants before the study began (ClinicalTrials.gov; NCT03912324). The study cohort initially included 200 patients with PAF (70.0% males, 59.6±11.8-years-of-age) who underwent AFCA for symptomatic and drug-refractory non-valvular AF. The exclusion criteria were as follows: 1) persistent or permanent AF, 2) AF with severe cardiac malformation or structural heart disease, 3) severe renal impairment or CT imaging difficulty using contrast media, 4) a history of AF ablation or cardiac surgery, and 5) valvular AF (mitral stenosis >grade 2, mechanical valve, and mitral valvuloplasty).

Before all ablation procedures, we defined the anatomy of the LAs and PVs using three-dimensional (3D) computed tomography (CT) scans (64-channel, light speed volume CT, Philips,

Brilliance 63, Amsterdam, Netherlands). All patients discontinued all anti-arrhythmic drugs (AADs) for at least five half-lives, and amiodarone was stopped more than one month before the procedure. This study was performed under a prospective single-center randomized clinical study protocol. We conducted randomization using computer-generated random permutation sequences to avoid any potential bias. The patients were blinded to the initial allocation, and the rhythm outcomes were determined by the research coordinators based on Holter and electrocardiogram (ECG) monitoring. Except for 3 patients whose follow-up duration was less than 3 months, of the 197 enrolled patients, 104 and 93 were assigned to the WT-guided PVI (WT group) and conventional PVI (Control group) groups, respectively (Figure 1).

Preparing left atrial wall thickness maps using CT

We used the previously developed automated customized software (AMBER, LaonMed, Korea) to measure myocardial thickness from cardiac CT images. This software has been validated with 3D-printed LA phantom models, over 120 AF patients, and through 12 other previously published studies. The day before the procedure, experienced investigators measured a 3D LAWTT map from CT images of the patient acquired before the ablation procedure and then delivered it to the clinical procedure team (taking approximately 20 min per patient). As a summary of AMBER software, obtaining myocardial wall thickness consists of three steps. First, we divided the boundaries of the myocardium with thresholds of cardiac tissues obtained from CT histograms and guidelines drawn by investigators. Next, we extracted the myocardial wall based on the morphological and intersection operations. In the third stage, we calculated the WT of the streamlines connecting the endo- and epicardium by applying Laplace's equation and Euler's method. This approach is reported as a robust method for WT measurement because it considers both endo- and epicardial surfaces despite the complex morphology of the atria.

Electrophysiological mapping and AF catheter ablation

Intracardiac electrograms were recorded using the Prucka CardioLab™ Electrophysiology system (General Electric Medical Systems, Inc., Milwaukee, WI, USA). After the transeptal puncture, multi-view pulmonary venograms were obtained. Details of the AFCA technique and strategy have been reported in our previous studies. Systemic anticoagulation was performed using intravenous heparin to maintain an activated clotting time of 350–400 seconds during the procedure. The esophageal temperature was monitored in all patients, and the luminal esophageal cut-off temperature was 38.4°C for AFCA.

The AFCA was performed using a 3D electro-anatomical mapping system (NavX; St. Jude Medical, USA.) merged with 3D spiral CT. In the WT group, we merged the spatiotemporal information of each electrogram with a previously analyzed LAWTT map (merging time, 15 min). In both groups, we used a FlexAbility catheter (St. Jude Medical, Inc., Minnetonka, MN) without contact force monitoring. In the Control group, we delivered 60 W (for a target temperature of 45°C) to the anterior part of the LA and constant 50 W RF to the posterior part of the LA for 15 seconds. However, in the WT group, we used the same catheter but delivered RF for 15s at each point with LAWTT>2.1mm, 13s at points with LAWTT around 1.4–2.1mm, and 11s at areas with LAWTT <1.4mm. Cavotricuspid isthmus ablation and SVC-RA isolation were carried out in the majority of patients in both groups.

Ablation endpoint and repeat ablation

After the completion of the protocol-based ablation, we conducted an isoproterenol provocation test to induce extra-PV triggers in both groups. We observed extra-PV foci within 10 min after cardioversion with an isoproterenol infusion (5–10 µg/min depending on the β-blocker use with a target sinus heart rate of 120 bpm). After careful mapping, any extra-PV triggers were ablated as much as possible.

Post-ablation management and follow-up

We tried to discharge all patients without AADs except for those who had recurrent extra-PV triggers after the AFCA procedure, symptomatic frequent atrial premature beats, non-sustained atrial tachycardia (AT), or early AF recurrence on telemetry during the admission period. Patients visited the outpatient clinic regularly at 1, 3, 6, and 12 months postoperatively and then every 6 months thereafter or whenever symptoms occurred after the AFCA. All patients underwent ECGs during every visit and 24-h Holter recordings at 3 and 6 months postoperatively and then every 6 months thereafter according to the 2012 HRS/EHRA/ECAS Expert Consensus Statement guidelines. Holter monitoring or event monitor recordings were obtained when the patients reported symptoms of palpitations suggestive of an arrhythmia recurrence. Holter analysis and adjudication were performed by an individual blinded to the study group assignments. AF recurrence was defined as any episode of AF or AT lasting at least 30 seconds. Any ECG documentation of AF recurrence within a 3-month blanking period was diagnosed as early recurrence, while any AF recurrence that took place more than 3 months after the procedure was diagnosed as a clinical recurrence. The primary study endpoint was freedom from documented episodes of AF or AT lasting longer than 30 seconds and occurring after a 3-month blanking period following a single ablation procedure. The secondary endpoints were the peri-procedural complication rate and the response to AADs or the electrical cardioversion rates after post-procedural recurrences.

Data analysis

The sample size was estimated from the recurrence rate derived from our previous AF ablation data. The AF recurrence rates were presumed to be 20% in the WT group and 40% in the control group. An overall sample size of more than 162 was expected to have an 80% power to detect a statistical difference between the 2 groups at a 2-sided alpha of 0.05. We performed all statistical analyses using R version 3.6.0 (R Foundation for Statistical Computing, Boston, Massachusetts, United States).

Application

Patient characteristics

Table 1 summarizes the baseline clinical characteristics of the WT group (n=104) and the Control group (n=93). Both ablation groups were well-balanced in terms of baseline demographics. The mean age of the participants was 59.8±11.7 years, and 138 patients (70.1%) were men. The mean CHA2DS2-VASc score was 1.5±1.3. Of the 197 study participants, 15.2% (30) had a history of heart failure, 29.9% (59) had hypertension, and 15.2% (30) had diabetes mellitus. We found no significant difference in the comorbidities between the two groups (p=NS). The mean LA dimension was 38.4±5.8mm, and the mean LAVI was 34.8±9.7 ml/m². We found no significant difference in the echocardiographic parameters between the two groups (p=NS).

Procedural characteristics

We summarized the procedural results and clinical outcomes in Table 2 and Table 3. There was no significant difference in the total procedure time (102.5 ± 15.7 vs. 104.4 ± 23.8 min; $p=0.517$) or the total ablation time (1858.8 ± 293.5 vs. 1857.5 ± 393.2 s; $p=0.980$). The first-pass PVI rate did not differ between the two groups (49.5% in the WT group vs. 57.1% in the C group, $p=0.358$). Post-PVI isoproterenol provoked extra-PV triggers in both groups (8.7% in the WT group vs. 12.8% in the Control group; $p=0.494$), and the locations of the extra-PV triggers are summarized in Table 2.

Primary outcome

During the mean 9.7 ± 4.8 months of follow-up, neither the early recurrence rate within 3 months of the AFCA (21.4% vs. 12.8%; $p=0.160$) nor the clinical recurrence rate (9.7% vs. 6.4%; $p=0.554$) significantly differed between the WT and Control groups. (Table 3). A Kaplan-Meier analysis revealed no significant difference in the overall AF recurrence (log-rank; $p=0.326$; Figure 3A), or AAD-free AF recurrence (excluding patients treated with an AAD at the 3rd month from the AFCA) (log-rank; $p=0.866$; Figure 3B) between the two groups. Upon a multivariate Cox regression analysis, the LVMI (HR: 1.03 [1.00–1.05], $p=0.032$) and the presence of extra-PV trigger (HR: 8.29 [2.27–30.33], $p=0.001$) were independently associated with the clinical recurrence of AF, but the WT-guided ablation was not (Table 4). The major complication rates did not significantly differ between the two groups (6.8% vs. 4.3%; $p=0.642$).

Secondary outcome

The AAD prescription rates did not differ between the two groups at discharge (17.5% vs. 14.9%; $p=0.766$), at 3 months after the procedure (28.2% vs. 19.1%; $p=0.189$), nor at the final follow-up (22.3% vs. 14.9%; $p=0.249$, Table 3). Finally, the freedom rates from documented AF after the cessation of AADs were 67.0% and 76.6% in the WT and Control groups, respectively ($p=0.182$). Of 16 patients with clinical recurrence, AF recurred in 14 patients, and AT recurred in two patients (Table 3). Among the patients with clinical recurrence, the proportion of AT (10% [1/10] vs. 16.7% [1/6]; $p=NS$) and the cardioversion rate (10% [1/10] vs. 0% [0/6]; $p=NS$) did not differ between the WT and Control groups.

Future

Durable PVI is the cornerstone of ablation procedures to prevent atrial arrhythmias and AF recurrence. In our study, we first evaluated the efficacy and safety of WT-guided PVI using HPSD ablation. However, WT-guided energy titration did not affect the clinical outcomes of HPSD-PVI. There are several potential explanations for this result. First, we designed this study using homogenous 15 seconds ablation for the Control group and downward RF energy titration in the WT group to focus on the evaluation of safety. Second, the superficial confluent lesion formation by the current HPSD ablation protocol may create transmural lesions and overcome the limitation of WT. Third, there is a possibility that the HPSD 15s ablation energy was excessive for PV-LA transmural lesion formation. The cardiac tamponade rate was slightly higher in this study than in previous studies. Therefore, it is important to find an optimal RF titer for durable PVI satisfying both safety and effectiveness.

SUPPORTING DOCUMENTS

1 **Table 1. Baseline clinical characteristics**

	Overall (n=197)	WT (n=103)	Control (n=94)	p-value
Age, (years)	59.8 ± 11.7	60.6 ± 10.3	58.9 ± 13.0	0.301
Male, n (%)	138 (70.1)	70 (68.0)	68 (72.3)	0.607
AF duration, (months)	31.8 ± 32.7	35.2 ± 35.7	28.1 ± 28.8	0.129
BMI (kg/m ²)	24.5 ± 3.3	24.4 ± 2.6	24.6 ± 3.9	0.615
Comorbidities, n (%)				
Heart failure	30 (15.2)	15 (14.6)	15 (16.0)	0.941
Hypertension	59 (29.9)	32 (31.1)	27 (28.7)	0.839
Diabetes mellitus	30 (15.2)	18 (17.5)	12 (12.8)	0.471
Stroke	14 (7.1)	6 (5.8)	8 (8.5)	0.649
Vascular disease	10 (5.1)	6 (5.8)	4 (4.3)	0.860
CHA ₂ DS ₂ -VASC score	1.5 ± 1.3	1.5 ± 1.4	1.5 ± 1.3	0.987
H2FPEF score	5.1 ± 1.36	5.2 ± 1.3	4.9 ± 1.4	0.151
Echocardiography				
LA dimension, mm (n=195)	38.4 ± 5.8	38.5 ± 5.5	38.2 ± 6.2	0.679
LA volume index, ml/m ² (n=195)	34.8 ± 9.7	35.2 ± 9.9	34.3 ± 9.4	0.522
LV ejection fraction, % (n=195)	65.6 ± 7.5	65.8 ± 7.8	65.3 ± 7.2	0.612
E/Em (n=188)	10.2 ± 4.3	10.5 ± 4.9	9.7 ± 3.4	0.222
LV mass index, g/ m ² (n=191)	93.8 ± 21.2	96.0 ± 19.2	91.3 ± 23.0	0.122
Mean LA Wall Thickness (n=196), mm	1.70 ± 0.32	1.71 ± 0.32	1.68 ± 0.32	0.649
Mean LA voltage (n=184), mV	1.92 ± 0.76	1.93 ± 0.77	1.92 ± 0.76	0.925
LA pressure, mmHg				
Peak pressure, AF (n=72)	24.3 ± 7.2	24.5 ± 7.2	23.9 ± 7.4	0.720
Mean pressure, AF (n=72)	12.9 ± 5.3	13.1 ± 5.7	12.4 ± 4.6	0.578
Peak pressure, SR (n=195)	21.3 ± 10.0	21.6 ± 6.9	20.9 ± 12.6	0.641
Mean pressure, SR (n=195)	10.5 ± 4.9	11.2 ± 4.7	9.8 ± 5.1	0.056
HRV (pre AFCA)				
Mean heart rate (bpm) (n=89)	65.7 ± 11.5	63.9 ± 9.0	67.5 ± 13.4	0.140
rMSSD (n=62)	33.2 ± 21.1	29.9 ± 16.9	37.0 ± 24.8	0.192
HF (n=62)	13.1 ± 9.6	11.4 ± 7.4	14.9 ± 11.5	0.148
LF (n=62)	20.9 ± 17.5	18.9 ± 15.4	23.2 ± 19.7	0.347
LF/HF (n=62)	1.6 ± 0.4	1.6 ± 0.4	1.6 ± 0.4	0.762
HRV (post AFCA 3months)				
Mean heart rate (bpm) (n=102)	77.2 ± 12.3	75.5 ± 13.3	79.0 ± 10.8	0.145
rMSSD (n=74)	18.4 ± 15.4	16.6 ± 9.4	20.5 ± 20.6	0.289
HF (n=74)	7.2 ± 6.8	6.6 ± 5.5	8.0 ± 8.1	0.384
LF (n=74)	8.9 ± 11.5	8.1 ± 12.1	9.9 ± 10.9	0.503
LF/HF (n=74)	1.1 ± 0.5	1.0 ± 0.5	1.2 ± 0.5	0.100

AF, atrial fibrillation; BMI, body mass index; LA, left atrium; LV, left ventricle; E/Em, ratio of the early diastolic mitral inflow velocity (E) to the early diastolic mitral annular velocity (Em); RVSP, right ventricular systolic pressure; SR, sinus

Table 2. Procedural findings and characteristics

	Overall (n=197)	WT (n=103)	Control (n=94)	P-value
Procedure time, min	103.4 ± 19.9	102.5 ± 15.7	104.4 ± 23.8	0.517
Fluoroscopic time, min	20.7 ± 6.8	19.9 ± 5.3	21.5 ± 8.1	0.082
Ablation time, s	1858.2 ± 343.8	1858.8 ± 293.5	1857.5 ± 393.2	0.980
Ablation lesions, n(%)				
CPVI	197 (100.0)	103 (100.0)	94 (100.0)	NS
CTI	196 (99.5)	102 (99.0)	94 (100.0)	NS
SVC-RA	197 (100.0)	103 (100.0)	94 (100.0)	NS
First pass PVI rate, n (%) (n=194)	103 (53.1)	51 (49.5)	52 (57.1)	0.358
Extra PV Triggers, n (%)	21 (10.7)	9 (8.7)	12 (12.8)	0.494
Coronary Sinus	2	1	1	-
CSos	2	1	1	-
CSpx	1	0	1	-
Crista terminalis	1	0	1	-
Fossa ovalis	1	0	1	-
LA posterior wall	1	1	0	-
Septum	4	3	1	-
SVC	3	2	1	-
Unmappable, multifocal	6	1	5	-

CPVI, circumferential pulmonary vein isolation; CTI, cavotricuspid isthmus; PV, pulmonary vein; CS, coronary sinus; OS, ostium; PX, proximal; LA, left atrial; SVC, superior vena cava.

Table 3. Clinical rhythm outcomes and safety

	Overall (n=197)	WT (n=103)	Control (n=94)	p-value
Follow-up duration (months)	9.7 ± 4.8	9.5 ± 5.1	10.0 ± 4.5	0.500
Post-ABL medication				
ACEi, or ARB, n (%)	48 (24.4)	29 (28.2)	19 (20.2)	0.258
Beta blocker, n (%)	70 (35.5)	34 (33.0)	36 (38.3)	0.532
Statin, n (%)	93 (47.2)	52 (50.5)	41 (43.6)	0.411
AAD Use				
AADs at discharge, n (%)	32 (16.2)	18 (17.5)	14 (14.9)	0.766
AADs after 3 months, n (%)	47 (23.9)	29 (28.2)	18 (19.1)	0.189
AADs at final follow-up, n (%)	37 (18.8)	23 (22.3)	14 (14.9)	0.249
Final SR without AAD	141 (71.6)	69 (67.0)	72 (76.6)	0.182
Early recurrence, n (%)	34 (17.3)	22 (21.4)	12 (12.8)	0.160
Recurrence type AF, n (% in early recur)	27 (79.4)	18 (81.8)	9 (75.0)	0.979
Recurrence type AT, n (% in early recur)	7 (20.6)	4 (18.2)	3 (25.0)	0.979
Clinical recurrence, n (%)	16 (8.1)	10 (9.7)	6 (6.4)	0.554
AF Recurrence, n (% in recur/ % overall)	14 (87.5/7.1)	9 (90.0/8.7)	5 (83.3/5.3)	NS
AT Recurrence, n (% in recur/ % overall)	2 (12.5/1.0)	1 (10.0/1.0)	1 (16.7/1.1)	NS
Cardioversion, n (% in recur/ % overall)	1 (6.3/0.5)	1 (10.0/1.0)	0	NS
Complications, n (%)	11 (5.6)	7 (6.8)	4 (4.3)	0.642
Tamponade	6 (54.5)	3 (42.9)	3 (75.0)	
Hemopericardium	2 (18.2)	1 (14.3)	1 (25.0)	
3 rd degree AV block	1 (9.1)	1 (14.3)	0 (0)	
Sick sinus syndrome	1 (9.1)	1 (14.3)	0 (0)	
Rt. Phrenic nerve palsy	1 (9.1)	1 (14.3)	0 (0)	

IQR, Interquartile range; ABL, ablation; ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; AAD, antiarrhythmic drug; SR, sinus rhythm; AF, atrial fibrillation; AT, atrial tachycardia; AV, atrioventricular

Table 4. Cox regression analysis for clinical recurrence

	Univariate		Multivariate	
	HR (95% CI)	P-value	HR (95% CI)	P-value
Age, years *	1.01 (0.96-1.05)	0.773	1.00 (0.96-1.05)	0.948
Male, n (%) *	1.04 (0.36-2.99)	0.944	0.85 (0.28-2.61)	0.780
AF duration, months	1.00 (0.99-1.01)	0.988		
Comorbidities				
Heart failure	1.98 (0.64-6.14)	0.238		
Hypertension	0.56 (0.16-1.98)	0.372		
Diabetes mellitus	<0.001 (0-Infinite)	0.997		
Stroke *	1.29 (0.62-2.71)	0.498		
Vascular disease	<0.001 (0-Infinite)	0.998		
CHA ₂ DS ₂ -VASc score	1.01 (0.69-1.47)	0.975		
H2FPEF score	0.97 (0.67-1.39)	0.848		
Echocardiographic parameters				
LA dimension, mm *	1.07 (0.98-1.17)	0.133	1.05 (0.93-1.20)	0.409
LA volume index, ml/m ²	1.03 (0.98-1.08)	0.263		
LV ejection fraction, %	0.99 (0.93-1.06)	0.794		
E/Em	1.00 (0.89-1.12)	0.933		
LVMI, g/m ²	1.03 (1.01-1.05)	0.007	1.03 (1.00-1.05)	0.032
Mean LA wall thickness, mm	0.40 (0.08-2.12)	0.281		
Extra-PV trigger, n(%)	6.36 (2.16-18.7)	<0.001	8.29 (2.27-30.33)	0.001
WT guided ablation *	1.65 (0.60-4.55)	0.331	2.03 (0.69-5.98)	0.200

AF, atrial fibrillation; LA, left atrium; LV, left ventricle; E/Em, mitral inflow velocity/mitral annulus tissue velocity; LVMI, LV mass index; AAD, antiarrhythmic drug; PV, pulmonary vein; WT, wall thickness

* selected variables were used for multivariate cox regression analysis

Figure Legends

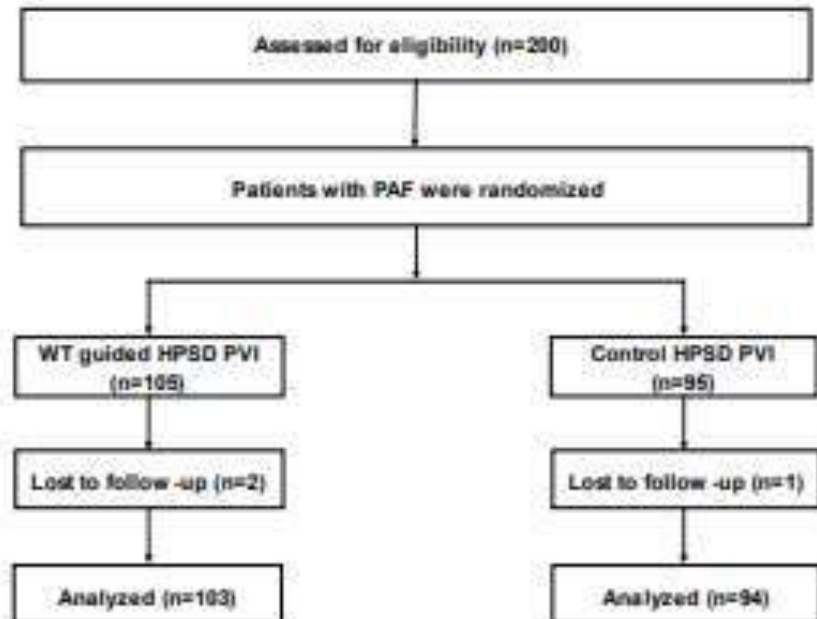


Figure 1

Figure 1. Flow diagram of study population enrollment

PAF, paroxysmal atrial fibrillation; WT, wall thickness; HPSP high-power short duration; PVI, pulmonary vein isolation

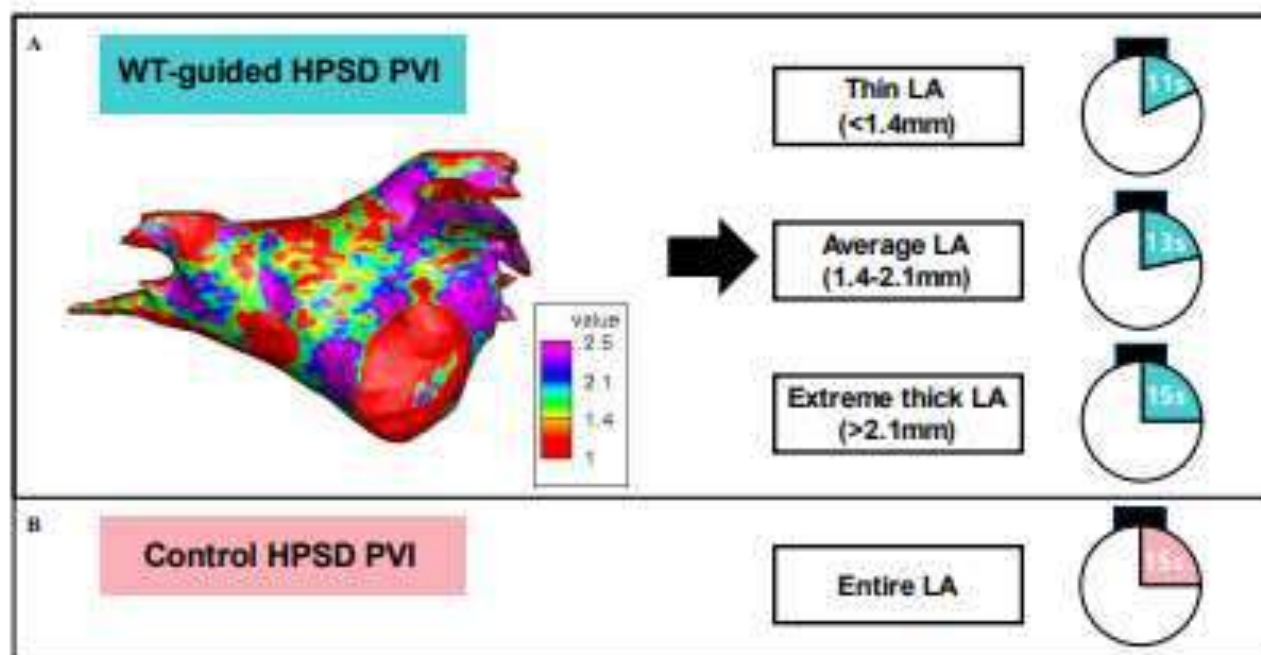


Figure 2

Figure 2. The representative images of the atrial wall thickness map and ablation time according to ablation strategy.

A. In the WT group, the left atrial wall thickness map was obtained by using cardiac CT images. We delivered RF at 60W but titrated the RF duration for 15s at each point with LAWT>2.1mm, 13s at points with LAWT around 1.4–2.1mm, and 11s at areas with LAWT <1.4mm.

B. In the Control group, we delivered 60 W (for a target temperature of 45°C) to the anterior part of the LA and constant 50 W RF to the posterior part of the LA for 15 seconds.

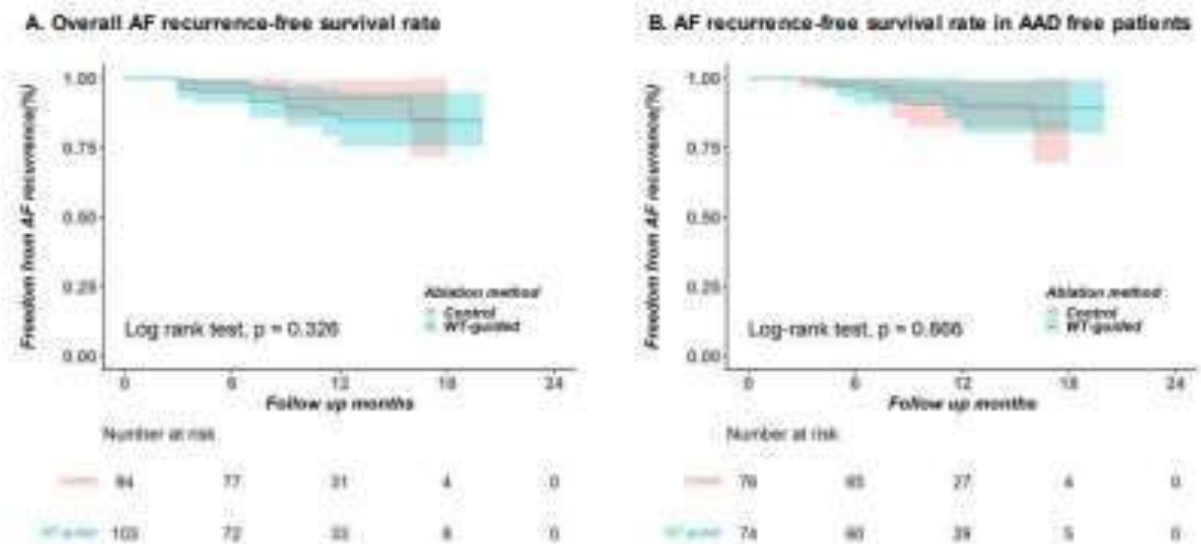


Figure 3

Figure 3. Kaplan–Meier analysis of the AF recurrence-free survival rate (A), AF recurrence-free survival rate in AAD free patients (B)

AF, atrial fibrillation; AAD, anti-arrhythmic drug;

Early Prediction of Paroxysmal Atrial Fibrillation Through an Artificial Intelligence (AI) Prediction Algorithm

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¹*Ewha Womans University Medical Center, Seoul, South Korea*, ²*Kangwon National University, Chuncheon-si, South Korea*

Objective

This study aims to develop a precise predictive AI model for screening PAF using normal sinus rhythm (NSR) ECG within 1 month.

Materials and methods

This retrograde cohort study included patients with age between 18 and 99 with NSR ECG on 12 lead standard ECG (10-second) in Ewha Womans University Medical Center between May 23th, 2017 and Sep 2nd, 2020. The data was preprocessed into 3 window periods (which were defined with the duration from NSR to PAF detection) – 1week, 2weeks, and 4weeks from the AF detection prospectively. For the experiment, we adopted the residual neural network based on 1D-CNN proposed in [1]. Our model consists of 4 layers with skip connections.

Results

We used 7,595 NSR ECGs with window periods of 1week, 2weeks, and 4weeks for analysis; 5,488, 6,555, and 7,595 ECGs, respectively. The algorithm was verified by internal validation using test data and it showed AUC of 0.812 and accuracy of 0.75 (F1-score of 0.74) in the 1:1 matched group of 1week window period. For the 1:1 matched group of 2weeks window period, it showed AUC of 0.813 and accuracy of 0.75 (F1-score of 0.74). Finally, for the 1:1 matched group of 4weeks window period, it showed AUC of 0.803 and accuracy of 0.74 (F1-score of 0.74).

Conclusion

The AI-prediction algorithm showed the possibility of risk stratification for early detection of PAF. Unlike previous ones, this study showed that a short window period is also sufficient to detect PAF.

[1] Nature communications 11.1 (2020): 1-9.

SUPPORTING DOCUMENTS

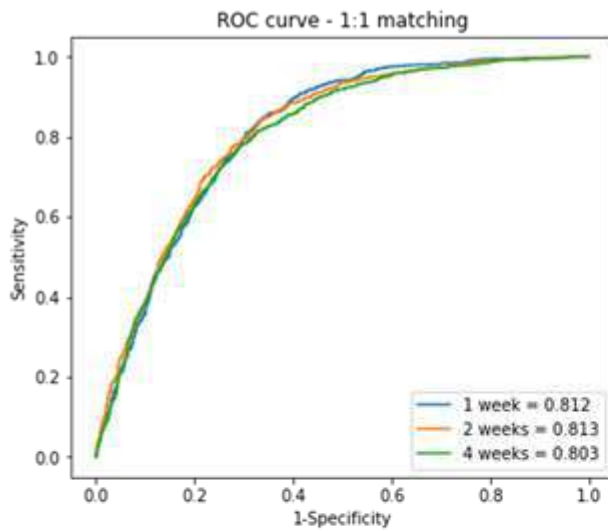


Figure 1. ROC curves of the residual block model on the test data set.

In the analysis, we divided the data into three window periods, which were defined with duration from NSR to PAF detection. 1:1 matched ECGs of control group included for analysis.

		AUROC	F1 score	accuracy	Specificity	Sensitivity (Recall)
1:1 matching	1 week	0.812	0.74	0.75	0.61	0.88
	2 weeks	0.813	0.74	0.75	0.63	0.86
	4 weeks	0.803	0.74	0.74	0.66	0.82
1:4 matching	1 week	0.862	0.84	0.84	0.91	0.57
	2 weeks	0.864	0.85	0.85	0.93	0.56
	4 weeks	0.842	0.83	0.84	0.93	0.48

Table1. Model performance

Threshold of sensitivity, specificity, F1-score, and accuracy was calculated based on 0.2

High power strategy at sites adjacent to the esophagus during Laser balloon-based pulmonary vein isolation.

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OBJECTIVES

Laser balloon-based pulmonary vein isolation is an established therapeutic option in patients with atrial fibrillation. However, suddenly elevated esophageal temperature is sometimes problematic that increases the risk of esophageal collateral damage. This study aims to evaluate the efficacy and safety among different power settings at the points documented sudden esophageal temperature increase.

MATERIALS AND METHODS

We enrolled 50 points in 11 patients where esophageal temperature reached 39°C within 5 seconds after the ablation. We allocated four power settings (12W, 10W, 8.5W, and 5.5W), and ablation was immediately stopped when the esophageal temperature reached 39°C. The efficacy outcomes were ablation time and total energy calculated by the product of power and ablation time. The safety outcomes were maximal temperature and the integral value of esophageal temperature over 39°C.

RESULTS

Although ablation time required for the esophageal temperature to reach 39°C was shortest in the 12 W group (12W: 3.1±2.1 seconds, 10W: 3.6±2.7 seconds, 8.5W: 4.7±3.9 seconds, 5.5W: 8.0±7.2 seconds; p<0.001), total energy did not differ among the four groups (40±35 J, 35±26 J, 38±31 J, 40±39 J; p=0.864). There were no significant differences in maximal esophageal temperature (40.2±1.7 °C, 40.3±1.9 °C, 40.1±1.5 °C, 39.8±1.1 °C; p=0.532) and the integral value of esophageal temperature over 39°C (16±49 °C·t, 18±57 °C·t, 12±29 °C·t, 7±14 °C·t; p=0.564) among the four groups.

CONCLUSION

A high power short duration strategy could give the comparable energy application without excessive esophageal collateral damage estimated by esophageal temperature.

Quantitative Comparison of Ablation Lesion Between the Third- and First-generation Visually Guided Laser Balloon.

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¹*Kouseikai Takeda Hospital, Kyoto, Japan*

Objective :

The third-generation laser balloon (LB3) is equipped with more compliant balloon, compared with the first-generation laser balloon (LB1). Because of the balloon development, the LB3 inflated to larger size may isolate wider-area circumferential PV antrum. However, the difference of isolation area between larger-sized LB3 and larger-sized LB1 remains to be elucidated. The aim of this study is to compare the isolation area after PV isolation using larger-sized LB3 with larger-sized LB1 in acute phase.

Methods :

Thirty-nine patients with atrial fibrillation (AF) who underwent LB3 ablation were matched to 39 patients who treated with LB1 ablation by propensity scores. All PVs were electrically isolated only by laser balloon, and the isolation area was extended by larger-sized balloon. After the ablation, voltage maps were created with PENTARAY catheter, and isolation areas were calculated with CARTO-3 system. The isolation area was defined as the low voltage area ($<0.1\text{mV}$) around PV antrum.

Result :

In the LB3 group, the left- and right-sided isolation area was 12.1 ± 3.4 and $18.9\pm4.4\text{ cm}^2$, respectively. The total isolation area was $31.0\pm6.6\text{ cm}^2$. On the other hand, those of the LB1 group was 11.4 ± 2.9 , 16.2 ± 5.2 , and $27.2\pm6.8\text{ cm}^2$. These results revealed that larger-sized LB3 ablation yield statistically grater isolated areas of right-sided ($P=0.014$) and total ($P=0.016$) PV antrum than those of larger-sized LB1 ablation.

Conclusion :

The ultra-compliant balloon of the LB3 may contribute to create wider isolation area than the LB1.

Early Rhythm Control on the Risk of Dementia in Atrial Fibrillation Patients With Prior Stroke

Asst Prof So-Ryoung Lee¹, Prof Eue-Keun Choi¹, Mr. Seung-Woo Lee², Professor Kyung-Do Han³, Professor Seil Oh¹, Professor Gregory Y. H. Lip⁴, **Dr Soonil Kwon¹**

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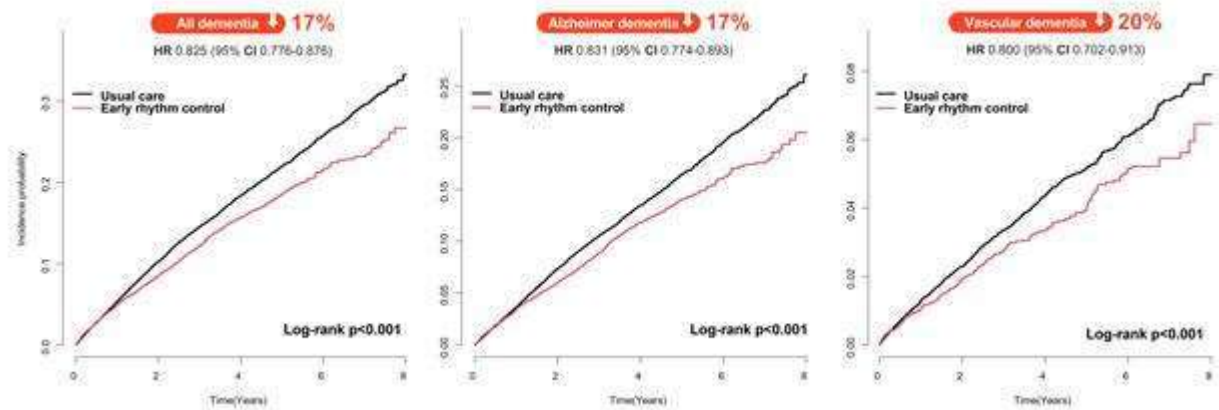
Objective: To evaluate whether early rhythm control (ERC) reduces the risk of developing dementia in patients with atrial fibrillation (AF) and prior stroke.

Methods: Using the Korean nationwide claims database, we identified patients who were newly diagnosed as AF and had prior stroke. Patients who received rhythm control therapy, including antiarrhythmic drug, cardioversion, or AF catheter ablation, within 1 year after incident AF were defined as the ERC group, otherwise as to the usual care group. Propensity score weighting was used to balance baseline characteristics between the two groups. The incidence of all dementia, Alzheimer's dementia, and vascular dementia were evaluated during follow-up.

Results: A total of 41,370 patients were included (mean age, 70±11 years; mean CHA₂DS₂-VASc score 5.3±1.6): 10,213 were in the ERC group and 31,157 in the usual care group. During a median of 2.7 years of follow-up, 6414 patients developed incident dementia (4.9 per 100 person-years). Compared to usual care, ERC was associated with lower risks of all dementia, Alzheimer's dementia, and vascular dementia (hazard ratio [95% confidence interval], 0.825 [0.776-0.876], 0.831 [0.774-0.893], and 0.800 [0.702-0.913], respectively, all p<0.001) (Figure). The beneficial effect of ERC on the risk of dementia was consistent regardless of the characteristics of prior stroke, such as recent stroke, disabling stroke, and severe stroke.

Conclusion: ERC within 1 year after AF diagnosis might be beneficial to prevent dementia in patients with incident AF and a history of stroke. To prevent the progression of further cognitive dysfunction, ERC would be considered in these patients.

SUPPORTING DOCUMENTS



Machine Learning Prediction for the Recurrence After Electrical Cardioversion of Atrial Fibrillation

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¹*Seoul National University Hospital, Seoul, South Korea*, ²*Seoul National University, Seoul, South Korea*

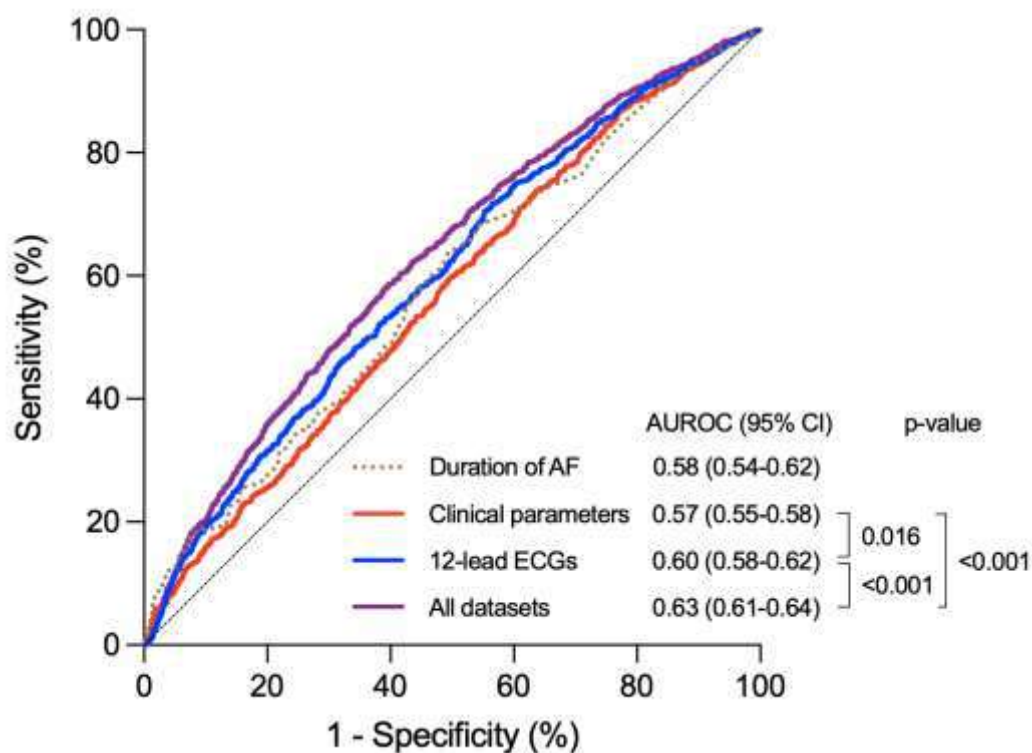
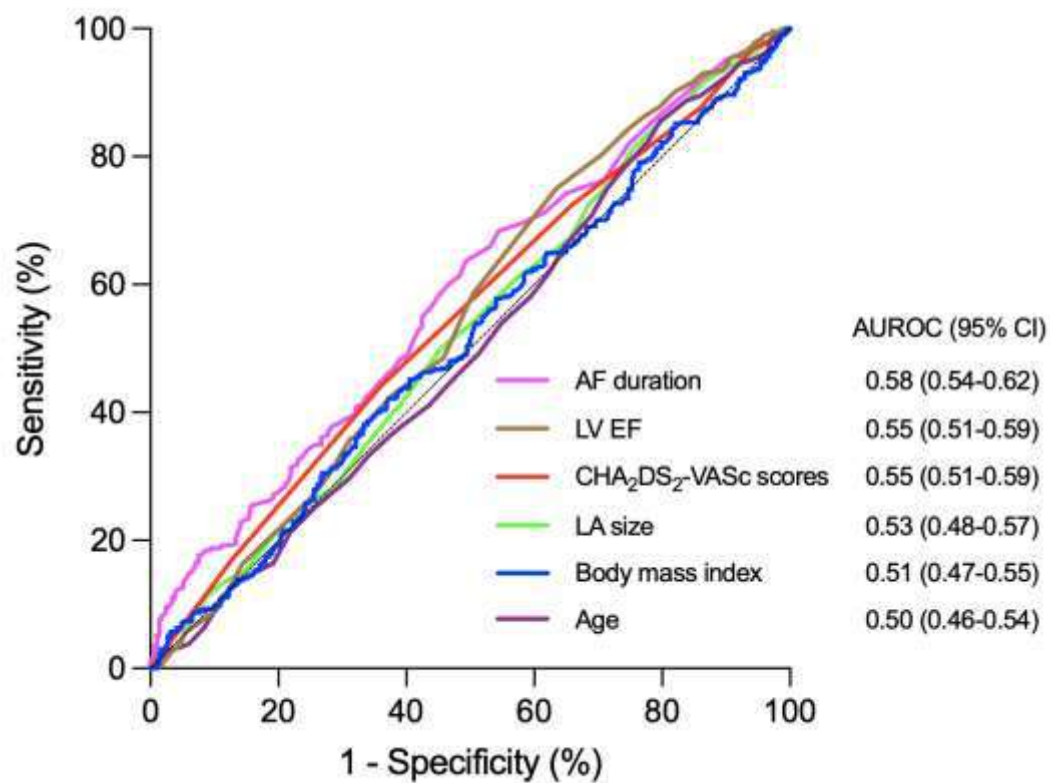
Objectives: There is limited evidence regarding machine learning prediction for the recurrence after electrical cardioversion (ECV) of patients with atrial fibrillation (AF). This study aimed to predict the recurrence of AF after ECV using machine learning of electrocardiogram (ECG) and clinical parameters.

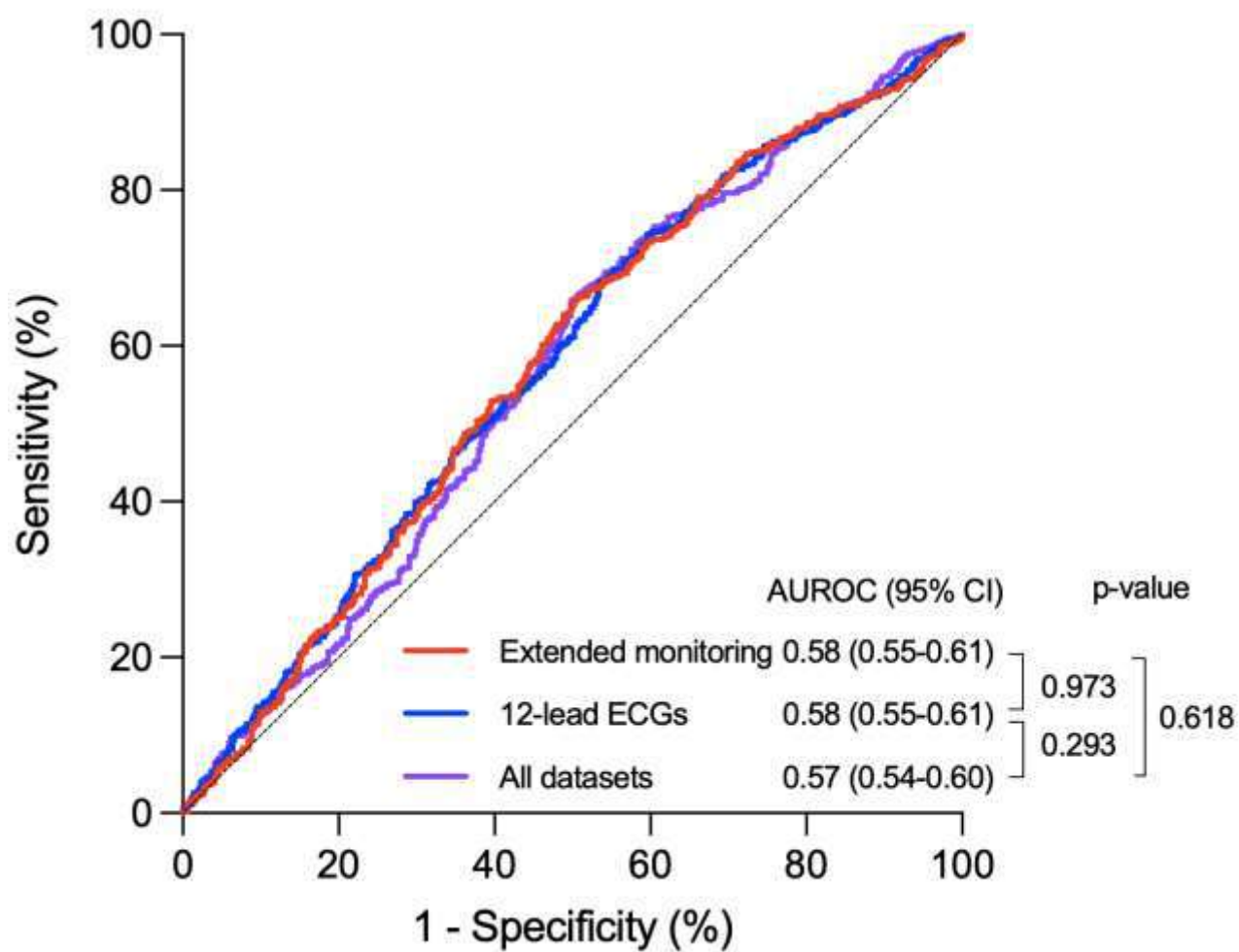
Materials and Methods: We analyzed the patients who received successful ECV for AF. Machine learning was designed to classify those with 1-month recurrence or not. Individual 12-lead ECGs both before and after the ECV and various clinical parameters were collected to train the XGBoost-based model. Ten-fold cross-validation was used to evaluate the model's performance. The model's performance was compared to the C-statistics of selected clinical parameters.

Results: Among a total of 718 patients (mean age 63.5±9.3 years, male 78.8%), AF recurred in 435 (60.6%) patients at 1-month. With the XGBoost-based model, the AUROCs were 0.57, 0.60, and 0.63 if the model was trained by clinical parameters, ECGs, and both (the final model), respectively. For the final model, sensitivity, specificity, and F1-score were 84.7%, 28.2%, and 0.73, respectively. Although AF duration showed the best predictive performance (AUROC 0.58 [0.54-0.62]) among the clinical parameters (Figure 1), it was significantly lower than that of the final machine learning model (AUROC 0.63 [0.61-0.64]) (Figure 2). Additional training of 15-min single-lead ECG and photoplethysmography monitoring in selected patients (N =261) did not significantly improve the model's performance (Figure 3).

Conclusion: Machine learning of both ECG and clinical parameters showed a synergistic effect to predict the recurrence after ECV among AF patients.

SUPPORTING DOCUMENTS





Initial Clinical Experience Using Forward-Solution Computational ECG Mapping for Adjunctive Atrial Fibrillation Driver Ablation

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¹University of California San Diego, San Diego, United States, ²VA San Diego Healthcare System, San Diego, United States, ³Vektor Medical, Carlsbad, United States

Objective: Forward-solution ECG mapping has demonstrated accurate atrial fibrillation (AF) driver localization in a blinded, retrospective study, but its effectiveness during AF ablation is unknown. We hypothesized that the forward-solution algorithm provides effective mapping to facilitate adjunctive AF driver ablation in the electrophysiology laboratory setting.

Materials and Methods: Consecutive patients with refractory AF undergoing adjunctive AF driver ablation after pulmonary vein isolation (PVI) at a tertiary medical center were enrolled. Baseline demographic, electrocardiographic, echocardiographic data, and procedural outcomes were recorded. Procedural duration and fluoroscopy use were obtained from laboratory records.

Results: Ten patients (male=4 [40%], age 71 years [65–76], EF 61% [52–69], left atrial (LA) volume 32 mL/m² [25–36]) with AF (persistent=9 [90%]) were studied according to an IRB-approved protocol. Procedure duration was 205 minutes [192–226]; fluoroscopy use was 11.3 minutes [6.2-15.6]. An average of 1.3±0.5 AF driver sites were ablated following PVI. 12 of 13 sites (92%) were in the LA, the most common site was the anterior base of the LA appendage (4/13, 31%). 4 patients had driver site ablation during ongoing AF or focal AT, resulting in arrhythmia termination in 3 of 4 (75%) cases. 9 of 10 patients were non-inducible with rapid pacing after ablation; the remaining patient spontaneously converted to sinus rhythm after the procedure and has remained AF-free.

Conclusion: Forward-solution ECG mapping is a noninvasive, rapid, and effective strategy to facilitate adjunctive driver site ablation in refractory AF patients. Future studies will examine spatial accuracy, long-term outcome, and cost implications associated with this approach.

Cryoballoon based left atrial appendage isolation for the treatment of persistent atrial fibrillation

Assoc Prof Christian Heeger¹, Julia Vogler, Charlotte Eitel, Samuel Reincke, Roland Tilz

¹*Uksh Lübeck, Germany*

Background: Although PVI is an effective treatment strategy for patients with paroxysmal atrial fibrillation (AF), it is associated with limited success rates in patients with persistent AF (PersAF). The LAA was recently identified as a target of catheter ablation especially in PVI non-responders. Yet, this strategy was assumed to be associated with an increased risk of thromboembolism despite oral anticoagulation (OAC). Cryoballoon- (CB) based LAAI might offer a valuable option to achieve safe and durable LAAI.

Objective: To assess safety, efficacy and one year follow-up on CB-based LAAI.

Methods: CB-based PVI and LAAI was performed in 31 patients with PersAF. LAAI was performed by utilizing a bonus freeze protocol. After LAAI all patients received endocardial LAA closure.

Results: Stable LAAI was achieved after a mean of 2.1 +/- 1.4 CB applications with a mean minimal temperature of -55 (-49, -55) °C. Unless one phrenic nerve palsy (3.2%) of the left phrenic nerve and one hematoma (3.2%) no further complications occurred. Successful LAAI was performed in 28/31 (90%). Transesophageal echocardiography was performed after a median of 49 (47, 56) days and detected LAA-thrombus in 6/31 (19.3%) patients. Successful LAA-closure was performed in all patients after a median of 50 (47, 91) days. The LAA was durable isolated in 22/31 patients (71%). After a follow-up of 12.5+/-3.6 months 68% of patients showed stable Sinusrhythm.

Conclusions: LAAI was successfully isolated in the majority of patients. However, a relatively high rate of LAA-Thrombus was detected after LAAI. Therefore, LAA-closure is mandatory in this population.

A Comparison of the Anticoagulation Therapy and Prognosis in Patients With Atrial Fibrillation: data From APHRS-AF and EORP-AF.

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Objective. To compare the adherence to the current guidelines for stroke prevention and to evaluate the 1-year prognosis between the European and Asian-Pacific atrial fibrillation (AF) patients, participating in the APHRS-AF Registry and EORP-AF Registry.

Materials and methods. The analyses using individual level data from a common protocol and case records from 4664 patients in APHRS-AF and 11096 from EORP-AF. The clinical endpoints were 1-year mortality and major-bleeding.

Results. APHRS-AF patients were younger (68.5 ± 12.0 vs 69.2 ± 11.4 , $p < 0.001$), had a lower prevalence of females (34.1% vs 40.7%, $p < 0.001$) and a lower mean ($\pm$ SD) CHA₂DS₂-VASc (2.7 ± 1.7 vs 3.1 ± 1.8 , $p < 0.001$) and HAS-BLED (1.6 ± 1.1 vs 1.4 ± 1.0 , $p < 0.001$) score than EORP-AF. Overall oral anticoagulation (OAC) usage was higher in European than Asian patients (84.1% vs 77.1% , $p < 0.001$). No significant differences were found for OAC use in the high-risk patients (CHA₂DS₂-VASc ≥ 2) between the two registries. The most used type of OAC were the non-vitamin K antagonist OACs (NOACs) in APHRS-AF (61.7% vs 35.0% , $p < 0.001$) and VKA in EORP-AF (50.1% vs 20.2% , $p < 0.001$). EORP-AF patients were more frequently treated with antiplatelet drugs alone or in combination with OAC.

After 1-year follow-up in APHRS-AF and EORP-AF registries the following events were recorded: 118 (2.5%) and 478 (4.3%) deaths for any causes, 47 (1.0%) and 124 (1.1%) major bleedings, respectively. Cardiovascular causes of death were more prevalent in EORP (44.1% vs 22%, $p < 0.001$) while extracranial hemorrhage were the main causes of major bleedings in APHRS (45.4% vs 64.5%, $p = 0.008$).

Conclusion. There are significant clinical differences between European and Asian AF patients in age, sex, comorbidities, and antithrombotic treatments, as well as clinical outcomes. These differences should be accounted for in optimisation of AF management.

SUPPORTING DOCUMENTS

Figure 1. COOL-AF score for death (PANEL A) and its comparison with CHA₂DS₂-VASC (PANEL B) in APHRs.

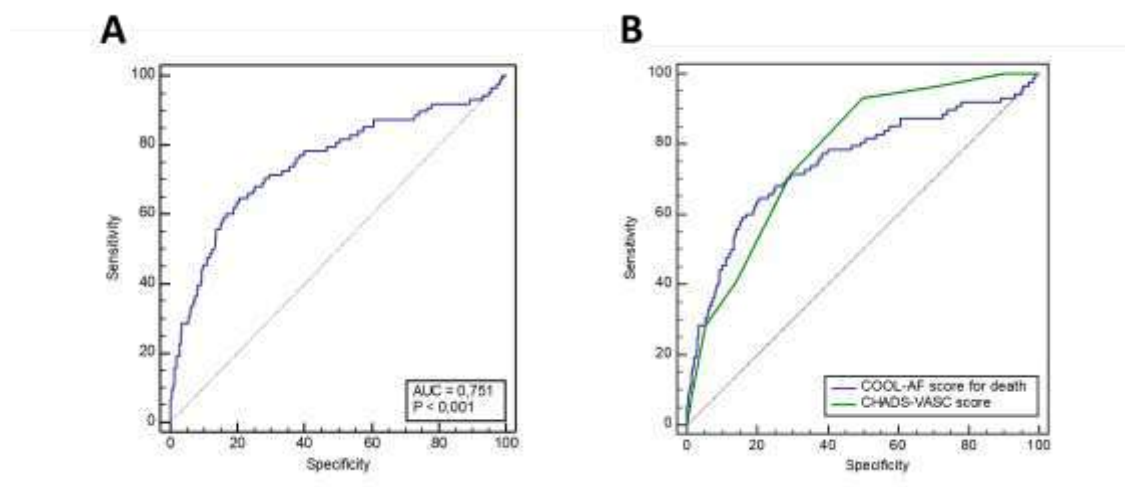


Figure 2. COOL-AF score for major bleeding (PANEL A) and its comparison with HAS-BLED (PANEL B) in APHRs.

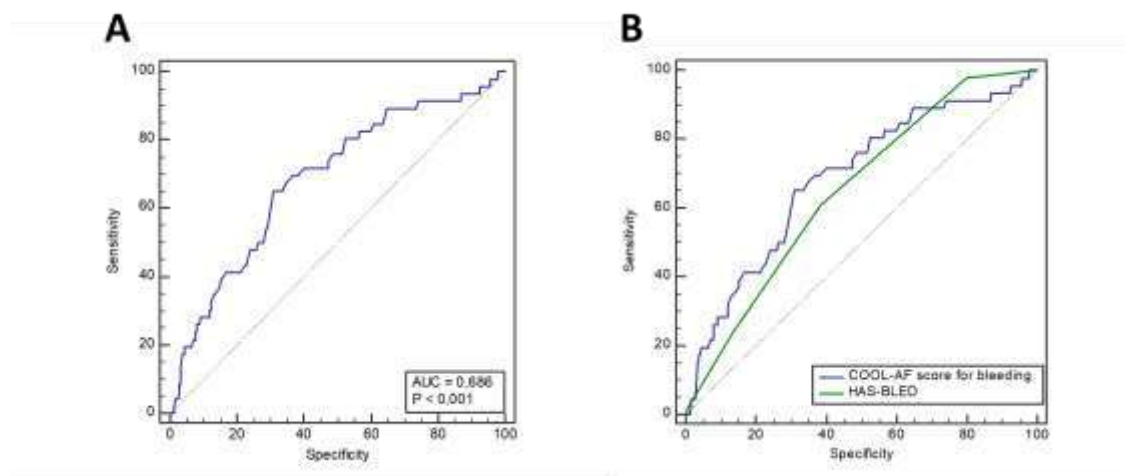
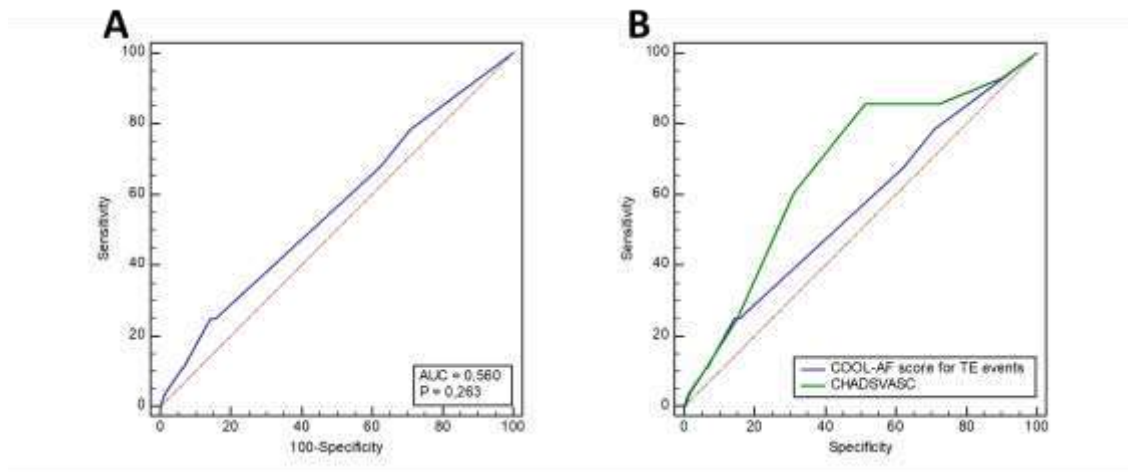


Figure 3. COOL-AF score for thromboembolic events (PANEL A) and its comparison with CHA₂DS₂VASC in APHRS (PANEL B).



Validation of COOL-AF score in APHRS-AF Registry and Comparison of its Performance in EORP-AF Registry

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Objective. To validate the COOL-AF score in the APHRS-AF and to compare its performance in the EORP-AF.

Materials and methods. The analyses included 4664 patients from the APHRS-AF and 11096 from EORP-AF registry. ROC curves analyses were utilized to test the predictive value of COOL-AF score and to compare it with CHA2DS2-VASc and HAS-BLED score.

Results. EORP-AF patients were older (69.2 ± 11.4 vs 68.5 ± 12.0 , $p < 0.001$) and had a lower prevalence of male sex (59.3% vs 65.9%, $p < 0.001$) than APHRS. After 1-year follow-up in APHRS and EORP-AF registries the following events were recorded: 118 (2.5%) and 478 (4.3%) death for any causes, 47 (1.0%) and 124 (1.1%) major bleeding, and 29 (0.6%) and 118 (1.0%) thromboembolic events, respectively. In APHRS, COOL-AF score shown a good predictive value for all-cause mortality (AUC 0.75; 95% Confidence Interval (CI) 0.73-0.76, $p < 0.001$) and major bleeding (AUC 0.68; 95% CI 0.67-0.70, $p < 0.001$), and was not inferior to CHA2DS2-VASc and HAS-BLED scores. In EORP-AF, the predictive value of COOL-AF score for all-cause mortality (AUC 0.66; 95% CI 0.65-0.67, $p < 0.001$) and major bleeding (AUC 0.59; 95% CI 0.58-0.60, $p < 0.001$) was lower than APHRS. COOL-AF score was not predictive of thromboembolic events and its performance was inferior to CHA2DS2-VASc in both registries.

Conclusion. COOL-AF scores may be an easy tool to identify Asian AF patients at risk for death and major bleeding and seems to perform better in APHRS-AF than in EORP-AF registry. Its utility in identifying AF patients at risk for thromboembolic events need further validation.

SUPPORTING DOCUMENTS

Figure 1. COOL-AF score for death (PANEL A) and its comparison with CHA₂DS₂-VASC (PANEL B) in APHS.

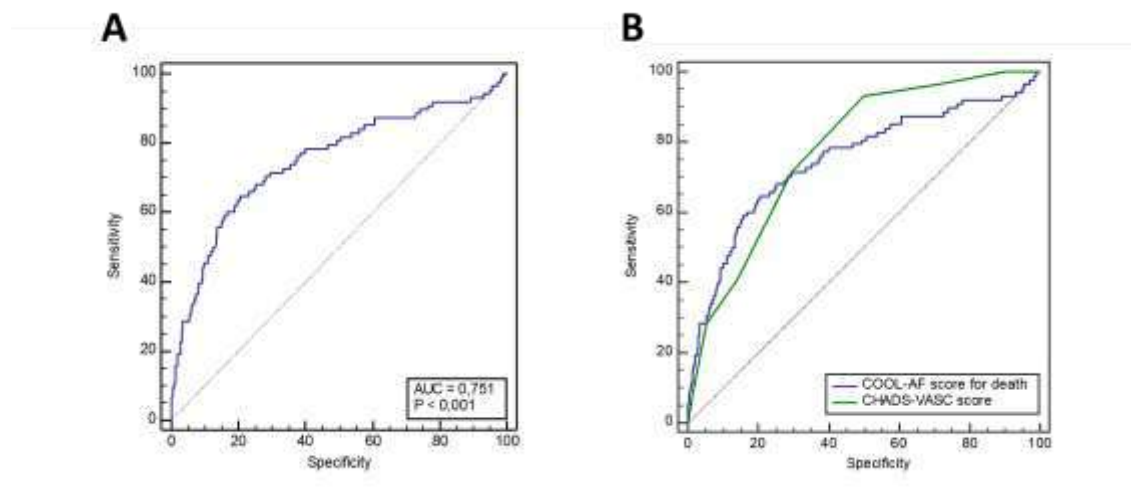


Figure 2. COOL-AF score for major bleeding (PANEL A) and its comparison with HAS-BLED (PANEL B) in APHS.

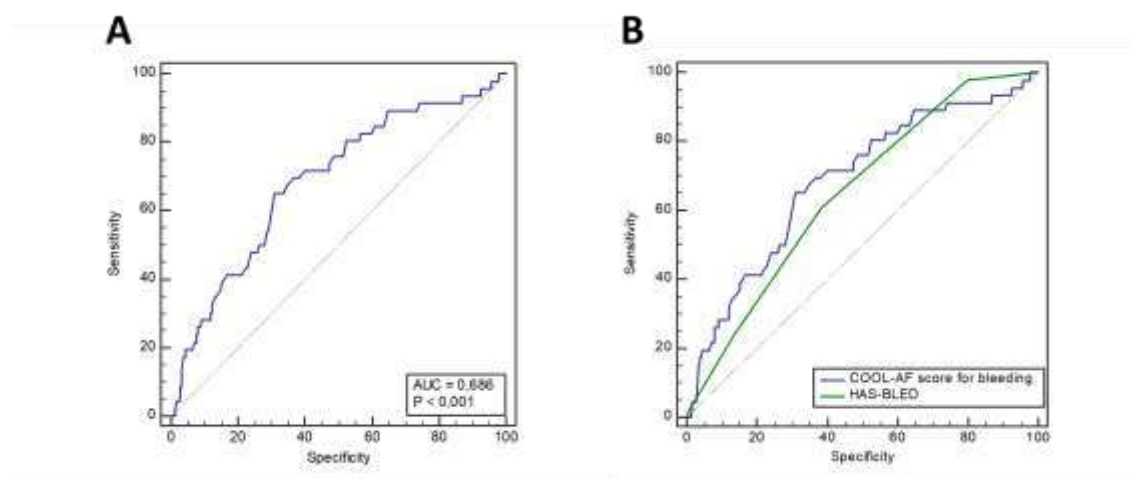
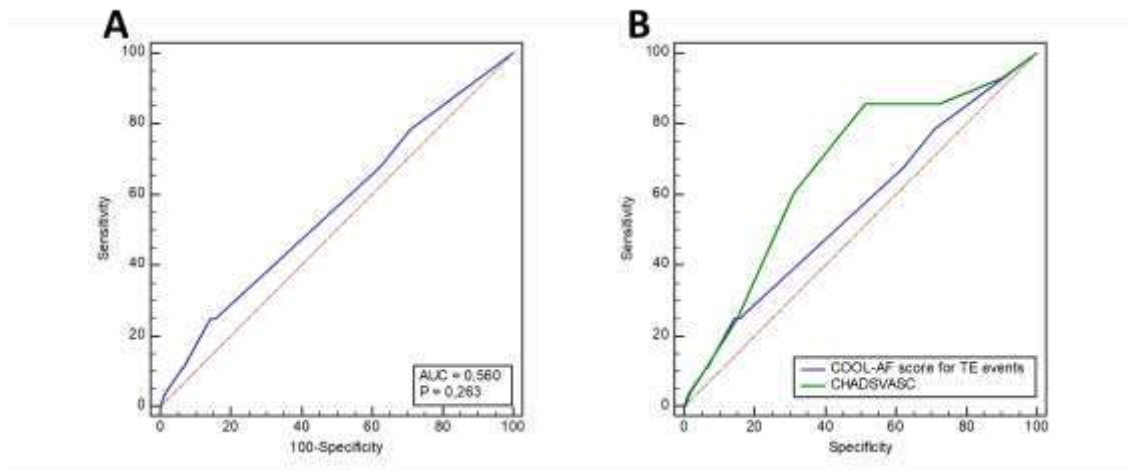


Figure 3. COOL-AF score for thromboembolic events (PANEL A) and its comparison with CHA₂DS₂VASC in APHRS (PANEL B).



TTR-INR Guided Warfarin Adjustment Protocol: Strategy to Improve TTR in Patients with AF receiving VKA

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Objectives: To study the association of change of TTR after implementation of TTR-INR guided warfarin adjustment protocol in patients with atrial fibrillation receiving warfarin.

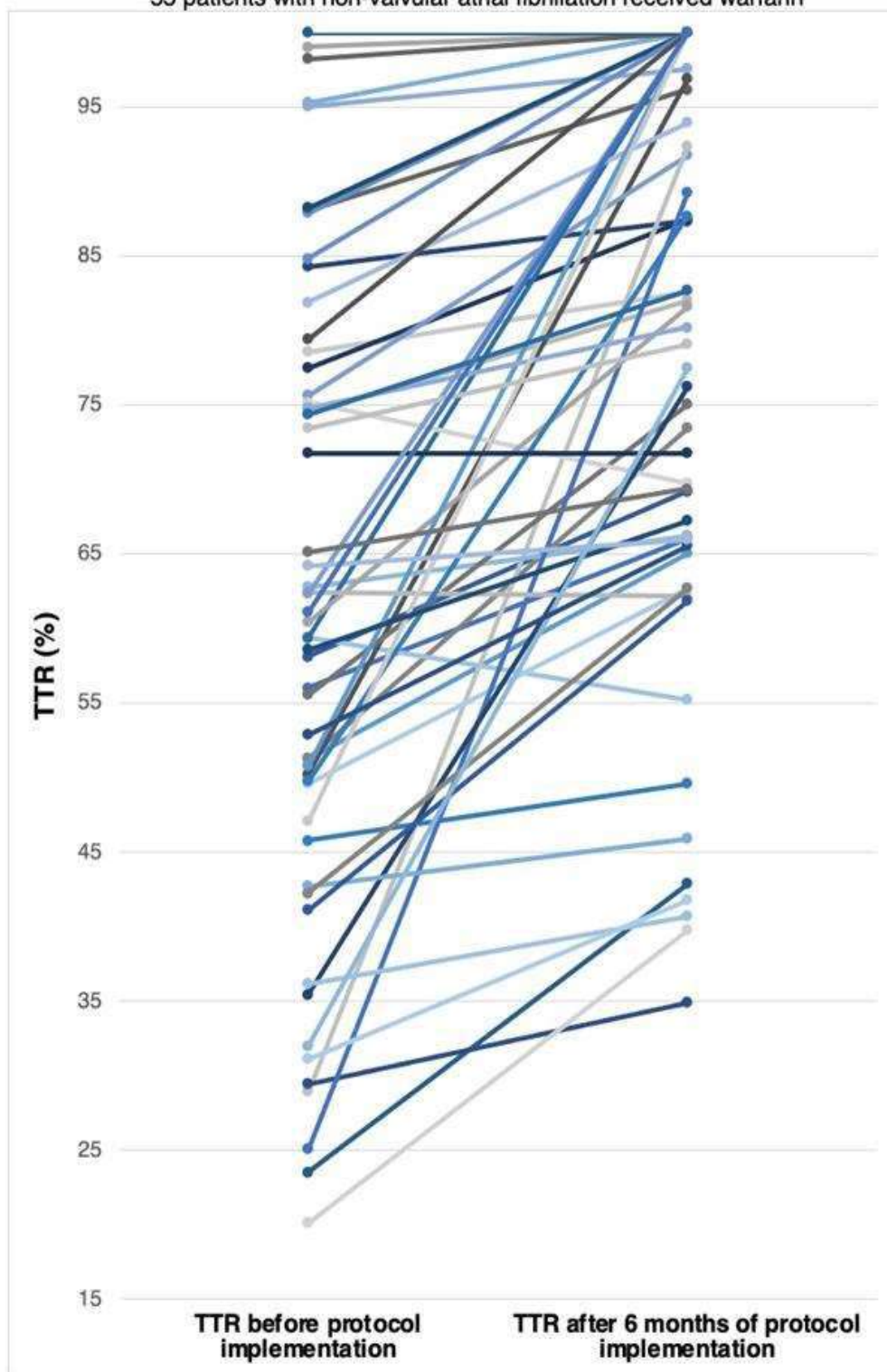
Materials & Methods: This is a prospective study of patients with nonvalvular AF at warfarin clinic of King Chulalongkorn Memorial Hospital. TTR was calculated at baseline and 6 months after protocol implementation. Patient characteristics, risk scores, bleeding risk scores, treatments, and outcomes including TTR improvement, embolic and bleeding events, hospitalization, and mortality were collected. McNemar's Chi-square test and paired t-test were used to evaluate outcomes.

Results: A total of 95 patients were screened with 56 patients enrolled. Hence, over 56 patients were analyzed, (mean age of 72 ± 12 years, 47.3% females), of which the historical records of ischemic heart diseases, ischemic stroke, and diabetes were reported 24.3%, 22.6%, 40.5% respectively. The baseline risk scores were 3.84 ± 1.7 for the CHA₂DS₂-VASc scores, 2.20 ± 1.01 for the HAS-BLED scores, and 3.32 ± 0.74 for the SAMe-TT₂R₂ scores. The TTR at baseline was $61.92 \pm 21.6\%$ (59% of patients had TTR less than 65%). After 6 months of protocol implementation, TTR were significantly improved ($77.96 \pm 19.4\%$) ($p < 0.001$). Significant improvement of proportion of patients with TTR $\geq 65\%$ was shown after protocol implementation (from 41% to 78%) ($p < 0.001$). No ischemic or major bleeding events were occurred during the follow-up in the first 6 months.

Conclusion: The TTR was significantly improved after 6 months of protocol implementation. This strategy may offer additional value in TTR improvement and good outcomes in patients with AF receiving warfarin.

SUPPORTING DOCUMENTS

Figure 1. Individual change of TTR before and after of protocol implementation in 55 patients with non-valvular atrial fibrillation received warfarin



Cryoballoon Pulmonary Vein Ablation Lesions Mapped During Repeat Procedures for Recurred Atrial Fibrillation

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SUPPORTING DOCUMENTS

Abstract

Background: The lesion set of cryoballoon pulmonary vein (PV) isolation differs from radiofrequency (RF)-PV isolation (PVI), but the quantitative comparison has not been done in patients with atrial fibrillation (AF). We compare the pattern of the remnant potential of PV antrum in patients who had undergone repeat procedures after cryoballoon PVI (Cryo-PVI).

Methods: Among 613 consecutive AF patients who underwent cryo-PVI, we evaluated the voltage map (NavX) acquired at the 2nd procedure after recurrence in 14 patients (mean age: 56,6±12,1 years, male 71,4%, Paroxysmal AF 64,3%). The PV antrum was defined by connecting a straight line from top to bottom on the left atrium (LA) posterior side at the maximal inflection point of round surface LA outside the PV ostium. We evaluated remnant PV antral potential (PVAP) with or without PV potential (PVP) at 224 segments of 56 PVs.

Results: 1. PVP reconnections were found in 16 (28,6%) of PVs of 8 (57,1%) patients.

2. Time between de novo and repeat procedures was significantly longer in patients in the PVP- group (20,5±10,8 months) than in the PVP+ group (10,5±3,9 months, p=0.044).

3. There was no preferential PVP+ veins 18,8% in left superior [LS] PV, 18,8% in left inferior (LI) PV, 31,3% in right superior (RS) PV and 31,3% in right inferior [RI] PV). Time to isolation (p=0,28), nadir temperature (p=0,49), thawing time (p=0,80), single shot isolation rate (p=0,52) did not differ between PVP+ veins and PVP- veins.

4. By logistic regression analysis, paroxysmal AF (OR 0,3, 95% CI 0,09–0,94, P=0,047), left ventricular ejection fraction (EF) (OR 0,91, 95% CI 0,86–0,97, P=0,03), second ablation timing since *de novo* procedure (OR 0,83, 95% CI 0,72–0,97, P=0,016) were associated with PVP+ reconnections in univariate analyses.

5. PVAP was found in 34,2% of LSPV, 31,6% of RSPV, 18,4% of LIPV, and 15,8% of RIPV (p-for trends =0,009). The sites where the PVAP was most commonly observed were the anterior segment of LSPV (9,8%) and RSPV(9,8%), the superior segments of LSPV (9,1%) and RSPV (9,1%).

6. Among PVP- patients, PVAP was more commonly found in LSPV (90.0%) and RSPV (77.8%) than in the LIPV (45.4%) or RIPV (22.2%, p=0.008).

Conclusions: In the repeat ablation procedure after Cryo-PVI, PVP was found in 57% of patients, especially with shorter ablation time between *de novo* and second procedure. PVAP is commonly found in LSPV and RSPV, suggesting Cryo-PVI lesion differs from RF-PVI lesion.

Key Words: Atrial fibrillation, Catheter ablation, Cryoablation, Antral potential, Pulmonary vein

Figure 1. Division of the antrum of each pulmonary vein into four segments

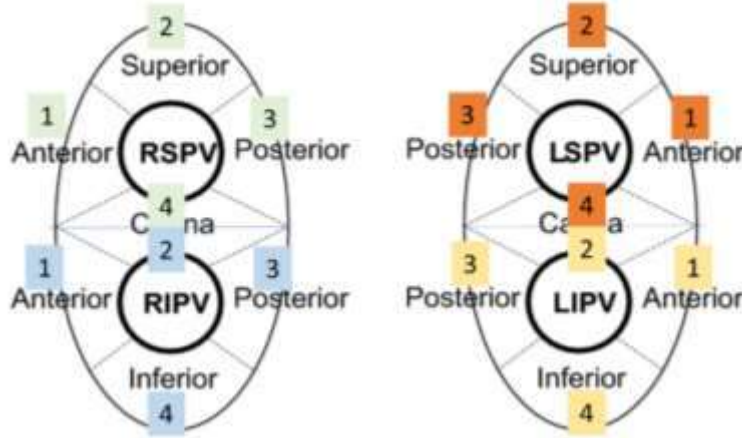


Table 1. Clinical, echocardiographic parameters, *de novo* procedure according to recurrence of electrical PV reconnection.

	Patient (n=14)	PVP+ (n=8)	PVP- (n=6)	P
Male Gender(n,%)	10(71,4%)	7(87,5%)	3(50%)	0,25
Age(years)	56,64 ± 12,11	56,17± 13,21	57,0 ± 12,14	0,92
PAF(n,%)	9(64,3%)	4(50%%)	5(83,3%)	0,30
BMI(kg/m ²)	23,77 ± 3,29	23,37 ± 4,16	24,07 ± 2,74	0,76
AF duration (months)	70,29 ± 47,90	48,0 ± 44,07	87,0 ± 46,1	0,06
Second ablation timing since <i>de novo</i> procedure (months)	14,79 ± 8,90	10,50 ± 3,93	20,50 ± 10,77	0,044
LVEDD(mm)	49,07 ± 5,01	49,0 ± 4,05	49,13 ± 5,91	0,88
LVEF(%)	59,50 ± 11,18	56,67± 13,20	61,63 ± 9,78	0,60
E/Em	8,48 ± 1,97	9,83 ± 1,86	7,52 ± 1,50	0,07
LA volume index (mL/m ²)	41,54 ± 9,42	40,20 ±10,45	42,54 ± 9,16	0,66
LA dimension (mm)	40,43 ± 6,02	40,83 ± 6,74	40,13 ± 5,90	0,84
Tricuspid regurgation jet	2,13 ± 0,3	2,1 ± 0,3	2,2 ± 0,3	0,30
RVSP(mmHg)	24,4 ± 5,5	22,0 ± 5,2	26,8 ± 5,2	0,14
<i>De novo</i> procedure	PVs(n=44)	PVP+(=13)	PVP-(n=31)	P
Time to isolation(s)	330,6 ± 128,9	378,1±169,1	310,7±104,9	0,28
Thawing time(s)	10,9 ± 6,3	10,0 ± 4,6	11,4 ± 6,9	0,8

Times(n)	2,1 ± 1,1	2,2 ± 1,2	2,0 ± 1,0	0,5
Nadir temperature(° C)	-50,1 ± 7,9	-48,8 ± 6,0	-50,7 ± 8,7	0,49
Single-shot(n,%)	29(65,9%)	9(69,2%)	20(64,5%)	0,98
Ostium long(mm)	19,6 ± 3,2	19,5 ± 2,4	19,7 ± 3,6	0,82
Ostium short(mm)	13,6 ± 3,4	13,4 ± 4,1	13,7 ± 3,2	0,44
Antrum long(mm)	21,2 ± 3,3	21,5 ± 2,7	21,1 ± 3,5	0,59
Antrum short(mm)	16,0 ± 4,5	16,2 ± 4,0	16,0 ± 4,8	0,94

Table 2. PV potential and antrial potential for each PVs

<u>Compare for each PVs</u>	Total(n=56)	PVP+(n=16)	PVP-(n=40)	P
LSPV	14	3 (18,8%)	11(27,5%)	0,77
LIPV	14	3 (18,8%)	11(27,5%)	
RSPV	14	5 (31,3%)	9(22,5%)	
RIPV	14	5 (31,3%)	9(22,5%)	
		PVAP+(n=38)	PVAP-(n=18)	P
LSPV	14	13 (34,2%)	1(5,6%)	0,009
LIPV	14	7(18,4%)	7(38,9%)	
RSPV	14	12 (31,6%)	2(11,1%)	
<u>RIPV</u>	14	6(15,8%)	8(44,4%)	

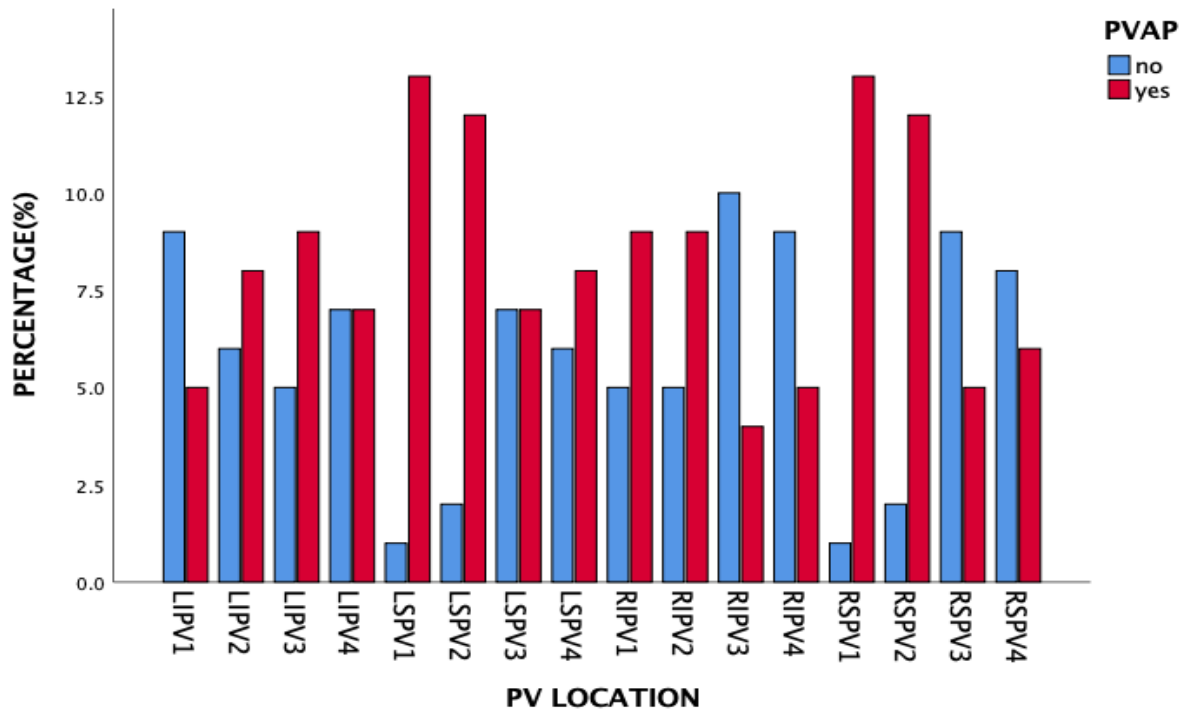
Table 3. Logistic regression analysis of clinical and procedure variables predictive of PVP reconnection

PVP+	Univariate analysis		Multivariate analysis	
	OR(95%)	P	OR(95%)	P
Age(years)	0,99(0,94 – 1,04)	0,62	1,01(0,90-1,12)	0,90
Gender(n,%)	0,93(0,82 – 1,05)	0,22	2,06(0,11-40,34)	0,63
BMI(kg/m ²)	0,98(0,81 – 1,17)	0,79		
PAF(n,%)	0,30(0,09 – 0,94)	0,047	5,72(0,16-207,6)	0,34

LA volume index (mL/m ²)	1,01(0,94 – 1,07)	0,85		
LA dimention (mm)	1,02(0,92 – 1,13)	0,68		
LVEDD(mm)	1,06(0,94 – 1,20)	0,34		
LVEF(%)	0,91(0,86 – 0,97)	0,003	0,91(0,81-1,03)	0,09
E/Em	1,36(0,95 – 1,94)	0,09	1,61(0,92-2,38)	0,09
LVMI(g/m ²)	1,0(0,98 – 1,03)	0,75		
Tricuspid regurgation jet	1,29(0,11 – 14,92)	0,84		
RVSP(mmHg)	0,96(0,94 – 1,09)	0,52		
Second ablation timing since de novo procedure (months)	0,83(0,72-0,97)	0,016	0,87(0,60-1,24)	0,43
Times(n)	1,25(0,69-2,25)	0,46		
Time to isolation(s)	1,0(0,99-1,01)	0,13		
Single shot(n)	1,24(0,31-4,96)	0,76		
Thwing time(s)	0,96(0,86-1,08)	0,52		
Nadir temperature(° C)	1,03(0,94-1,13)	0,51		

Figure 2. Logistic regression analysis variables predictive of PVP reconnection.

Figure 3. Antral Potential for each PV segments



1. Anterior; 2. Superior; 3. Posterior; 4. Inferior

Table 4. Rate of antral potential within PVs in PVP- group

Area	Rate (%)	P
LSPV	10/11(90,9%)	0,008
LIPV	5/11(45,4%)	
RSPV	7/9(77,8%)	
RIPV	2/9(22,2%)	

The Usefulness of Auto-quantified Epicardial Adipose Tissue in Predicting Atrial Fibrillation Recurrence after Catheter Ablation

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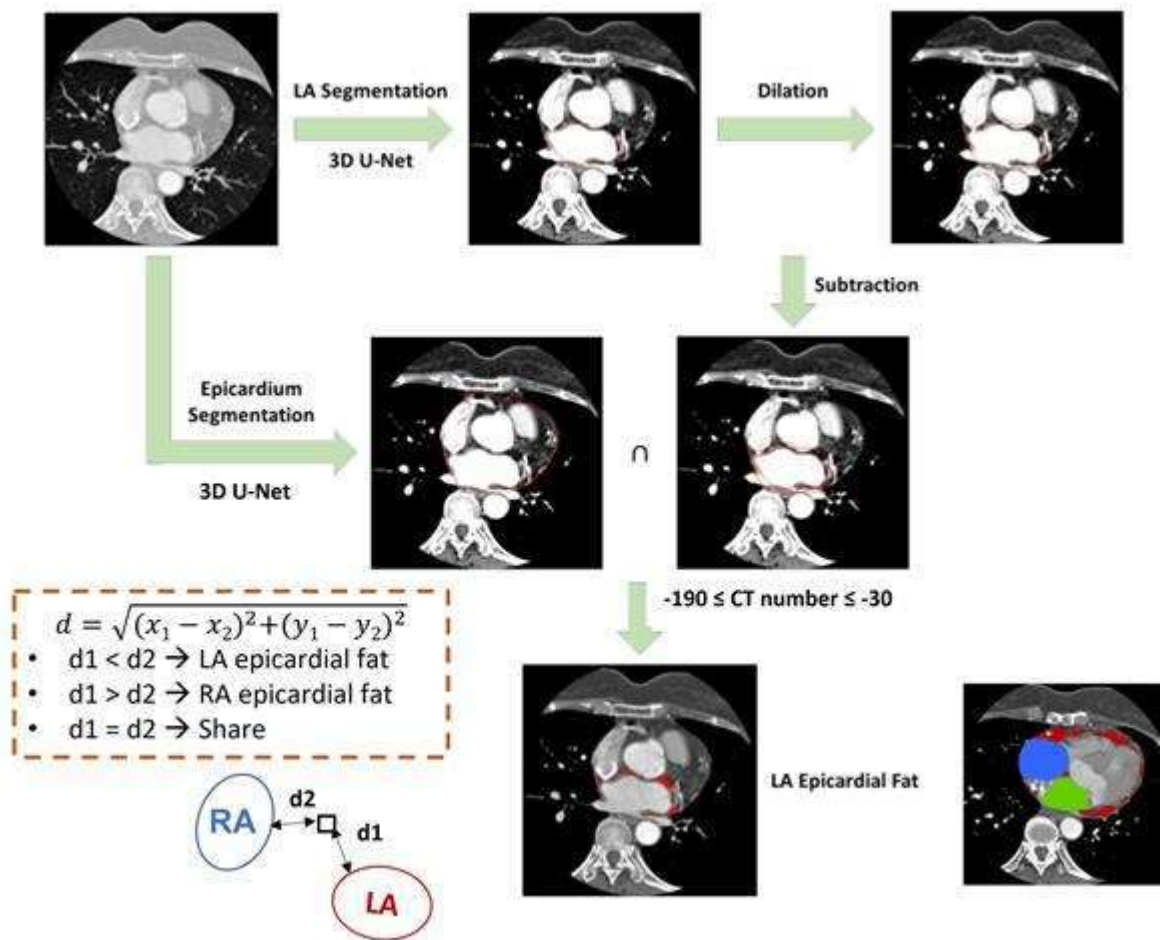
Objectives: Left atrial (LA) volume and epicardial adipose tissue (EAT) have been associated with recurrence after catheter ablation (CA) in atrial fibrillation (AF). The interactive effect has not been tested. We aim to examine the co-impact of atrial and EAT volumes on the prognostic significance in AF.

Materials and Methods: This is a single center, retrospective study of 334 patients between 2015 and 2017 with AF referred for CA. Atrial and EAT volumes were auto-segmented and quantified by 3D U-Net model from computed tomography images and indexed to body surface area to calculate atrial and EAT volume indices. EAT was allocated to LA or right atrium (RA). We performed cox regression analysis adjusting for factors associated with AF to examine the predictors of AF recurrence.

Results: The mean age was 56 ± 11 years, 251 (75%) were men, mean CHA2DS2-VASc score was 1.4 ± 1.2 , and 79 (24%) had persistent AF. Mean volume index of LA, RA, LA EAT, RA EAT, and total EAT was 68 ± 20 , 65 ± 20 , 8 ± 4 , 12 ± 4 , and 47 ± 19 ml/m², respectively. Over 2 years, 139 (42%) had AF recurrence. In univariate analysis, diabetes mellitus, persistent AF, larger volume index of LA, RA, LA EAT and RA EAT were predictors of AF recurrence; After multivariate adjustment, persistent AF (Hazard ratios [HR]:1.6, 95% confidence interval [CI]:1.1-2.3, p=0.01) and larger LA EAT volume index (HR:1.1, 95% CI:1.0-1.1, p=0.04) were independent predictors.

Conclusions: LA EAT volume measured by auto-segmented and auto-quantified 3D U-Net model could be useful in predicting AF recurrence after CA.

SUPPORTING DOCUMENTS



Systolic Blood Pressure Visit-to-visit Variability and Outcomes in Asian With Atrial Fibrillation: the COOL-AF Registry

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OBJECTIVES

We aimed to assess the association between systolic blood pressure visit-to-visit variability (SBP-VVV) and outcomes in Asian patients with atrial fibrillation (AF).

MATERIALS AND METHODS

AF patients in the COOL-AF registry with SBP measured at baseline, and at least two other visits were studied. We defined SBP-VVV using the standard deviation (SD) of average SBP. Patients were categorized according to the quartiles of SBP SD. The association between SBP-VVV and outcomes was assessed in the adjusted Cox model.

RESULTS

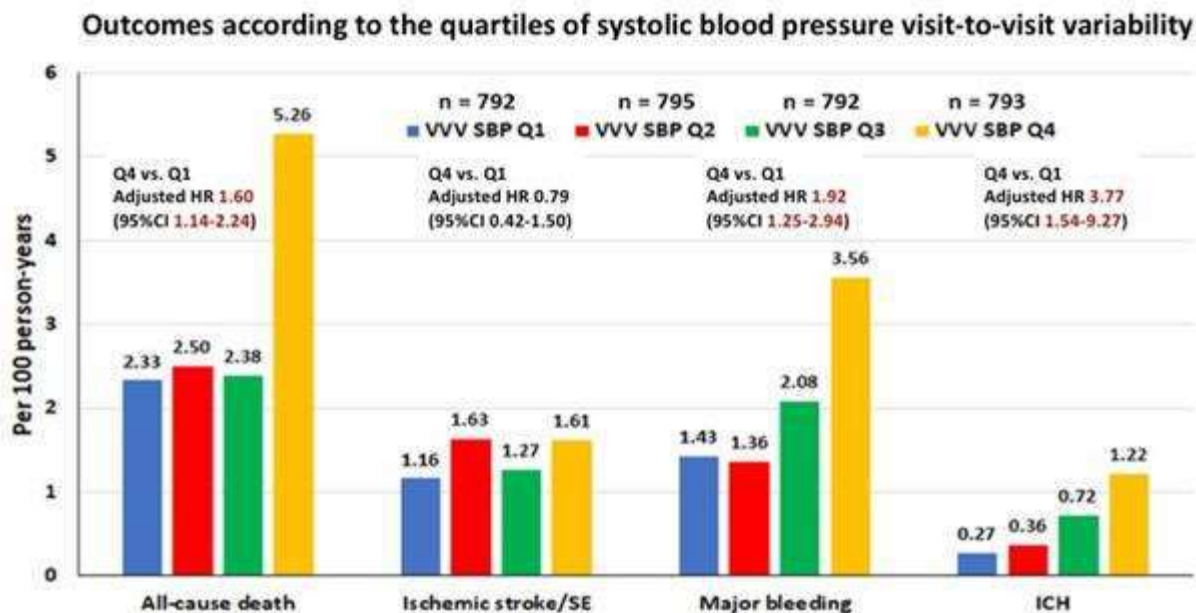
Of the 3,172 patients included in the present analysis, the mean age was 67.7 years, and 41.8% were female. The prevalence of hypertension and diabetes was 69% and 25.1%, respectively. Warfarin was used in 69% of patients, whereas 7% received non-vitamin K oral anticoagulant.

The rate of all-cause mortality, ischemic stroke or systemic embolization (SSE), major bleeding, and intracranial hemorrhage (ICH) in the study population was 3.10, 1.42, 2.09, and 0.64 per 100 person-years. Compared with the group with the lowest SBP-VVV (the first quartile), the group with the highest SBP-VVV (the fourth quartile) had a significantly higher risk of all-cause mortality (adjusted hazard ratio (aHR) 1.60, 95%CI 1.14-2.24), major bleeding (aHR 2.48, 95%CI 1.63-3.78) and ICH (aHR 3.77, 95%CI 1.54-9.27). The risk of SSE was not significantly different among the quartiles.

CONCLUSION

SBP-VVV significantly impacted the long-term outcomes of Asians with AF. Adequate SBP control and maintaining SBP stability over time may improve outcomes for AF patients.

SUPPORTING DOCUMENTS



Characteristics of Spatial Distribution of Rotors in Pulmonary Vein Isolation Refractory Non-paroxysmal Atrial Fibrillation Patients

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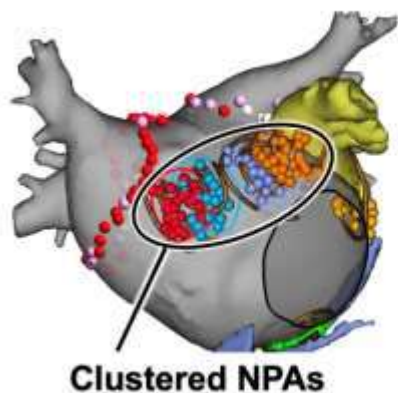
OBJECTIVES: Non-paroxysmal atrial fibrillation (non-PAF) rotors, detected by online real-time phase-mapping system (ExTRa Mapping), are always meandering, and the rotor distributions varied among patients. We tried to find the characteristics of distribution of non-passively-activated areas (NPAs), which reflect high probability of rotor existence.

MATERIALS AND METHODS: Fifty-one non-PAF patients refractory to pulmonary vein isolation were enrolled and non-passive ratio (%NP) reflecting rotor existence probability was obtained by ExTRa Mapping in each mapping area. Then, left atrium (LA) was divided into 7 regions and NPAs showing above 40% (NPA₄₀) were counted in each region.

RESULTS: Two-hundred-fifteen NPA₄₀s were obtained in 51 patients. NPAs tended to form cluster. The number of NPA clusters varied from 1 to 5 in each patient and 88% of patients had at least one cluster. Patients with only one cluster were most common. When the number of NPA cluster was 1 and 2, the mean number of NPAs forming cluster was 3.5 ± 1.6 and 2.6 ± 0.5 , respectively. The numbers of NPA₄₀s, NPA₄₀s in anterior, inferior, and septum were significantly larger in patients with clustered NPA. However, age, gender, and factors included in CHA₂DS₂-VASc score showed no statistic differences. (Figure Right)

CONCLUSION: The fact NPAs formed clusters with non-uniform spatial distribution suggests non-PAF rotors meandered within the limited areas. However, the existence of clustered NPAs was revealed only by ExTRa Mapping. To know maintenance mechanisms of non-PAF, phase mapping with ExTRa Mapping in LA is very important and helps us to find and select NPAs which can be therapeutic targets.

SUPPORTING DOCUMENTS



	with clusters	without clusters	p value
N	44 (88)	7 (12)	
Age	66 ± 7	62 ± 11	0.25
Male (%)	31 (70)	6 (85)	0.66
Non-PAF duration	30 ± 30	24 ± 17	0.61
CHA ₂ DS ₂ -VASc score	2.6 ± 1.4	1.6 ± 1.7	0.09
# of NPA ₄₀ s	4.9 ± 3.1	0	<0.001
# of NPA ₄₀ s in anterior	2.2 ± 1.4	0.9 ± 0.7	0.02
# of NPA ₄₀ s in inferior	1.4 ± 1.2	0.6 ± 0.5	0.01
# of NPA ₄₀ s in septum	0.7 ± 0.8	0.1 ± 0.4	0.01

Word count: 249 words from “OBJECTIVES” to “CONCLUSION”.

Polysaccharide peptide of Ganoderma lucidum Reduce Inflammatory Process In Atrial Fibrillation : Randomized Clinical Trial

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Objective:

The objective of this study was to evaluate the role of Ganoderma lucidum for controlling the rate, rhythm, inflammatory process and oxidative stress in patients with AF

Material and Method:

A randomized, Single-blind, placebo-controlled clinical trial was conducted in 44 patients with atrial fibrillation. Ganoderma lucidum extracts 750mg was given to Intervention group (IG) in 3 divided dose for 90 days and placebo was given to Controlled group (CG). The parameters were inflammatory marker (HsCRP, IL-1, IL-6, and TNF- α) and oxidative stress marker (superoxide dismutase (SOD), malondialdehyde (MDA), Transthoracic Echocardiography (Focused on LAVi), ECG (Focused on P Wave Duration and Dispersion) measured at baseline and after 90 day's of treatment.

Results:

The change in heart rate was significance in IG compared with placebo ($-6.13 \pm 9.6/\text{min}$ vs. $1.43 \pm 3.04/\text{min}$; $P = 0.021$) Ganoderma lucidum significantly reduce $\text{tnf-}\alpha$ level compared with placebo ($-185.34 \pm 164.9 \text{ pg/ml}$ vs $-21 \pm 87.12 \text{ pg/ml}$; $p = 0.001$). il-6 and il-1 concentration was significantly lower compared with placebo ($-23.03 \pm 107.3 \text{ pg/ml}$ vs. $58.53 \pm 134.64 \text{ pg/ml}$; $p = 0.000$; $-23.03 \pm 19.46 \text{ pg/ml}$ vs. $15.7 \pm 28.65 \text{ pg/ml}$; $p = 0.025$, respectively). Sod level in IG significantly increased compared with placebo, $p = 0.021$. MDA concentration significantly reduced in IG compared with placebo, $p = 0.002$. P wave dispersion and P wave Maximal duration in IG were significantly decrease, $p = 0.046$, $p = 0.004$, respectively).

Conclusion:

Ganoderma lucidum can reduce inflammatory cytokine and oxidative process result in maintenance of sinus rhythm is significantly improved

SUPPORTING DOCUMENTS

Table 1. Baseline Characteristics

Variable	IG N=20	CG N=18	P
AGE	63,61±8,5	62,5±10,5	0,65
SEX (male)	29,0%	30,6%	0,89
Body Mass Index (BMI)	26,3±5,4	26,4±4,06	0,62
SYSTOLIC BLOOD PRESSURE (SBP)	138,8±18,7	132,2±16,4	0,068
DIASTOLIC BLOOD PRESSURE (DBP)	86,51±14,02	87,97±10,2	0,63
HEART RATE (HR)	80,4,95±14,7	75,83±12,25	0,18
Smoker	23.8%	25%	0.93
Diabetes Mellitus	30%	22.2%	0.82
Hypertension	55%	55.5%	0.96
History of CVA	10%	5.55%	0.28
CAD	25%	33.3%	0.46
Ace Inhibitor/ARB	80%	94%	0.16
CCB	25%	22.2%	0.86
B Blocker	90%	94.4%	0.88
Statin	75%	77.78%	0.98
Digoxin	10%	5.6%	0.64
Warfarin	80%	88.8	0.68
P Wave dispersion	40.18±24.28	40.7±23.6	0.88
P max	119.3 ± 14.8 mm	118.3 ± 9 mm	0.84
LAVI	26.45 ± 2.85	24.48 ± 1.76	0.52
Nytric Oxide	33,7±12,61	36,5±14,34	0,35
MDA	1,53±0,56	1,66±0,43	0,28
HsCRP	2,99±0,86	2,83±1,13	0,49
TNFα	14,79±1,98	13,28±2,40	0,14
IL-1	14,82±1,88	13,74±1,26	0.14
IL-6	15,60±2,17	14,46±1,71	0,11
PT	12,20±3,17	13,46±2,41	0,61
APTT	23,20±4,47	24,26±3,61	0,62
INR	2,04±1,17	2,26±1,21	0,81
Physical Functioning	90,22±9,79	88,11±17,9	0.82
Limitation To Physical Health	86,5±20,5	85,7±34,5	0.64
Limitation To Emotional Problem	80,5±27,72	80,95±35,4	0.71
Energy Fatigue	78,78±15,9	75,3±19,69	0.68
Emotional Well Being	82,77±15,5	78,9±16,15	0.165
Social Functioning	88,75±15,1	83,6±28,5	0.179
Pain	86,08±24,1	83,19±28,5	0.522
General Health	77,54±14,3	79,55±16,26	0.83
Physical Limitation	79,25±18,39	76,3±19,9	0.176

Table2 Clinical Characteristics Post Intervention

VARIABLE	CONTROLLED GROUP	INTERVENTION GROUP	P
SBP	-10.5±15,03	-22.5±17,6	0.002
DBP	-3.3864±11,3	-7.7429±10,9	0.109
BMI	-0.04±1.00	-0.01±0,78	0.76
MAP	-12.77±11.35	-5.8±11.60	0.01
HR	-2.027±5.5	-4.97±10.5	0.15
NO	2.26±2,4	4,54±10,5	0.125
SOD	-0.31±0.22	0.19±0.11	0.021
MDA	0.045±0.24	-0.296±0.52	0.002
HSCRp	-0.39±0.69	-1,62±0.9	0.038
TNF	-0.87±1.1	-2.59±1,75	0.013
IL-1	-0.804±1,2	-2.63±1.69	0.001
IL-6	-1.08	-3.27±1.80	0.006
PT	1,32±1,26	1.22±1,42	0.64
APTT	2,20±1,47	2,26±2,61	0.82
INR	0.04±1,17	0.16±1,21	0.68

Table 3. Atrial Remodelling After Intervention

Variable	IG N=20	CG N=18	P
P Wave dispersion	-4.7±23.6	-1.18±24.28	0.046
P max	-10.8 ± 4 mm	-1.3 ± 10.8 mm	0.004
LAVI	-2.38± 2.04	-1.08± 3.46	0.15

Table 4 Quality of Life After Intervention

PHYSICAL FUNCTIONING	3.02±2.73	-3.98±2.73	0.00
LIMITATION TO PHYSICAL HEALTH	4.78±11.09	0.22±13.9	0.03
LIMITATION TO EMOTIONALPROBLEM	2.75±3.76	1.71±13.4	0.18
ENERGY FATIGUE	4.38±13.46	-2.71±13.4	0.044
EMOTIONAL WELL BEING	3.81±17.15	2.41±3.92	0.48
SOCIAL FUNCTIONING	2.28±7.7	.2±4.8	0.86
Pain	4.61±13.09	0.6±7.66	0.026
General Health	2.95±7.58	-2.54±4.60	0.16
HEALTH CHANGE	4.46±10.54	-2.66±7.80	0.008

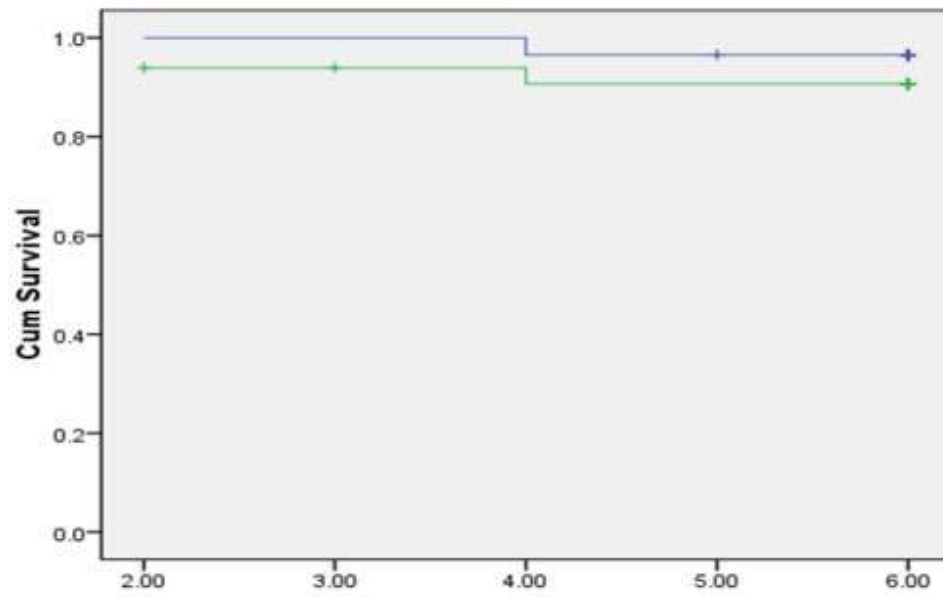


Figure 1. Kaplan-Meier plot of survival free from AF rehospitalization after Treatment

Validity of MENARI Plus (Self Pulse Assessment and Clinical Scoring) Mobile apps For Detecting Atrial Fibrillation

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Objective

The aim of this study to validity of AF screening using Self pulse assessment and clinical scoring (MENARI PLUS) based on android apps compared with an ECG recording conducted at the same time.

Methods

We collected from total of 1385 subject's with CHA2DS2-VASc Score ≥ 2 , age > 50 years attending 8 primary care centers (PCCs) in Malang were invited to take part in AF screening. Every participant evaluate self pulse assessment, then evaluate MENARI plus Score. After that, Every participant performed electrocardiography examination and classified with AF and Sinus Rhythm group.

Results

In this study, mean age of this patients were $61,5 \pm 6,9$ years old and 76% subjects were female. We found 11% patient's with AF. The average age of the atrial fibrillation group was 63.6 ± 5.1 years with an average CHA2DS2-VASc score 2.9 and 68/156 (43.5%) new cases of AF were detected. Anticoagulants (ACs) could be initiated in 65/68 (95.5%) of these cases. The sensitivity for self pulse palpation was 73.1% (95% CI 68%-76%) and specificity was 68.3% (95% CI 65%-72%). MENARI PLUS had an area under the receiver operating curve (AUC) of 0.86 (95% CI 0.82 to 0.89) with sensitivity per measurement occasion was (84%, 95% CI 82%–88%) and specificity was (87.9%, 95% CI 82%–90%). Positive predictive value for MENARI PLUS was (46.8%, 95% CI 42%–54%).

Conclusion

In this study, we suggested that MENARI PLUS has a high sensitivity and specificity for atrial fibrillation. It may also be a useful screen to apply opportunistically for previously undetected atrial fibrillation.

SUPPORTING DOCUMENTS

Variables	AF	Non AF	P
Age	63.6±5.0	61.2±7.1	0.000
Female	72.4%	76.4%	0.27
SBP	133±17.7	122.8±16.7	0.000
DBP	80.8±10.3	79±12.8	0.37
Weight	62.7±11.3	61.6±9.6	0.33
BMI	26.9±4.6	26.7±3.3	0.26
CHA2DS2-VASc Score	3.92±0.48	2.5±0.78	0.000
Age >65	43.4%	26.8%	0.03
BMI > 26	9.3%	8.8%	0.45
Hypertension	67.9%	32.8%	0.000
Diabetes Mellitus	44%	40.4%	0.43
Stroke/TIA	7.6%	4.2%	0.18
PAD	13.5%	11.1%	0.39
Dyspneu	10.3%	9.4%	0.74
Palpitation	68.6%	51%	0.000
Chest pain	1.9%	1.1%	0.34
Syncope	8.3%	4.8%	0.09
Fatigue	53.2%	40.8%	0.003
Irregular self pulse palpation	71.3%	31.7%	0.000

MENARI PLUS score$\geq$7	84%	12.1%	0.000

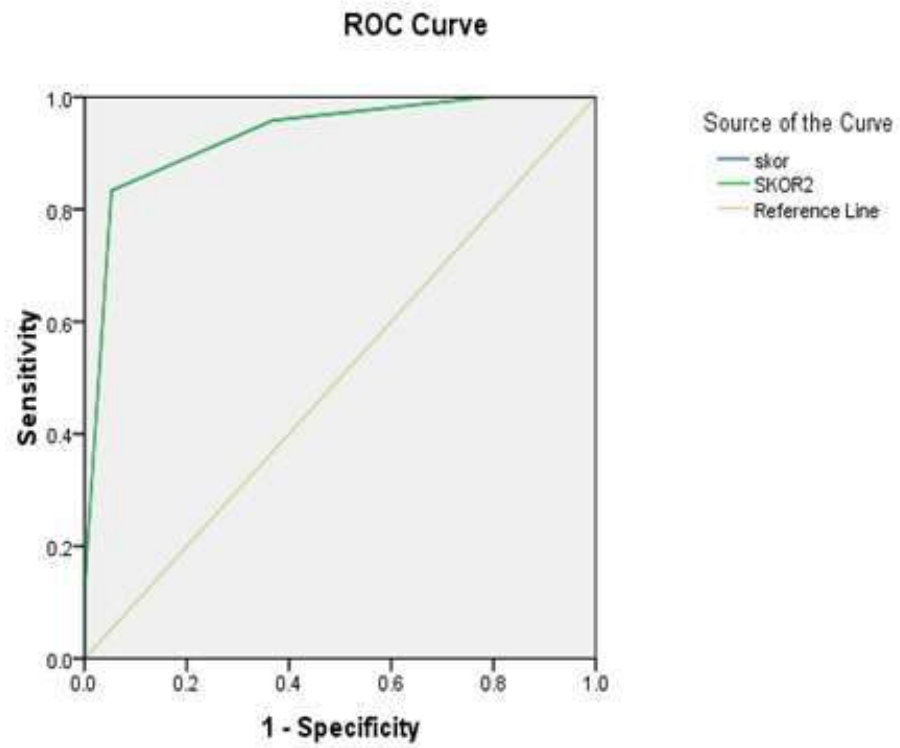
**Table 1. Baseline
Characteristics**

Table2. MENARI PLUS Clinical Scoring

Predictors	Multiplying Factor
Irregular MENARI	+4
Palpitation	+2
Age >65	+2
Hypertension	+2



Picture 1. MENARI Plus Mobile Apps



Diagonal segments are produced by ties.

Picture 2. MENARI PLUS had an area under the receiver operating curve (AUC) of 0.86 (95% CI 0.82 to 0.89)

Real-world Atrial Fibrillation Detection Using an Insertable Cardiac Monitor in Patients With Cryptogenic Stroke

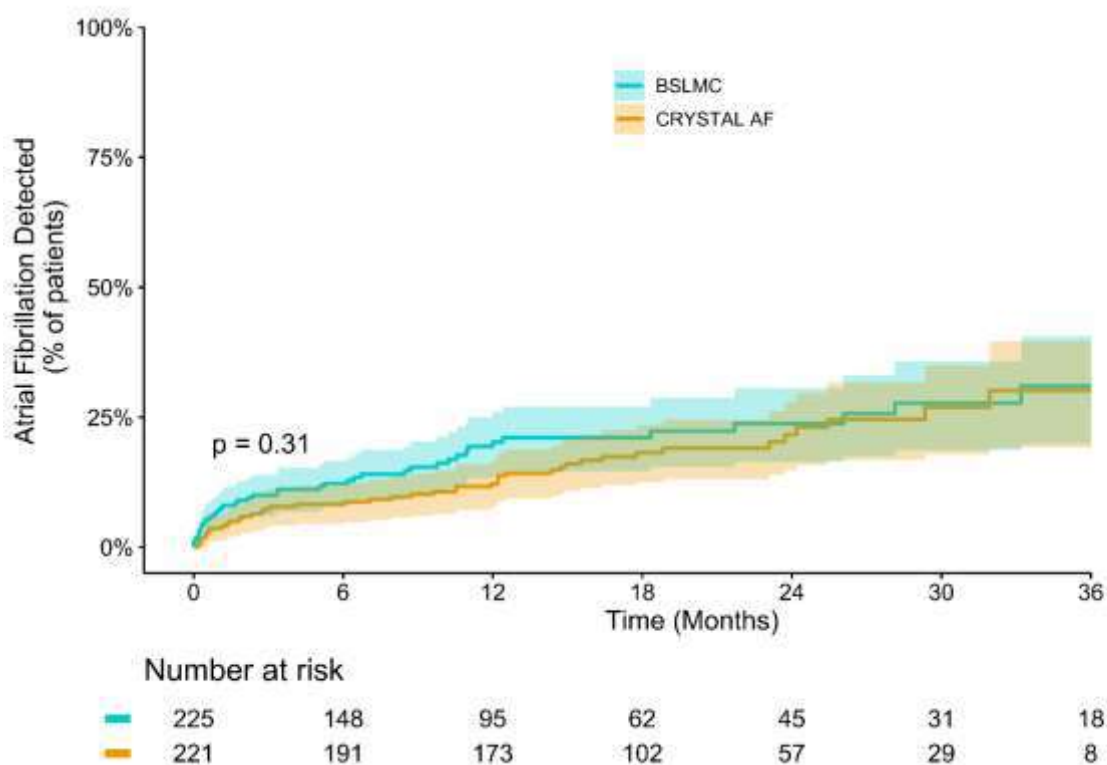
Assoc Prof Mihail Gabriel Chelu^{1,2,3}, Dr. Erica Kim¹, Dr. Muzamil Khawaja¹, Dr. Payam Safavi-Naeini¹, Dr. Jitae Kim¹, Dr. Joanna Molina Razavi¹, Dr. Mohammad Saeed¹, Dr. Abdi Rasekh¹, Dr. Mehdi Razavi¹

¹Baylor College of Medicine, Houston, United States, ²Texas Heart Institute, Houston, United States, ³Baylor St. Luke's Medical Center, Houston, United States

Abstract submitted in Supporting Document.

SUPPORTING DOCUMENTS

Figure 1. ICM rate of AF detection in BSLMC and CRYSTAL-AF cohorts.



Comparison of Persistent Atrial Fibrillation Ablation Acute Procedural Endpoints for AcQMap Guided vs Conventional Systems

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Objective:

To compare procedural endpoints in patients undergoing catheter ablation (RFA) of persistent AF using the AcQMap system compared to a control group using conventional mapping systems.

Methods:

Clinical / procedural data were collected for consecutive patients undergoing persistent AF RFA during a 2 year period. System choice for RFA was by operators preference /not randomised.

Results:

38 patients underwent AcQMap-guided ablation (PVI only =1) and 51 underwent ablation using standard mapping systems (PVI only =18). PVI only cases were excluded from further analysis.

11 patients (29.7%) converted to sinus rhythm with RFA alone in AcQMap group compared to 1 (3%) of the conventional group (p =0.004)

Conventional group were on average younger than AcQMap (58+/-9.6 vs 62.7+/- 8 years) and had fewer previous RFA procedures (1.8+/- 0.6 vs 2.3+/- 0.8). Other demographics were well matched (table 1)

Duration of RF energy was lower in the AcQMap group (23 v 33 min, p = 0.0103)

AcQMap guided RFA was delivered to specifically to sites of abnormal activation as directed by global activation mapping.

Conventional RFA strategies used were

- Box isolation 55%,
- Roof line 33%
- LPV-Mitral line 36.0%
- RPV-Mitral line 12.1%
- Cavo-tricuspid isthmus 12%
- Fractionation Sites 36.4%

Force –sensing RFA catheters were used in all cases.

Conclusion:

A patient specific targeted AcQMap-based substrate approach for persistent AF ablation is associated with significantly higher rate of acute conversion to sinus rhythm, reduced ablation delivery but at the expense of longer procedure times.

SUPPORTING DOCUMENTS

Variable	Acutus AcQMap Guided n = 37	Carto / Precision Guided n = 33	P Value
Age (yrs)	62.7 (8.4)	58.0 (9.6)	0.027
Male (%)	32 (84.2)	42 (82.4)	ns
CHADS-VASc	1.3 (1.2)	1.1(1.0)	ns
Procedure number	2.3 (0.8)	1.6 (0.6)	0.00016
Procedure duration (mins)	272 (65)	214 (44)	0.00002
Fluoroscopy duration (mins)	34 (14)	22 (9)	0.00003
RFA energy duration	23 (12)	33 (14)	0.0103
Ablation to sinus rhythm (%)	11 (29.7)	1 (3.0)	0.004
Redo PVI + substrate ablation (%)	32 (86,5)	29 (87.9)	ns

Spontaneous Cardioversion of Persistent Atrial Fibrillation Following AcQMap-Guided Ablation Compared To Conventional Mapping Based cases

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Objective

The AcQMap system highlights areas of abnormal conduction during AF. Sites of local rotational, irregular and focal activation are targeted during AcQMap-based AF ablation procedures.

This study examines the rate of post-procedural spontaneous cardioversion in patients undergoing persistent AF ablation using the AcQMap system in comparison with a control group using standard mapping systems.

Methods:

Clinical and procedural data were collected from consecutive patients undergoing persistent AF ablation. Patients receiving PVI only were excluded. Patients who remained in AF at procedure end were included. Short term outcomes following AcQMap-based ablation were compared with procedures using Carto or Precision mapping systems.

Results:

15 patients underwent AcQMap-based ablation and 15 underwent ablation using standard mapping systems. Lesion sets were delivered according to operator preference.

The groups were well matched; demographic data are presented in table 1.

In the 6 weeks post-procedure, 7/15 patients (47%) reverted to sinus rhythm spontaneously in the AcQMap group. In comparison only 1/15 patients (3%) in the Carto/Precision group reverted spontaneously over the same period ($p=0.035$).

AcQMap procedures were significantly longer than those using standard mapping systems ($p<0.0001$) (table 1). There were no complications.

Conclusion:

AcQMap guided ablation for persistent AF is associated with a significantly higher rate of post-procedural spontaneous cardioversion to sinus rhythm than for standard ablation cases using conventional mapping approaches

SUPPORTING DOCUMENTS

Variable	AcQMap (n=15)	Precision/Carto (n=15)	p value
Age (yrs)	61.9±6.6	57.6±13.8	NS
Male (%)	15 (100)	14 (93)	NS
Hypertension (%)	7 (47)	6 (40)	NS
LVSD (%)	3 (20)	2 (13)	NS
IHD/CVA/PVD (%)	1 (7)	3(20)	NS
Procedure number	2.3±0.9	1.9±0.8	NS
Procedure duration (mins)	275±34	196±41	p<0.0001
Fluoroscopy duration (mins)	39±14	28±13	p =0.04
Spontaneous Reversion to Sinus Rhythm post procedure	7 (47%)	1 (6%)	p = 0.035

Ivabradine for rate control in rheumatic atrial Fibrillation and left atrial strain dynamics

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¹Sanjay Gandhi PGIMS, Lucknow, Lucknow, India

SUPPORTING DOCUMENTS

OBJECTIVES: Role of Ivabradine for rate control in rheumatic AF and effect on left atrial strain.

METHODS

80 patients, chronic rheumatic AF, HR >80 bpm (48 ± 12 yrs, 28% males, AF duration 6.2±3.2 years, mean rate 136±14 bpm) randomized to Ivabradine or placebo in background of ongoing beta blocker/calcium channel blockers. LA strain and NT Pro BNP levels were also assessed. Ivabradine started @ 2.5 mg BD and in those with inadequate response at 1 week (failure to decrease HR < 10% vs baseline), dose titrated to 5 mg BD. After Holter at 1 month, dose escalated to 7.5 mg BD if needed.

RESULTS

Those on Ivabradine had **lower HR** (81 ±10 vs 99 ± 9) at 3 months and 6 months (79 ± 8 vs 94 ±8, p < 0.001). **Reduction in HR was** 56 ± 15 vs 31± 14, and **% change in HR was** 41±7 vs 24±9 %, both p <0.00001, in Ivabradine group.

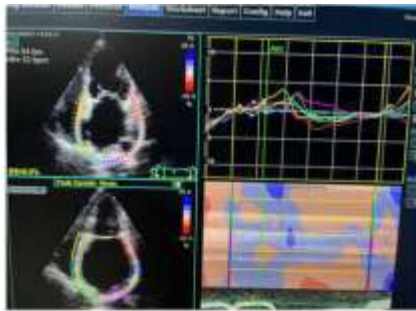
At 6 months, Ivabradine group had:

1. Significantly better day-time and night-time Holter rate control.
2. Lower NT Pro BNP (1368 vs 1607 pg/ml)
3. Higher 6 minute walk distance (410 ±47 vs 349±54 m, all p < 0.001)
4. Asymptomatic (EHRA score 1) 80% vs 37.5%
5. Improvement of >1 EHRA class from baseline 60% vs 17%
6. Better LA Strain (22.8±2.8% vs 20.6 ± 2.5%)

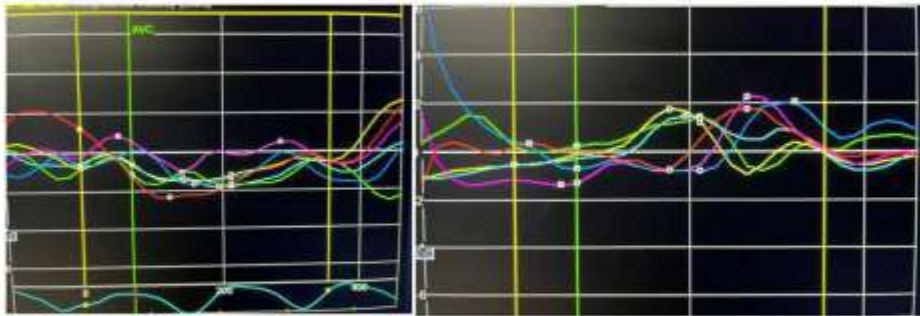
Ivabradine was well tolerated and no patient needed drug withdrawal.

CONCLUSION

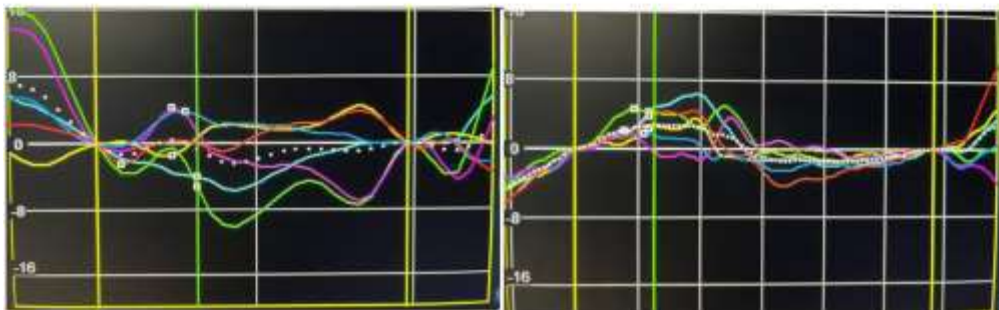
Ivabradine can be a good option for rate control in patients with rheumatic AF.



Methodology to calculate LA strain (LAS)



LAS in controls (left panel: pre and right panel: 6 month FU)



LAS in Ivabradine group
(left panel: pre and right panel: 6 month FU)
Higher LAS with lesser
LA dysynchrony

Transcutaneous auricular Vagus Nerve Stimulation relieves long-term pacing-induced AF by reducing atrial Endoplasmic Reticulum Stress

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Objective : To investigate the effect and potential mechanism of transcutaneous auricular Vagus Nerve Stimulation (ta-VNS) on long-term pacing-induced Atrial Fibrillation (AF) in dog models.

Methods: Eighteen healthy adult beagle dogs were randomly divided into three groups: sham-operated group, AF group, and AF+ ta-VNS group. All dogs were implanted with a right atrial rapid pacemaker and were given 600 beats/minute pacing parameters for 4 weeks (except Sham group). The AF+ta-VNS group was given ta-VNS after 4 weeks until the end of 8 weeks, while the other groups were given sham stimulation. Left/right atrial diameter and ejection fraction (EF) were assessed at baseline, 4 weeks, and 8 weeks. Atrial effective refractory period (AERP), AF vulnerable window (WOV), AF induction rate and AF average duration were detected. At the end of the experiment, the atrial tissues were taken for TUNEL staining and the protein expression levels of GRP78, PERK, P-PERK, EF2 α , P-EF2 α and CHOP were detected.

Results: In vivo electrophysiological examination showed that ta-VNS could effectively reduce WOV, AF inducibility, duration of AF and restore AERP in dogs with AF ($P < 0.05$). At the same time, ta-VNS can effectively reduce the left/right atrial diameter and restore ejection fraction ($P < 0.05$). Molecular biological analysis showed that AF+ta-VNS could effectively reduce the apoptosis of atrial myocytes and the expression of GRP78, PERK, p-PERK, EF2 α , p-EF2 α , CHOP and other Endoplasmic Reticulum Stress-related proteins ($P < 0.05$).

Conclusion: Transcutaneous auricular Vagus Nerve Stimulation can reduce long-term pacing-induced Atrial Fibrillation by inhibiting Endoplasmic Reticulum Stress and cardiomyocyte apoptosis.

Subclinical Atrial Fibrillation in Haemodialysis Patients: A Systematic Review & Meta-analysis

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¹*University Of Adelaide, Adelaide, Australia*, ²*Flinders Medical Centre, Adelaide, Australia*

OBJECTIVES

Individuals with chronic kidney disease have a high risk of developing atrial fibrillation. Patients with chronic kidney disease (CKD) on haemodialysis (HD) may suffer from previously unrecognized episodes of silent/ subclinical atrial fibrillation (SCAF). This systematic review sought to study the risk of subclinical atrial fibrillation in participants with end stage renal failure undergoing haemodialysis.

MATERIALS AND METHODS

We included observational studies, clinical studies, clinical trials and randomized controlled trials reporting SCAF in CKD patients on HD. PubMed, Embase and SCOPUS databases were systematically searched from inception until May 31st, 2022. Prevalence of SCAF and were studied using pooled population data. Egger test was done to assess risk of publication bias.

RESULTS

Five studies reporting on SCAF, with a total of 431 participants, were found to be eligible. SCAF screening was performed by 12-lead ECG (1 study), Holter/ECG patch (2 studies) or implantable loop recorder (2 studies). On screening, prevalence of AF was found to be 10% (95% CI; [3-17]) at baseline. A further 26% (95% CI; [12-39]) of patients were detected to have SCAF after initiation of haemodialysis. One study reported the mean CHA2DS2VaSc in patients with haemodialysis-related SCAF to be 3.2. Risk of publication bias was low.

CONCLUSION

The incidence of SCAF is high in patients undergoing haemodialysis. Incremental detection of SCAF was noted during follow up. This data has implications on the stroke risk in haemodialysis patients.

An External Validation of Simplified Warfarin Dosing Formula for Atrial Fibrillation Patient in Thailand

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Objective: To externally validate the simplified warfarin dosing formula for prevent stroke and systemic embolism in Thai patients with atrial fibrillation.

Material and Methods: Among 1207 patients visiting the outpatient clinic between 1st October 2011 and 30th September 2021. We identified 531 patients with atrial fibrillation who had been receiving warfarin with target INR of 2.0 to 3.0 for at least two consecutive follow-ups after initiation. The actual warfarin dose was defined as warfarin dose that result in INR of 2.0 to 3.0. The simplified warfarin dosing formula was $3.2 - (0.03 \times \text{age}(\text{years})) + (0.02 \times \text{body weight}(\text{kg}))$ (10% dose reduction if presence of heart failure (HF) and/or stroke). The optimal dosage was defined as difference from actual dose within 20%.

Results: The mean age was 68 ± 11 years, and men accounted for 44.4% of the population. Mean body weight was 61.6 ± 14 kg. Non-valvular AF was presented in 416 (78.34 %). The mean CHA2DS2-VASc Score was 3.65 ± 1.27 . The mean difference of warfarin dose between actual and simplified formular dose is 0.408 ± 1.07 mg/day (Min, Max -2.51 to 4.63). The disagreement was more apparent in patients requiring a higher dose of warfarin. The warfarin dosing formula resulted in optimal dosing in 37% and overdosing in of 24% of cases, whereas 3-mg dose resulted in optimal dosing in 39% and overdosing in 43% of patients.

Conclusion: A simplified warfarin dosing formula appeared to be safer than 3-mg dose. Inappropriate overdose after using warfarin formula was less prevalent than using 3-mg dose.

Quality-of-Life and Renal Function Improvement after His Bundle Pacing and AV-Nodal Ablation for Permanent AF

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Background: Permanent atrial fibrillation (AF) can increase the risk of heart failure, sudden death and stroke. In such case, rate control is recommended over rhythm control. In this report, we present a case of permanent AF uncontrolled with medications, that underwent his bundle pacing and AV-nodal ablation showing improvement of quality of life (QoL) and renal function.

Case Illustration: A 53-year old female, known to have an AF-RVR since 2 years prior, came to our institution with complaint of palpitations when doing her daily activities despite her compliant to her medications. On physical examination, patient was fully alert, BP of 130/80mmHg, HR of 120x/mins irregular, PR 100x/mins irregular, and physical exam findings were unremarkable. ECG showed AF-RVR. Holter examination was done showing atrial fibrillation as the basic rhythm average heart rate 120 bpm. Patient was then planned for the his bundle pacing and AV-nodal ablation. Upon follow-up, the heart rate became completely dependent on the pacemaker making it slower and more regular at 80 bpm. The QoL was improved from 56.25 to 100 score (Aquarel questionnaire) and from 69.4 to 100 score (SF-36 questionnaire). Renal function also improved from eGFR of 20 to 26ml/min/1.73m² within 2 weeks.

Conclusion: In cases of permanent AF in which rate cannot be controlled with medications, it is recommended for the patient to have CRT and AV-nodal ablation with his bundle pacing as an alternative. In this case, the patient showed improvement in QoL and renal function on follow up visit after the procedure.

SUPPORTING DOCUMENTS

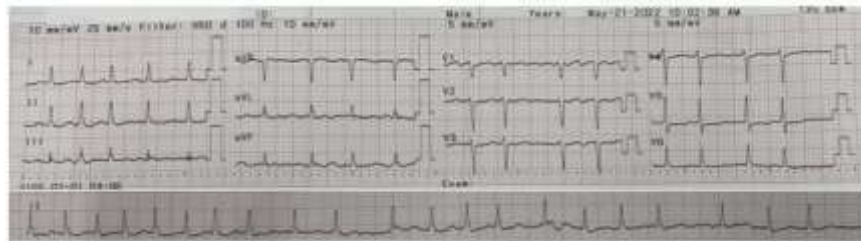


Figure 1. ECG Pre-Procedural

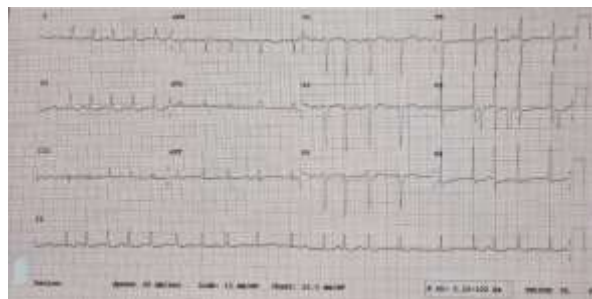


Figure 2. ECG on Follow up Post HIS Bundle Pacing

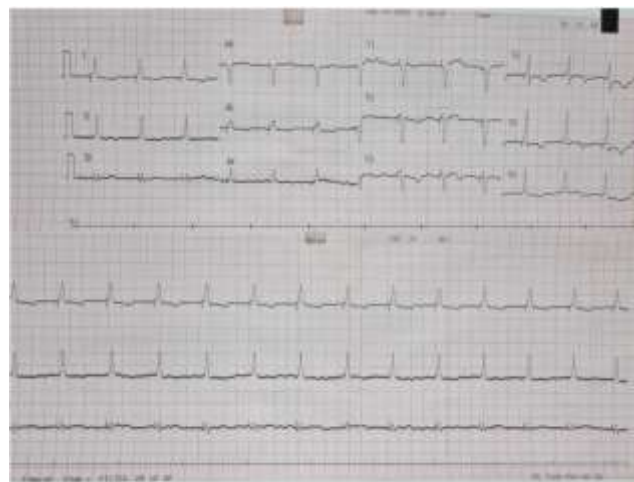


Figure 3. ECG on follow up post HIS Bundle Pacing

Safety and Efficacy of Hybrid Epicardial and Endocardial PVI in Longstanding Persistent Atrial Fibrillation.

Dr Robert Puchalski¹, Dr Stuart Healy¹, Dr David Adam¹, Dr Logan Bittinger¹, Dr Jeff Alison¹, Dr Emily Kotschet¹, Mr Adrian Pick²

¹Monash Heart, Melbourne, Australia, ²Department of Cardiac Surgery, Monash Health, Melbourne, Australia

OBJECTIVES

To assess safety and efficacy of hybrid approach pulmonary vein isolation in longstanding persistent AF patients.

MATERIALS AND METHODS

We performed retrospective analysis of 20 consecutive longstanding persistent AF patients whom underwent a totally thorascopic epicardial PVI (plus roof and floor line), followed by endocardial remapping and ablation where required. During remapping, location of ablation gaps were described. Ablation was targeted to ensure PVI, and ideally posterior wall isolation. Safety and efficacy data was collected.

RESULTS

Follow-up was complete for 19/20 patients (90%). Mean age of the patients was 60 ± 7 years, mean time to remapping procedure was 5.5 months, and mean follow-up time was 2.7 years. There was only one minor complication of post-operative mild pneumonia. There were no major complications. During remapping, only 5% of the left sided veins had reconnected. Ten-percent of the RIPVs had reconnected, whereas 25% of RSPVs were reconnected. At remap, 25% of posterior walls were durably blocked. Post endocardial ablation all veins showed entrance and exit block, and 16 patients has posterior wall isolation. Eighteen patients were in sinus rhythm at last follow-up. Only four patients (20%) had any AF during follow-up, and two of those patients maintained sinus rhythm after cardioversion. There were 3 cases of atypical left-sided flutter, one case of atypical right atrial appendage flutter and two cases of CTI dependent flutter.

CONCLUSION

Hybrid epicardial and endocardial PVI appears safe. In this exploratory data, there is low recurrence of AF in a traditionally difficult patient population group.

Reduced Cardiorespiratory Fitness in Atrial Fibrillation Associated with Abnormal Invasive Haemodynamics and Left Atrial Remodelling

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¹*Centre For Heart Rhythm Disorders, Adelaide, Australia*

SUPPORTING DOCUMENTS

Objective: To evaluate the association between cardiorespiratory fitness (CRF) and left atrial (LA) remodelling in patients with atrial fibrillation (AF), using invasive and non-invasive stress testing.

Materials & Methods: Consecutive patients with paroxysmal or persistent AF and preserved left ventricular ejection fraction >50% were recruited. Participants underwent cardiorespiratory pulmonary exercise testing (CPET) for assessment of peak oxygen uptake (VO_{2PEAK}). Participants also underwent resting and exercise transthoracic echocardiography (TTE) focussed on left ventricular (LV) and LA function. At AF ablation, participants underwent invasive assessment of LA pressures and LA electrical function using high density electroanatomical maps. The association between VO_{2PEAK} and atrial parameters were determined using multivariable linear regression models adjusted for age and sex.

Results: In total, one hundred participants were recruited. The mean age of the cohort was 63.6 ± 11.6 and 23% of the cohort was female. In age- and gender-adjusted analyses, VO_{2PEAK} was not associated with LV function at rest ($p=0.22$) or during exercise ($p=0.50$). However, VO_{2PEAK} was positively associated with LA emptying fraction at rest ($p<0.01$) and during exercise ($p<0.01$) as well as reservoir ($p<0.01$), booster ($p=0.05$) and conduit strain ($p=0.04$). On invasive testing, we observed an inverse relationship between VO_{2PEAK} and mean LA pressure ($p<0.01$). On electrical analysis, there was no association between CRF and LA voltage ($p=0.23$), conduction velocity

(p=0.24) or fractionation (p=0.33).

Conclusion: Reduced CRF in patients with symptomatic AF is associated with LA remodelling involving abnormal LA haemodynamics and mechanical function at rest and during exercise.

Improving CRF may improve LA function in patients with AF.

	Age and Gender Adjusted Model		
	β (95% CI)	R ²	p
Resting LVEF	0.1 (-0.1 to 0.4)	0.24	0.22
Resting Average E/e'	-0.6 (-1.1 to -0.2)	-0.31	<0.01
LV Mass Index	-0.01 (-0.08 to 0.04)	0.25	0.55
LA Max	-0.1 (-0.2 to 0.1)	0.27	0.27
LA Min	-0.3 (-0.4 to -0.1)	0.33	<0.01
Resting LAEF	0.2 (0.1-0.3)	0.35	<0.01
Reservoir Strain	0.3 (0.2 to 0.5)	0.41	<0.01
Booster Strain	0.3 (0.0 to 0.6)	0.38	0.05
Conduit Strain	0.3 (0.0 to 0.7)	0.36	0.04
Exercise LVEF	0.07 (-0.13 to 0.27)	0.23	0.50
Exercise E/e'	-0.2 (-0.6 to 0.2)	0.25	0.44
Exercise LAEF	0.2 (0.1 to 0.3)	0.36	<0.01
Mean LAP	-0.6 (-0.9 to -0.3)	0.36	<0.01
LA Voltage	0.8 (-0.5 to 2.1)	0.15	0.23
LA Conduction Velocity	9.1 (-6.5 to 24.7)	0.24	0.24
LA Fractionated Points	0.1 (-0.2 to 0.4)	-0.0008	0.33

Long Term Outcome of Lesion Index-guided High Power Ablation for PVI

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Objective

Lesion index (LSI) is useful to complete pulmonary vein isolation (PVI) for atrial fibrillation (AF). High power application with LSI guided ablation strategy (HP-LSI) may shorten the time to complete PVI. However, the long-term outcome for HP-LSI was limited.

Methods

147 paroxysmal AF patients underwent PVI by TactiCath ablation catheter were enrolled retrospectively. The first 80 patients were assigned to high power short duration ablation strategy (HPSD, anterior wall 50W, posterior wall 40 W, 10 seconds for each lesion), and the subsequent 67 patients were applied with HP-LSI strategy (anterior wall 50W/LSI at least 5.0, posterior wall 40W/LSI 4.0 to 4.5, with 20 seconds limited for each lesion). The primary outcome was AF recurrence between groups. PVI time and first pass isolation rate were considered as secondary outcome.

Results

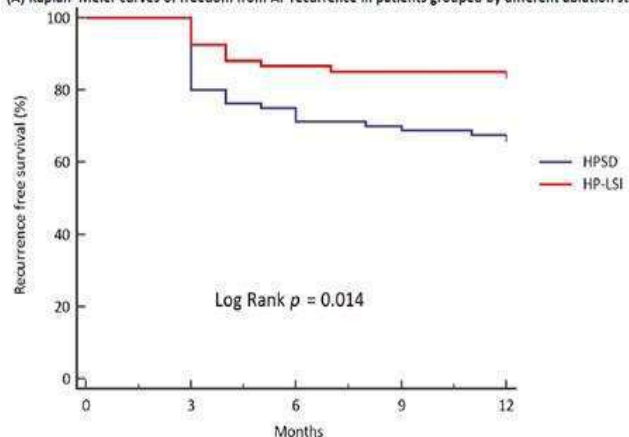
Over 12 months follow-up, there was a significant lower rate of AF recurrence in HP-LSI group compared to HPSD group (14.9% vs. 32.5%, $p = 0.020$) (Figure, Panel A). The PVI time was shorter (63.7 minutes vs. 87.7 minutes, $p < 0.001$), and first pass isolation rate were higher for both PVs (RPV: 42.2% vs. 13.7%, $p = 0.003$; LPV: 66.7% vs. 31.4%, $p = 0.001$) in HP-LSI group than HPSD group. Besides, there were fewer gaps found in several PV segments in HP-LSI group after first pass PV circumferential ablation (Figure, Panel B).

Conclusion

HP-LSI ablation strategy can result in durable PVI outcome and shorten PVI time with high first pass isolation rate in both PVs.

SUPPORTING DOCUMENTS

(A) Kaplan–Meier curves of freedom from AF recurrence in patients grouped by different ablation strategy



Number at risk

Group: HPSD

80

64

57

55

0

Group: HP-LSI

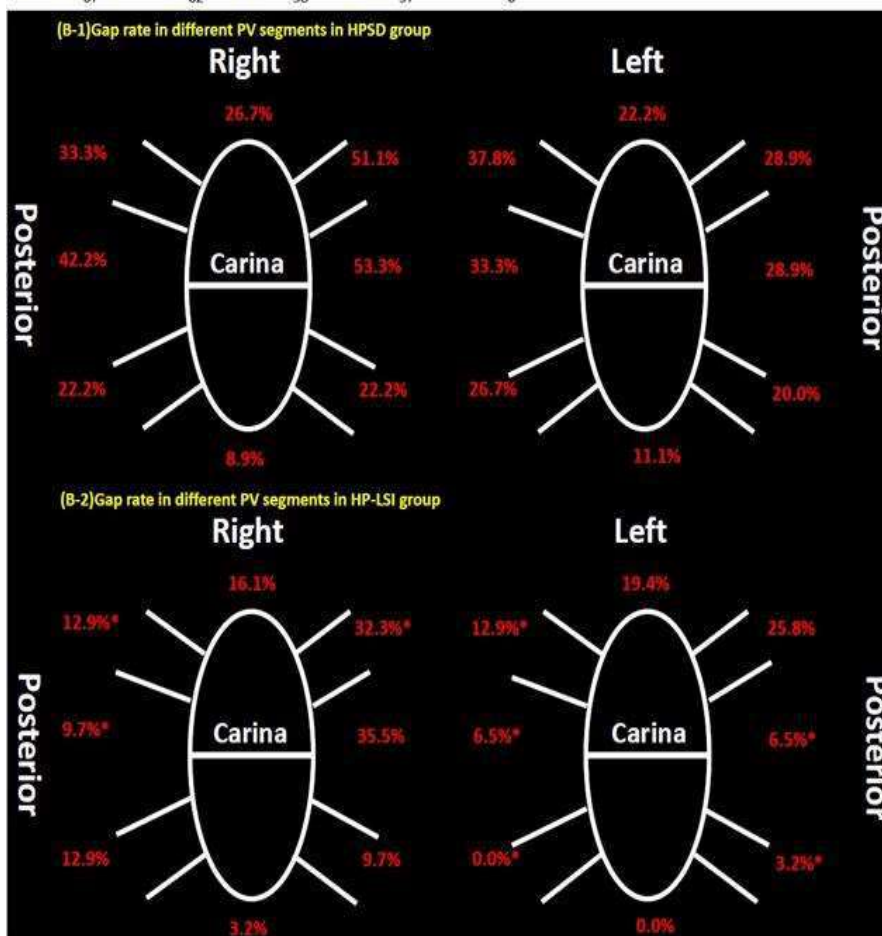
67

62

58

57

0



Panel A showed the Kaplan–Meier curves of freedom from AF recurrence in patients grouped by different ablation strategy. Panel B-1 showed the gap rate in different pulmonary vein (PV) segments in high power short duration (HPSD) group. Panel B-2 showed the gap rate in different PV segments in high power-lesion size index (HP-LSI) group, and asterisk (*) indicated significant difference ($p < 0.05$) compared to HPSD group.

Prevalence of Amyloidosis in Patients With Non-valvular Atrial Arrhythmias

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Introduction

Wild-type ATTR amyloidosis (WAA) is a disease of the elderly and predominantly affects the heart.

The prevalence of WAA in patients with atrial arrhythmias (AA), remains underevaluated

Purpose of the study

To determine the prevalence and predictors of WAA in patients with non-valvular AA.

Materials and Methods

Patients older than 55years with nonvalvular AA were recruited. All patients underwent

Technetium pyrophosphate scan. Rhythm control was considered in all patients.

Results

89 patients were included in the study. Mean age was 65.82 ± 10.07 years, 53 (59.6%) were males, 34 patients (38.2%) had diabetes, 59 (66.3%) patients had hypertension, and 3 (3.4%) patients had a history of stroke. Mean ejection fraction was $52.08 \pm 8.8\%$. while the mean CHADSVAS2 score was 2.63 ± 1.54 . Rhythm control was attempted in all patients but was unsuccessful in 32 (36.8%) patients. Technetium pyrophosphate scan was positive in 27 (30.3%) patients indicative of WAA. Concentric LVH was more common in patients with WAA (40% vs 18.5 %), the mean LV wall thickness being greater in patients with WAA as compared to patients without (11.5 ± 2.5 mm vs 9.7 ± 2.4 mm). Multinomial regression analysis odds of WAA was higher among male patients (OR = 7.54, p= 0.03) and patients with diabetes (OR= 8.85, p= 0.05).

Conclusion

A significant proportion of patients with AA have WAA. Male and diabetic patients with AA have higher odds of WAA. Further studies are required to assess the outcomes of rhythm control in patients with WAA and atrial arrhythmias.

SUPPORTING DOCUMENTS

Table 1 Characteristics of patients with and without WAA

	WAA Positive	WAA Negative
Age	61.9 ± 10.1	60.3 ± 12.3
Diabetes	66.7 %	26.5%
Hypertension	76.2 %	64.7%
EF	52.5 ±9.7%	51.4 ± 9.7%
LA Size	42.1±7.5 mm	41.2 ± 7.1 mm
Septal Thickness	11.5 ± 2.5 mm	9.7 ± 2.4 mm
Concentric LVH	40 %	18.5 %
Biatrial enlargement	38.1%	37.1%

WAA: Wild ATTR Amyloidosis, LVH : Left ventricular hypertrophy, EF; Ejection fraction, LA: Left atrium

Table 2 : Logistic regression model identifying the independent predictors of WAA

	OR (CI)	p value
Sex	0.03 (1.1 – 49.2)	0.18
Age	1.06 (0.2 – 5.4)	0.94
Diabetes	8.8 (1.8 – 42.6)	0.01
Hypertension	0.70 (0.2- 8.9)	0.70

Septal Thickness	0.91 (0.7 – 1.3)	0.91
Low voltage QRS in Limb leads	0.3 (0.06 – 2.3)	0.31
Low Voltage QRS in precordial leads	2.6 (0.16-43.7)	0.49

Individual Risk Prediction of Anticoagulation in Patients With Cirrhosis and Atrial Fibrillation

Asst Prof In-Soo Kim¹, Asst Prof Hye Won Lee², Asst Prof Jiwon Seo¹, Professor Eui-Young Choi¹, Associate Professor Beom Kyung Kim², Professor Jong-Youn Kim¹

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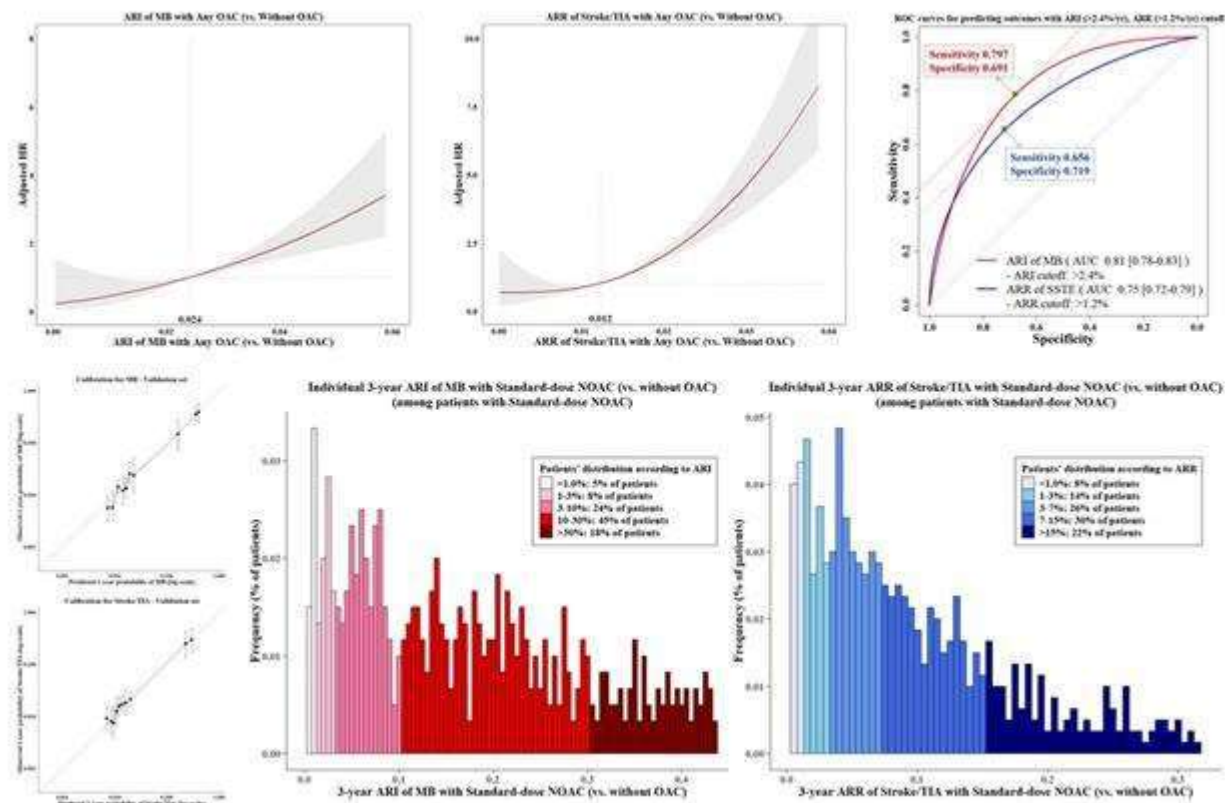
Background: We aimed to assess absolute risk and benefit from OAC therapies in individual AF patients with liver cirrhosis (LC), and to develop the optimal dose selecting risk calculator for each patient.

Methods: We derived and validated a prediction model for major bleeding (MB) and stroke/systemic thromboembolism (SSTE) in AF patients with LC from two-center observational cohort (n=420 in derivation cohort, n=180 in validation cohort) with 4 treatment options (standard-, low-dose NOACs, warfarin, and no OACs). Readily available clinical variables were included in machine learning-based ensembled risk calculation models.

Results: Model calibration and discrimination was adequate with c-statistics of 0.77[0.66-0.87] for MB and 0.74[0.74-0.84] for SSTE. Three-year absolute risk increases (ARIs) for MB with standard-dose NOACs ranged from <10% in 37% of patients to >30% in 18% of patients, with low-dose NOACs ranged from <10% in 47% of patients to >30% in 12% of patients compared without OACs. Three-year absolute risk reductions (ARRs) for SSTE with standard-dose NOACs ranged from <7% in 48% of patients to >15% in 22% of patients, with low-dose NOACs ranged from <7% in 57% of patients to >15% in 17% of patients compared without OACs. The ARI cutoff for MB and ARR cutoff for SSTE with OAC were shown as >2.4%/year and >1.2%/year (c-statistics 0.81[0.78-0.83], 0.75[0.72-0.79]).

Conclusions: Artificial intelligence combining clinical variables was found to predict individual patient's bleeding and stroke/systemic embolism risks well and it can also guide each patient's appropriate OAC dose in AF patients with LC (web-calculator can be accessed as: <https://riskcalc.shinyapps.io/AFLC/>).

SUPPORTING DOCUMENTS



Hypothyroidism Shows a Causal Association With Atrial Drivers During Catheter Ablation of Atrial Fibrillation

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SUPPORTING DOCUMENTS

Table 1. Baseline Characteristics Between 2 Groups				
Baseline Characteristics	All	With Hypothyroidism	Euthyroidism	P value
	(N=591)	(N=65)	(N=526)	
Age, years	57 ± 11	58 ± 11	57 ± 11	0.434
Male, n (%)	450(76.1)	52 (80)	398 (75.7)	0.440
HTN, n (%)	211(35.7)	32 (49.2)	179 (34)	0.016
Hyperlipidemia, n (%)	99(16.8)	9 (13.8)	90 (17.1)	0.506
DM, n (%)	49(8.3)	5 (7.7)	44 (8.4)	0.853
CAD, n (%)	66(11.2)	11 (16.9)	55 (10.5)	0.118
Old vascular disease, n (%)	2(0.3)	1 (1.5)	1 (0.2)	0.077
Old stroke, n (%)	7(1.2)	1 (1.5)	6 (1.1)	0.780
Valvular Heart Disease, n (%)	36(6.1)	5 (7.7)	31 (5.9)	0.567
Heart failure, n (%)	21(3.6)	3 (4.6)	18 (3.4)	0.624
CHA ₂ DS ₂ -Vasc Score	0.94 ± 1.0	1.1 ± 1.0	0.9 ± 1.0	0.109
PAF, n (%)	397 (67.2)	37 (56.9)	360 (68.4)	0.062
Echocardiographic parameters				
LAD (mm)	39.2 ± 6.3	41.1 ± 6.3	39.1 ± 6.3	0.015
LVEF (%)	58.3 ± 6.4	56.8 ± 7.7	58.5 ± 6.1	0.044
MV E velocity (cm/s)	78.6 ± 20.7	83.3 ± 21.6	78.0 ± 20.5	0.510
E/E' ratio (mean)	10.4 ± 4.1	10.9 ± 4.4	10.4 ± 4.1	0.320
RVSP (mmHg)	28.8 ± 7.7	29.2 ± 8.2	28.8 ± 7.7	0.697
Presence of Triggers and Drivers				
PV triggers, n (%)	257(43.5)	32 (49.2)	225 (42.8)	0.320
Non-PV triggers, n (%)	50(8.5)	7 (10.8)	43 (8.2)	0.480
Drivers, n (%)	41(6.9)	15 (23.1)	26 (4.9)	<0.001
PAF	8(1.3)	4 (10.8)	4 (1.1)	<0.001
Non-PAF	33(5.6)	11 (39.3)	22 (13.3)	0.001

Values are number and percentage (%) of the variables ± standard deviation.

HTN, hypertension; DM, diabetes mellitus; CAD, coronary artery disease; PAF, paroxysmal atrial fibrillation; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; MV E velocity, Mitral E wave velocity; RVSP, right ventricle systolic pressure

Table 2. Factors associated with AF in patients with hypothyroidism						
	Univariate analysis			Multivariate analysis		
	Hazard ratio	95% CI	P value	Hazard ratio	95% CI	P value
Age	1.009	0.99 - 1.03	0.433			
Male	1.286	0.68 - 2.44	0.440			
HTN	1.88	1.12 - 3.16	0.017	1.749	1.02 - 3.01	0.044
Hyperlipidemia	0.779	0.37 - 1.63	0.507			
DM	0.913	0.35 - 2.39	0.853			
CAD	1.744	0.86 - 3.53	0.122			
Old vascular disease	8.203	0.51 - 132.75	0.138			
Old stroke	1.354	0.16 - 11.43	0.781			
Valvular Heart Disease	1.331	0.50 - 3.55	0.569			
Heart failure	1.366	0.39 - 4.77	0.625			
CHA ₂ DS ₂ -Vasc Score	1.206	0.96 - 1.52	0.110			
PAF	0.609	0.36 - 1.03	0.064	1.114	0.59 - 2.10	0.739
2D-Echo parameters						
LAD	1.051	1.01 - 1.09	0.015	1.022	0.98 - 1.07	0.351
LVEF	0.965	0.93 - 0.99	0.046	0.969	0.93 - 1.01	0.099
MV E velocity	1.012	1.00 - 1.02	0.052	1.008	0.99 - 1.02	0.215
E/e'	1.029	0.97 - 1.09	0.322			
RVSP	1.007	0.97 - 1.04	0.696			
Presence of Triggers and Drivers						
PV triggers	1.297	0.77 - 2.17	0.323			
Non-PV triggers	1.356	0.58 - 3.15	0.480			
Drivers	5.769	2.87 - 11.60	<0.001	5.120	2.39 - 10.99	<0.001

*The multivariate regression model was calculated using multiple cox regression stepwise analysis (included all variables with p<0.1).

HTN, hypertension; DM, diabetes mellitus; CAD, coronary artery disease; PAF, paroxysmal atrial fibrillation; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; MV E velocity, Mitral E wave velocity; RVSP, right ventricle systolic pressure

Ablation of the Electrical Activity in the “Blind Spot” of Lasso-Verified PVI Reduces Early Recurrences

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Background

A lasso in the PV-ostium is standard to verify PVI. But circumferential isolating lines are placed in the much thicker myocardium of the antrum or atrium, i.e. distant to the lasso. Therefore, a substantial part of myocardium might escape the control of the lasso.

Objectives

A potential “blind spot” of the lasso was examined by separating the control of the isolation of the PVs with the lasso from the examination of the antral line with UHDM.

Methods

Isolation of the PVs was verified with a lasso by exit-block, entry-block, negative adenosine test and unexcitability along the ablation line. Then, the area between the position of the lasso in the PV-ostium and the antral ablation line was examined using UHDM. Any electrical activity in this “blind spot” was ablated. Patients were followed for 3 months for ERs.

Results

Lasso-verified PVI was achieved in 50 consecutive patients. UHDM also revealed isolated PVs in 100%. But residual electrical activity in the supposed “blind spot” was found in 36 patients (72%). These potentials could be traced in 12/36 patients (33%) into one region and in 24/36 patients (66%) into several regions. ERs were found in 5% of patients with paroxysmal AF and in 50% of those with persistent AF. Potential myocardial volumes of the “blind spot” were calculated using a mathematical model.

Conclusion

UHDM is able to trace electrical potentials into a “blind spot” of lasso-verified PVI. Ablation of these residual antral potentials results in a very low ER rate in paroxysmal AF.

LEFT ATRIAL THROMBUS EXCLUSION BEFORE ATRIAL FIBRILLATION ABLATION: RECONSIDERING THE ROLE OF CARDIAC COMPUTED TOMOGRAPHY

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OBJECTIVES

Considering the risk of aerosolization during the COVID-19 pandemic associated with transesophageal echocardiography (TEE), we evaluated the diagnostic performance of cardiac computed tomography (CCT) before pulmonary vein isolation (PVI) in comparison to semi-invasive TEE in excluding left atrial (LA)/LA appendage (LAA) thrombus, limiting the need for TEE to only patients with possible thrombus on CCT.

MATERIALS AND METHODS

We included a total of 145 consecutive patients with atrial fibrillation (AF) (age 52.4 ± 10.3 years; 63% males; 89 paroxysmal AF) referred for radiofrequency ablation in National Cardiovascular Center Harapan Kita, Jakarta, Indonesia. All patients underwent preprocedural single phase 128-slice multidetector CT and subsequent TEE as the reference standard with a mean time interval of 6.5 ± 5.3 days between the two procedures.

RESULTS

CCT identified 30 patients (20.7%) with a filling defect in the LA/LAA, 8 of which were confirmed by TEE as thrombi (22 false positive, 8 true positive), whereas 9 true thrombi (6.2%) were detected by TEE (1 false negative by CCT). The sensitivity and specificity of CCT were 88.9% and 83.8%, respectively, with a positive predictive value of 26.8% and a negative predictive value of 99.1%. The overall accuracy was 84.1%.

CONCLUSION

Apart from being a planned preparation modality before PVI, CCT is sufficient and could be used as an initial step to exclude the presence of LA/LAA thrombus, limiting the invasive TEE only for confirmation of the thrombus if detected by CCT.

SUPPORTING DOCUMENTS

Table 1. Clinical characteristics of patient population (n = 145)

Age, years	52.4 ± 10.3
Male sex	91 (63%)
Paroxysmal AF	89 (61%)
Time interval between procedures, days	6.5 ± 5.3
LA/LAA thrombus	9 (6.2%)

Table 2. Results of TEE and CCT for detection of LAA thrombus

		TEE		
		Thrombus	No thrombus	Total
CCT	Thrombus	8	22	30
	No thrombus	1	114	115
Total		9	136	145

Table 3. Diagnostic accuracy of CCT compared to TEE for detection of LAA thrombus

Sensitivity, % (95% CI)	88.9 (51.8 – 99.7)
Specificity, % (95% CI)	83.8 (76.5 – 89.6)
NPV, % (95% CI)	99.1 (94.7 – 99.9)
PPV, % (95% CI)	26.8 (19.0 – 36.4)
Accuracy, % (95% CI)	84.1 (77.2 – 89.7)

Abnormal Left-ventricular Global Longitudinal Strain is Associated With Diagnosis of Atrial Fibrillation in Embolic-stroke-of-undetermined Source

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Patients with embolic-stroke-of-undetermined-source (ESUS) have no immediate attributable cause despite evaluation. Undiagnosed atrial fibrillation (AF) is often diagnosed after prolonged monitoring. Left-ventricular-global-longitudinal-strain (LVGLS) is a sensitive marker of myocardial dysfunction and atrial reservoir function, but its role in ESUS is unknown. We sought to evaluate the role of LVGLS for predicting AF diagnosis in ESUS.

This study examined consecutive patients diagnosed with ESUS between October 2014 and October 2017 who were offered an implantable loop recorder (ILR). They were followed for new-onset AF and ischemic stroke recurrence. All patients had a transthoracic echocardiogram performed during the index admission. Post-hoc analysis was performed for two-dimensional (2D) speckle tracking deformation parameters including LVGLS. An abnormal LVGLS was defined as less than -18.0%.

157 ESUS patients were followed up for a median duration of 3.50 (interquartile range 3.29) years. They were predominantly male (72.6%) with a mean age of 61.0±11.6 years-old. 27 (17.2%) patients were eventually diagnosed with AF and 27 (17.2%) patients developed recurrent stroke. Among the patients with newly-diagnosed AF, 24 were started on oral anticoagulation while 3 had medical contraindications such as clinical bleeding or frailty. An abnormal LVGLS was associated with AF detection but not recurrent stroke. This association persisted on multivariable analysis adjusting for age, sex, hypertension, hyperlipidaemia, diabetes mellitus, left ventricular ejection fraction (LVEF) and left atrial volume index (LAVI).

LVGLS may be a potential marker for risk stratification where patients with an abnormal GLS can be followed more closely and stronger consideration given for ILR implantation.

Revisiting of Pulmonary Vein Stenosis After High-power Short-duration Radiofrequency Ablation in Patients With Atrial Fibrillation

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OBJECTIVES

Pulmonary vein isolation (PVI) by high-power short-duration (HPSD) radiofrequency (RF) energy reduces procedure time without difference in efficacy compared to conventional RF-PVI (Conv-PVI). We compared the frequency of symptomatic PV stenosis as long-term complications in Conv-PVI and HPSD-PVI.

MATERIALS AND METHODS

Among 4,540 consecutive patients (male 74.9%, 59.5 ± 12.0 years old, paroxysmal AF 64.2%, repeated procedure 11.7%) who underwent AF ablation, we compared who showed PV stenosis after Conv-PVI and HPSD-PVI (50~60W). We evaluated the characteristics of patients diagnosed with clinically significant PV stenosis by computed tomogram (CT).

RESULTS

Symptomatic PV stenosis was diagnosed in 12 of patients (male 75%, 50.8 ± 15.4 years old, paroxysmal AF 100%, repeat procedure 33.3%) 355.5 ± 155.2 days after the procedure (HPSD-PVI n=6, 0.5% vs. Conv-PVI n=6, 0.2%, p=0.085). Common symptoms were hemoptysis (58.3%) and dyspnea (33.3%). Stenotic PV were right inferior PV in 50%, left inferior PV in 33.3%, left superior PV in 33.3%, right superior PV in 16.7%, and multiple PVs in 41.7%. 58.3% of patients required surgical or endovascular interventions. In the multivariate logistic regression analysis, HPSD-PVI (OR 3.45[1.04-11.40], p = 0.042), left atrial diameter (OR 0.89[0.81-0.99], p = 0.030) and the number of ablation procedures (OR 2.53[1.10-5.82], p = 0.029) was independently associated with PV stenosis after AF ablations.

CONCLUSION

We observed symptomatic PV stenosis (58% requiring PV interventions) after median 11.17 months in 0.5% of patients after HPSD-PVI. HPSD-PVI reduces the procedure time, but caution is required for the risk of stenosis, especially in inferior PVs.

Coarse Atrial Fibrillation in Complete Atrioventricular Block: Rare Presentation of Staphylococcus Hemolyticus Mitral Valve Endocarditis

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Staphylococcus hemolyticus which are usually commensal organisms rarely present with native valve endocarditis (NVE), with only 8 documented cases in literature. Concomitant atrioventricular (AV) conduction abnormalities complicating S. hemolyticus infective endocarditis are rare. Here we present a 43-year-old, Filipino, female with end-stage renal disease on chronic hemodialysis presenting with 1-month history of exertional dyspnea, orthopnea, and eventually consulting for worsening dyspnea and dizziness. Workup revealed coarse atrial fibrillation in complete AV block on electrocardiogram. Echocardiography showed severe mitral regurgitation with multiple oscillating vegetations in the posterior mitral leaflet. Risk factors identified for developing NVE were prolonged central line use and predisposing valvular lesions. Although mitral valve endocarditis may be complicated with AV conduction abnormalities, the non-coronary aortic cusp and the anterior mitral leaflet are believed to be more commonly involved due to their close anatomic relationship with the AV node. We present the first documented case of aggressive S. hemolyticus posterior mitral valve leaflet endocarditis further complicated by coarse atrial fibrillation in complete heart block.

Association of Left Atrial Reverse Remodeling After Atrial Fibrillation Catheter Ablation Depending on H2FPEF Score

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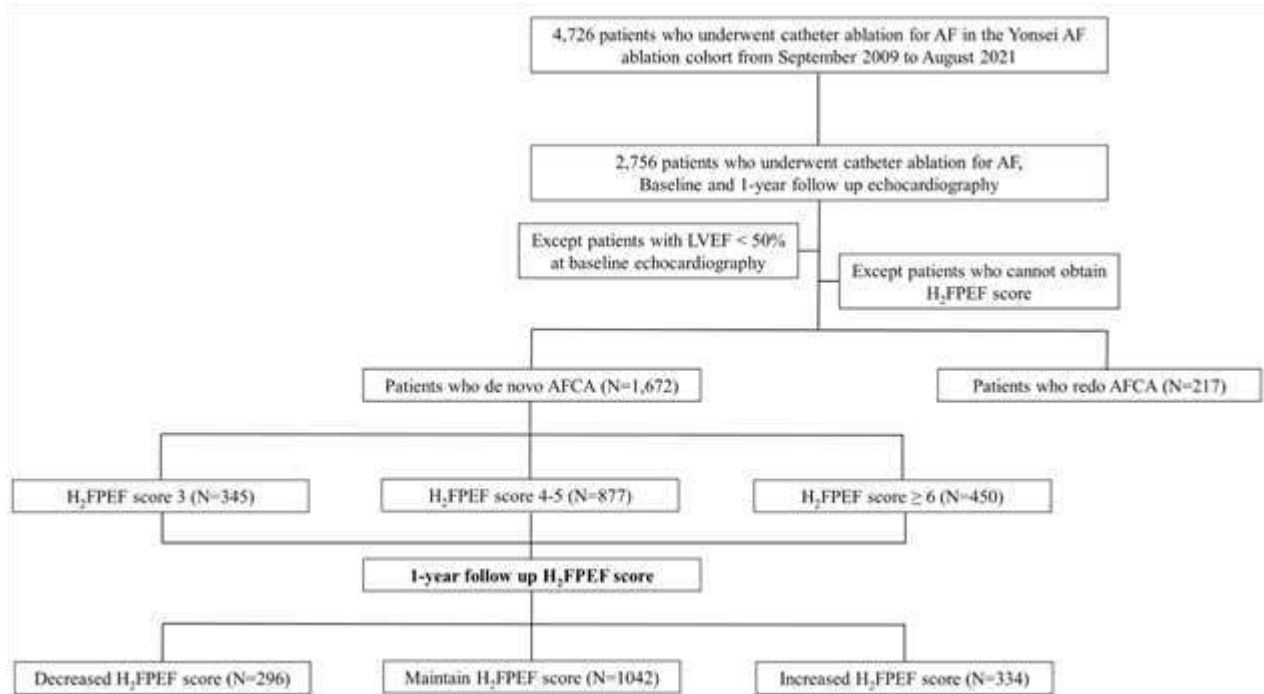
Background: There is growing evidence of the association between heart failure with a preserved ejection fraction (HFpEF) and atrial fibrillation (AF), diastolic function, and atrial myopathy. In this study, we hypothesized that changes in the H2FPEF score would be associated with a left atrial (LA) dimension % reduction one-year post-AF catheter ablation (AFCA).

Methods: Among 2,756 consecutive patients with AFCA, 1,672 (69.3% male, 60.2±10.5 years old, 66.1% paroxysmal AF) with a de novo AFCA, both baseline and 1-year echocardiograms, available baseline and 1-year H2FPEF scores, and protocol-based regular rhythm follow-up were included. We divided the patients into three groups according to the baseline H2FPEF or delta-H2FPEF score and their relationship to the percent reduction in the left atrial dimension (% delta-LA) one-year post-AFCA.

Results: AF patients with high H2FPEF scores (≥6 score, n=450) had larger LA dimensions, higher LA peak pressures, low LA voltages, and larger epicardial adipose tissue volumes (p<0.001) than those with H2FPEF scores<6 (n=1,222). Patients with decreased 1-year H2FPEF scores were independently associated with the % delta-LA (OR 1.034 [1.019-1.050], p<0.001), ejection fraction (OR 1.036 [1.011-1.161], p=0.004), left ventricular mass index (OR 1.007 [1.000-1.015], p=0.049), and epicardial adipose tissue volume (OR 0.996 [0.993-0.999], p=0.016). Throughout a 63.9±36.6 month follow-up, AF recurrence one-year post-procedure was significantly less in patients with a reduced one-year H2FPEF score than their counterpart (log-rank p=0.007).

Conclusions: Patients with a decreased H2FPEF score one-year post-AFCA were independently associated with a significant LA reduction, low epicardial adipose tissue volume, and lower long-term AF recurrence.

SUPPORTING DOCUMENTS



Blunted Atrial Reverse Remodeling After Catheter Ablation of Atrial Fibrillation and the Long-term Rhythm Outcome

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Background : Although active rhythm control by AFCA reduces the left atrial (LA) dimension, blunted atrial reverse remodeling can be observed in patients with atrial myopathy. We explored the characteristics and long-term outcomes in atrial fibrillation (AF) patients who had blunted atrial reverse remodeling despite the absence of AF recurrence within a year after atrial fibrillation catheter ablation (AFCA).

Methods : We included 1,685 patients underwent both baseline and 1-year follow-up echocardiograms, had a baseline LA diameter >40mm, and did not recur AF within a year. We divided them into tertile groups (T1–T3) based on the LA dimension 1-year percent change after propensity score matching. We investigated the genetic characteristics of patients using a genome-wide association study (GWAS).

Results : Blunted LA reverse remodeling (T1, n=424) was independently associated with LA peak pressure (OR 1.010 [1.002-1.019], p=0.019), LA wall thickness (OR 0.448 [0.252-0.789], p=0.006), LA voltage (OR 0.651 [0.463-0.907], p=0.012), and epicardial adipose tissue volume (OR 1.004 [1.001-1.008], p=0.014). Throughout 65.9±37.4 months of follow-up, the incidence of an AF recurrence a year after the procedure was significantly higher in the T1 group (log-rank p<0.001). Among 894 patients with a GWAS, the polygenic risk scores were associated with blunted LA reverse remodeling.

Conclusions : Blunted LA reverse remodeling after AFCA was independently associated with a low LA voltage, thin wall thickness, high LA pressure, and epicardial adipose tissue, and it had a genetic background. Long-term clinical recurrence a year after AFCA was higher in the group with suspected atrial myopathy.

Racial Differences and Similarities in Atrial Fibrillation Epidemiology, Risk Factors, and Mortality in Community Cohorts

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Objective: Atrial fibrillation (AF) is the most common arrhythmia that occurs clinically and is associated with mortality, morbidity and medical costs. However, most of the AF studies included predominantly white populations. In this study, we aimed to compare established associations between risk factors and AF in UK Biobank, a study with Western population, against Korean NHIS-HealS, a study with Asian.

Methods: We included 402,229 and 484,406 populations not diagnosed with non-valvular AF from the National Health Insurance Service-Health Screening (NHIS-HealS) cohort in Korea and UK biobank, respectively.

Results: Although the subjects in Korean NHIS-HealS had a high proportion of males, were younger, and had a lower BMI, cardiovascular disease was more prevalent in Korean NHIS-HealS. Fewer AF cases were observed in Korean NHIS-HealS (N=9182; 2.3%), than in UK biobank (N=25312; 5.2%). Multivariable-adjusted models showed cohort differences for the association of body mass index and AF (hazard ratio per standard deviation increase, 1.34; 95% confidence interval [CI], 1.32-1.36 in UK biobank versus 1.05; 95% CI 0.95-1.17 in Korean NHIS-HealS; interaction P value of 0.074). The relationship between systolic blood pressure and AF was showed similar results (hazard ratio per standard deviation increase, 1.03; 95% confidence interval [CI], 1.01-1.04 in UK biobank versus 1.04; 95% CI 0.93-1.17 in Korean NHIS-HealS; interaction P value of 0.308).

Conclusions: In a comparison of findings between UK biobank and Korean NHIS-HealS, we found close agreement for a series of well-established risk factors for atrial fibrillation according to race difference.

SUPPORTING DOCUMENTS

Risk factor and study	Interaction P value	Hazard ratio	P value	Relative hazard ratio (95% confidence interval)
Body mass index, kg/m ²				
UK biobank	0.074	1.34 (1.32 – 1.36)	<0.001	1.27 (1.16 – 1.38)
Korea NHIS		1.05 (0.95 – 1.17)	0.345	
Systolic blood pressure, mmHg				
UK biobank	0.308	1.03 (1.01 – 1.04)	<0.001	0.98 (0.86 – 1.10)
Korea NHIS		1.04 (0.93 – 1.17)	0.454	
Daily smoking or history of daily smoking				
UK biobank	0.058	1.24 (1.21 – 1.28)	<0.001	1.19 (0.89 – 1.49)
Korea NHIS		1.05 (0.79 – 1.39)	0.755	
Alcohol consumption (≥2 times/week)				
UK biobank	0.481	1.00 (0.98 – 1.03)	0.772	1.03 (0.76 – 1.30)
Korea NHIS		0.97 (0.74 – 1.28)	0.839	
History of heart failure				
UK biobank	0.127	1.58 (1.49 – 1.68)	<0.001	0.60 (-0.35 – 1.54)
Korea NHIS		2.65 (1.86 – 3.78)	<0.001	
History of myocardial infarction				
UK biobank	0.493	2.04 (1.75 – 2.38)	<0.001	1.06 (0.02 – 2.11)
Korea NHIS		1.92 (1.14 – 3.23)	0.014	
History of ischemic stroke or TIA				
UK biobank	0.020	1.75 (1.64 – 1.87)	<0.001	1.31 (0.84 – 1.78)
Korea NHIS		1.34 (0.95 – 1.88)	0.098	
HDL cholesterol, mg/dl				
UK biobank	0.805	1.01 (0.99 – 1.03)	0.214	1.03 (0.91 – 1.15)
Korea NHIS		0.98 (0.87 – 1.10)	0.725	
Glucose, mg/dl				
UK biobank	0.098	1.05 (1.03 – 1.06)	<0.001	1.05 (0.95 – 1.15)
Korea NHIS		0.99 (0.90 – 1.10)	0.911	

† Hazard ratios are adjusted for age and sex, with the exception of individual effects for age and sex.

‡ Hazard ratios for continuous variables are for 1 SD increased: body mass index; 4.80kg/m², systolic blood pressure; 18.68mmHg, HDL cholesterol; 14.78mg/dl, glucose; 22.23mg/dl. SDs were computed in UK biobank.

‡ Hazard ratios for continuous variables are for 1 SD increased: body mass index; 2.88kg/m², systolic blood pressure; 16.35mmHg, HDL cholesterol; 29.89mg/dl, glucose; 26.87mg/dl. SDs were computed in NHIS cohort studies.

Conduction System Pacing post Atrio-Ventricular Nodal Ablation in Drug refractory Atrial Fibrillation with Heart Failure

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Objective:

The aim is to study the feasibility, efficacy, and short-term outcomes of Conduction System Pacing (CSP) +/- (CRT) Cardiac Resynchronization Therapy in post-AV nodal ablation.

Methods:

Patients who were candidates for AVN ablation (Drug refractory atrial fibrillation (AF) with the fast ventricular rate (FVR) and heart failure) were prospectively selected and implanted with a CSP lead +/- coronary sinus lead.

Results:

A total of 15 patients were included in the study (Males-9, Mean age- 69±9.2 y, Ischemic Cardiomyopathy: 3, Sick sinus syndrome: 5, Rheumatic heart disease: 2, other etiology: 5. Patients were broadly divided into AV node ablation with CSP+CRT: 4 patients, AV node ablation with CSP + Dual chamber (DC) pacemaker: 11 patients. Six patients underwent HBP and 9 patients underwent LBBAP. Mean QRS duration at baseline was 139±20 ms which narrowed to 109±11ms post CSP. Mean CSP threshold in CRT arm was 1.0V(HBP) and 0.75V(LBBAP) compared to 1.8V(HBP) and 1V(LBBAP) in the DC pacemaker arm. Significant QT prolongation was noted in 4 out of 15 patients (Mean QTc = 531 ms). One patient with a QTc of 480 ms post-LBBAP assisted CRT had an episode of ventricular arrhythmia within 3 days post-procedure. Ejection fraction improved from 40±13% at baseline to 45±15% at 6 months follow-up. Functional class improved from NYHA class III-IV during baseline to NYHA class II during follow-up in 9/15 patients

Conclusion:

In patients with drug-refractory AF and heart failure, AVN ablation coupled with CSP +/- CRT is associated with improvement in symptoms and quality of life.

Dementia Risk of Direct Oral Anticoagulants Versus Warfarin for Atrial Fibrillation: Systematic Review and Meta-Analysis

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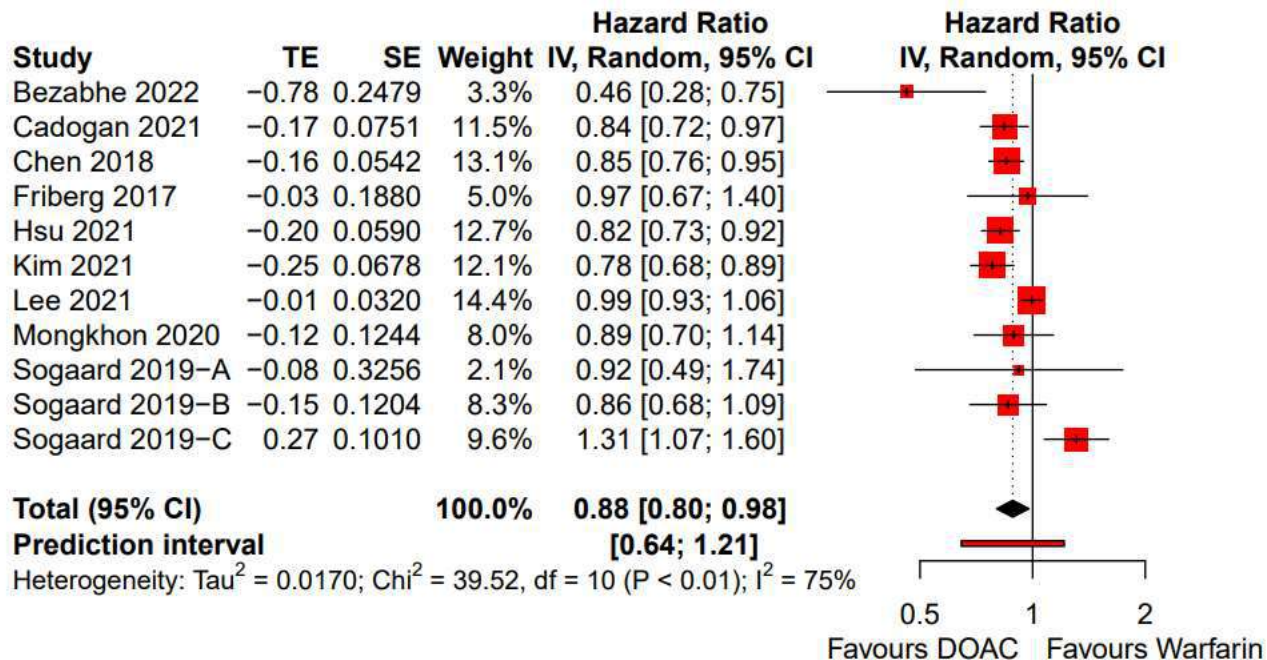
Objective(s): To evaluate the relative risks of dementia in direct oral anticoagulants (DOAC) versus warfarin in patients with atrial fibrillation (AF).

Materials and Methods: An electronic literature search was conducted to retrieve studies reporting comparisons of dementia incidence between patients treated with DOAC versus warfarin for AF. Hazard ratios (HRs) and their 95% confidence intervals (95%CI) were pooled in a random-effects meta-analysis. Where studies provided both raw and corrected HR estimates, the corrected HR was used. Subgroup analyses of HR were also performed for studies reporting stratified outcomes for patients ≥ 75 years of age, and for propensity score-matched (PSM) studies. Numbers of dementia diagnoses and person-years of follow-up were also pooled to determine incidence rate ratios (IRR). Finally, meta-regression was performed to identify variables influencing the results of the meta-analysis.

Result(s): Ten studies and 342,624 patients were retrieved. DOAC was associated with a significantly lower risk of developing dementia compared to warfarin (HR=0.88, 95%CI=0.80-0.98, $p=0.017$, $I^2=75\%$; IRR=0.87, 95%CI=0.76-1.00, $p=0.045$, $I^2=87\%$). Similar significance was seen in the subgroup of PSM studies, but not for patients aged ≥ 75 years. Meta-regression found that a lower mean age corresponded to significantly greater favoring of DOAC over warfarin.

Conclusion: The use of DOAC in AF appears to significantly reduce dementia risk compared to warfarin. Nonetheless, a suggestion of reversal of this effect with increasing age merits further research in the form of randomized trials with long-term follow-up, given that the underlying pathophysiological associations of AF and dementia have yet to be fully elucidated.

SUPPORTING DOCUMENTS



Biomarkers and CHA₂DS₂VASC Accuracy for Stroke Risk in Atrial Fibrillation: a Systematic Review and Meta-analysis

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SUPPORTING DOCUMENTS

OBJECTIVES

To determine whether the addition of biomarkers can yield improvements in discriminatory performance beyond the current accuracy for CHA₂DS₂VASC alone (c-statistic = 63.5-65.3%)¹.

MATERIALS AND METHODS

Searches were carried according to four databases (MEDLINE, EMBASE, Web of Science, SCOPUS) alongside gray literature (Google Scholar) and citation searching. Studies were included based on population (atrial fibrillation), reference test (CHA₂DS₂Vasc score), index test (CHA₂DS₂Vasc score + one or more quantifiable biomarkers) and outcome (evaluation of stroke risk or similar), whilst non-English articles and secondary articles were excluded. A standardised extraction tool will be used with studies being synthesised using the best evidence. Bias risk will be performed using QUADAS-2 with the Grading of Recommendations, Assessment, Development, and Evaluation approach (GRADE) being used to assess overall quality of evidence.

RESULTS

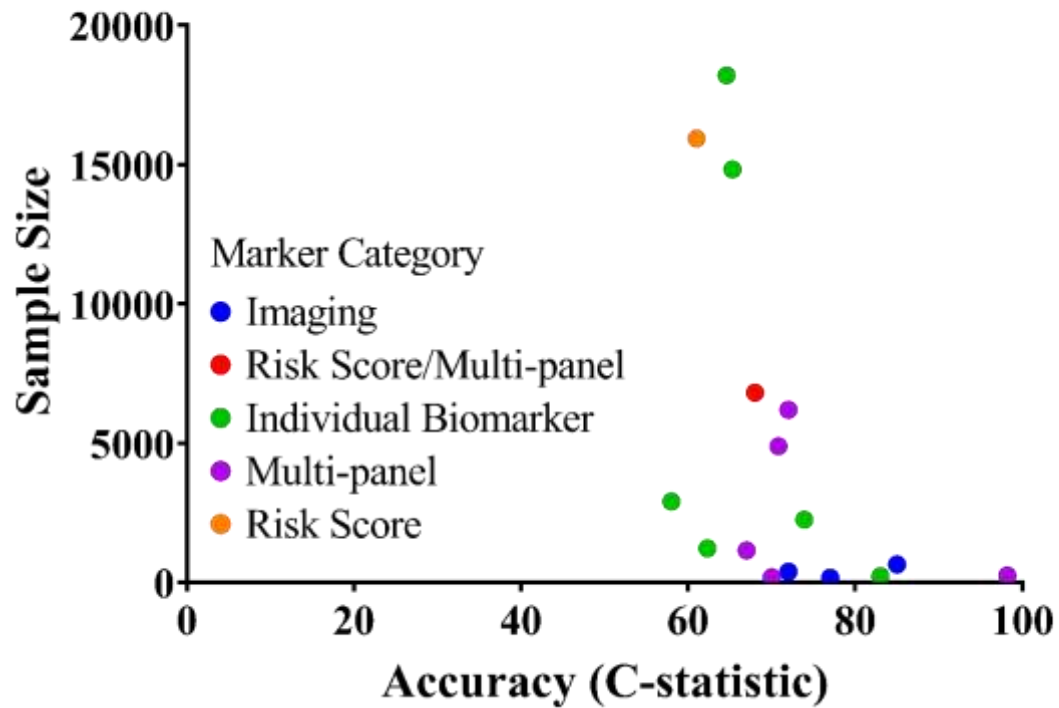
A total of 2568 articles were identified for screening, with 16 articles included. Of these, six included an individual biomarker (e.g. high sensitivity troponin, N-terminal pro-B-type natriuretic peptide, IL-6, von Willebrand factor, abnormal uric acid metabolism), six included a multi-panel of biomarkers and four included either an imaging specific or composite risk score. The accuracy (c-statistic) across these studies was 71.76 ± 10.20% (95% CI 66.3-77.2), with a range of 58% (high sensitivity troponin) to 98.2% (multi-panel of CRP, fibrinogen and troponin I).

CONCLUSION

¹ <https://academic.oup.com/europace/advance-article/doi/10.1093/europace/euac096/6650663?login=false>

This review helps to define the improved diagnostic accuracy when adding biomarkers to the existing CHADVASC2 score in evaluating the risk of stroke in those with AF and aims to contribute to improved clinical decision making.

Diagnostic Accuracy of CHA2DS2VASC + Biomarker



Statin is associated with a lower risk of heart failure in patients with atrial fibrillation

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Objectives To evaluate the association between statin use and heart failure (HF) in patients with atrial fibrillation (AF).

Materials and Methods Patients with newly diagnosed AF (n = 52,490) from 2010-2018 were included. An inverse probability of treatment weighting was used to balance baseline covariates between statin users (n = 23,239) and statin nonusers (n = 29,251). The primary outcome was incident HF. Cox proportional hazard models with competing risk regression were used to evaluate the risk of HF between statin users and nonusers.

Results The median age of the cohort was 74.7 years and 47.3% were female. Over a median follow-up of 5.1 years, incident HF occurred in 3,673 (15.8%) statin users and 5,595 (19.1%) statin nonusers. Statin use was associated with a 19% lower risk of HF (adjusted subdistribution hazard ratio [SHR] = 0.81, 95% CI [confidence interval]: 0.78-0.85, P <0.001). Compared to short-term use (3 months to <2 years), there was a stepwise reduction in the risk of incident HF among those with 2 to <4 years of statin use (SHR 0.86, 95%CI: 0.84-0.88, P <0.001), 4 to <6 years of statin use (SHR 0.74, 95%CI: 0.72-0.76, P <0.001) and ≥6 years of statin use (SHR 0.71, 95%CI: 0.69-0.74, P <0.001). Subgroup analysis showed consistent reductions in the risk of HF with statin use.

Conclusion Statin use was associated with a decreased risk of incident HF in a duration-dependent manner among AF patients.

Association of Discontinuing Oral Anticoagulants With Clinical Outcomes After Atrial Fibrillation Catheter Ablation

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Objective: To evaluate associations between oral anticoagulant (OAC) discontinuation after atrial fibrillation (AF) catheter ablation and risk of thromboembolic and bleeding complications.

Materials and Methods: This population-based cohort study included AF patients with a CHA₂DS₂-VASc score ≥ 2 receiving ≥ 8 weeks of anticoagulation after ablation in 2005-2015. The primary outcome was a net adverse clinical event (NACE), defined as a composite of ischemic stroke and major bleeding. Propensity overlap weighting was used to balance characteristics.

Results: Of 5,583 included, 4,398 (78.8%) discontinued OACs temporarily or permanently. During a median follow-up of 3.8 years, a total of 309 NACEs occurred with weighted incidence rates of 1.37 and 2.00 per 100 person-years among OAC nonusers and users, respectively. The HR was 0.85 (95% CI 0.66-1.10) for NACE when comparing no OAC use with OAC use. Among those without an evidence of AF recurrence during follow-up, no OAC use, compared with OAC use, was associated with lower risks of NACE (weighted HR 0.65, 95% CI 0.47-0.90) and major bleeding (weighted HR 0.58, 95% CI 0.37-0.89). Among those with AF recurrences, there were non-significant trends towards an increased risk of NACE for OAC use compared with no OAC use (weighted HR 1.30, 95% CI 0.81-2.08).

Conclusion: Among patients with AF undergoing catheter ablation, there were no differences in risks of adverse outcomes between long-term OAC use and nonuse. As long as there was no evidence of recurrence, OAC nonuse was associated with a positive net clinical outcome, driven by a decreased risk for major bleeding.

SUPPORTING DOCUMENTS

Figure. Analysis plan of the study

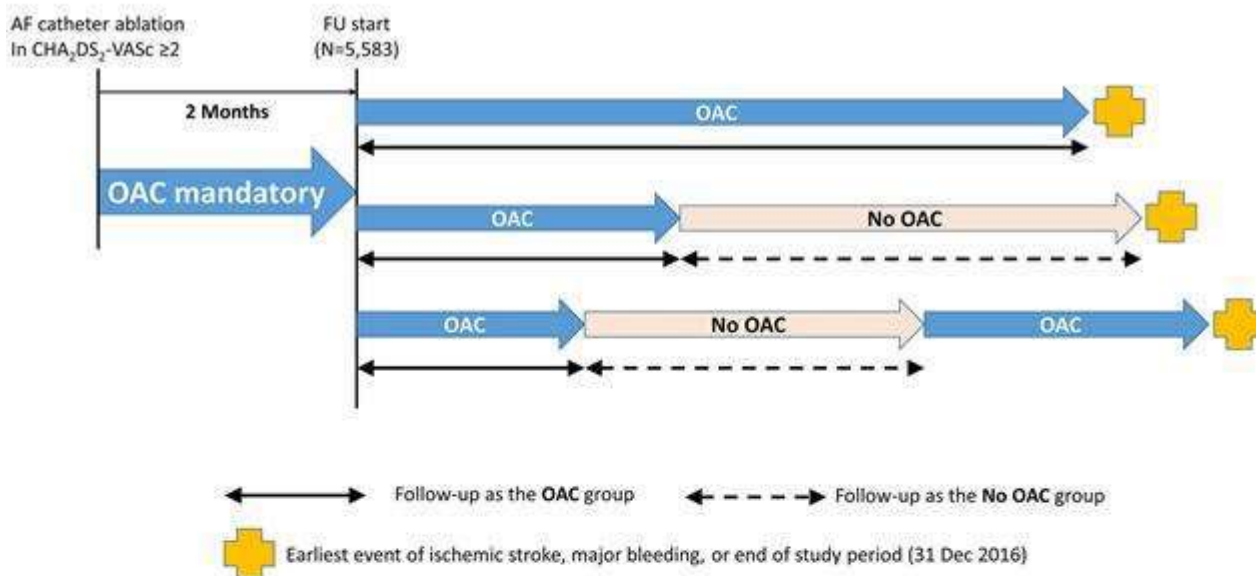


Table. Clinical outcomes according to the use of oral anticoagulants after catheter ablation of atrial fibrillation.

Outcome	No OAC			OAC			Absolute rate difference per 100 person-years* (95% CI)	Weighted HR (95% CI)	P value
	Number of events	Person-years	Event rate*	Number of events	Person-years	Event rate*			
Time-varying regression									
Overall CHA₂DS₂-VASc≥2									
Net adverse clinical event	181	13,661	1.37	128	6,148	2.00	-0.63 (-1.23 to -0.03)	0.85 (0.66–1.10)	0.220
Ischemic stroke	89	13,661	0.67	57	6,148	0.88	-0.21 (-0.61 to 0.20)	0.96 (0.67–1.39)	0.841
Major bleeding	99	13,661	0.75	74	6,148	1.17	-0.42 (-0.88 to 0.04)	0.76 (0.53–1.08)	0.124
AF recurrence during FU									
Net adverse clinical event	72	5,511	1.31	42	3,238	1.30	0.01 (-0.49 to 0.50)	1.30 (0.81–2.08)	0.281
Ischemic stroke	37	5,511	0.70	20	3,238	0.61	0.09 (-0.42 to 0.59)	1.29 (0.68–2.45)	0.432
Major bleeding	38	5,511	0.72	24	3,238	0.73	-0.01 (-0.55 to 0.53)	1.13 (0.59–2.15)	0.710
No AF recurrence during FU									
Net adverse clinical event	109	8,150	1.38	86	2,910	2.81	-1.43 (-2.44 to -0.42)	0.65 (0.47–0.90)	0.010
Ischemic stroke	52	8,150	0.66	37	2,910	1.19	-0.53 (-1.19 to 0.13)	0.76 (0.47–1.24)	0.274
Major bleeding	61	8,150	0.77	50	2,910	1.66	-0.89 (-1.66 to -0.12)	0.58 (0.37–0.89)	0.013
Time-varying regression + additional censoring at AF recurrence									
Overall CHA₂DS₂-VASc≥2									
Net adverse clinical event	109	10,063	1.12	86	4,426	1.84	-0.72 (-1.42 to -0.03)	0.76 (0.56 – 1.04)	0.311
Ischemic stroke	52	10,063	0.54	37	4,426	0.78	-0.24 (-0.70 to 0.21)	0.90 (0.56 – 1.44)	0.658
Major bleeding	61	10,063	0.62	50	4,426	1.08	0.46 (-0.99 to 0.07)	0.68 (0.47 – 1.32)	0.070

*Weighted incidence rate (per 100 person-years) comparing non-OAC users to OAC users after overlap weighting was applied.

CI, confidence interval; HR, hazard ratio.

Cryo-balloon Pulmonary Vein Isolation Vs High-power, Short-duration Vs Conventional Radiofrequency Catheter Ablation of Atrial Fibrillation

Dr Hanjin Park¹, Prof Je-Wook Park¹, Prof Daehoon Kim¹, Prof Hee Tae Yu¹, Prof Tae-Hoon Kim¹, Prof Jae-Sun Uhm¹, Prof Boyoung Joung¹, Prof Moon-Hyoung Lee¹, Prof Hui-Nam Pak¹

¹*Yonsei University, College Of Medicine, Seoul, South Korea*

Objectives: We examined the comparative efficacy and safety of cryo-balloon pulmonary vein isolation (Cryo-PVI), high-power, short-duration (HPSD) radiofrequency catheter ablation (RFCA), and conventional RFCA in patients with atrial fibrillation (AF).

Methods: This propensity-score weighted study included 3,036 participants who underwent their first AF ablation without empirical left atrial (LA) ablation. We compared procedural factors, early and late recurrence rates, complication rates, and post-procedural heart rate variability (HRV) between the Cryo-PVI (n=527), HPSD-RFCA (n=653), and conventional RFCA (n=1,856).

Results: The procedural time was shortest in the Cryo-PVI (73min Cryo-PVI vs 110min HPSD vs 154min conventional RFCA, $p<0.001$), and the early recurrence was lowest in the HPSD-RFCA (26.3% HPSD-RFCA vs 30.4% Cryo-PVI vs 29.9% conventional RFCA, $p<0.001$). Major complication rate (Cryo-PVI 3.4% vs HPSD-RFCA 2.1% vs Conventional RFCA 2.5%, $p=0.203$) and late recurrence did not significantly differ (log-rank, $p=0.120$) between groups. In subgroup analysis, HPSD-RFCA revealed better rhythm outcome compared to conventional RFCA among those with low mean heart rate (<77 bpm, weighted hazard ratio [HR] 0.58, 95% CI 0.38-0.90, $p=0.027$), high rMSSD (≥ 26 , weighted HR 0.55, 95CI: 0.27-0.93, $p=0.027$), high LF component (≥ 13 , weighted HR 0.46, 95CI 0.24-0.89, $p=0.021$), and high LF/HF ratio (≥ 1.40 , adjusted HR 0.55, 95% CI 0.31-0.96, $p=0.037$).

Conclusion: Among participants underwent first AF ablation without empirical LA ablation, Cryo-PVI and HPSD-RFCA showed shorter procedure time with similar major complication rates and overall rhythm outcome compared to conventional RFCA. HPSD-RFCA showed the possibility for improved rhythm control compared to conventional RFCA in subgroups with high cardiac autonomic activity.

Lifetime Risk of Atrial Fibrillation According to Optimal, Borderline, or Elevated Levels of Risk Factors

Dr Hanjin Park¹, Prof Daehoon Kim¹, Dr Eunsun Jang¹, Prof Hee Tae Yu¹, Prof Tae-Hoon Kim¹, Prof Dong-min Kim², Prof Jung-Hoon Sung³, Prof Hui-Nam Pak¹, Prof Moon-Hyoung Lee¹, Prof Pil-Sung Yang³, Prof Boyoung Joung¹

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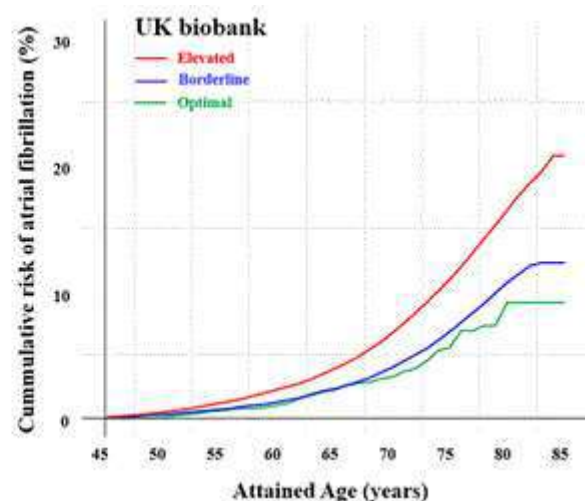
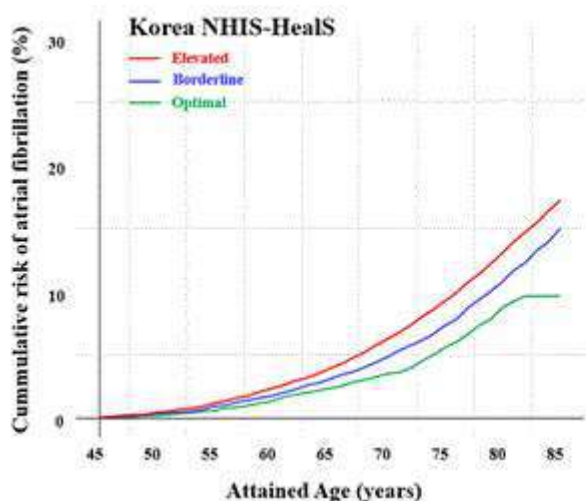
Objective: We aimed to examine the association between lifestyle risk factor burden and lifetime risk of AF using longitudinal data from Korea NHIS-Heals cohort and UK biobank.

Methods: A cluster of lifestyle risk factors including blood pressure, body mass index, smoking status, diabetes, alcohol consumption, and physical activity were assessed and classified as optimal, borderline, and elevated risk factor profiles. We estimated the lifetime risk of AF at index age 45 years to 85 years, accounting for the competing risk of death.

Results: There were 383,048 Korean and 292,499 UK white participants. The overall lifetime risk of AF in Korea and UK white were 16.5% vs 19.0%. Lifetime risk of AF among those with optimal risk factor in Korea and UK white were similar (UK white vs Korea; 9.1% vs 9.6%, $p=0.773$). However, the lifetime of AF in UK white individuals became greater than Korean individuals among those with any elevated risk factor profile (UK white vs Korea; 20.6% vs 17.1%, $p<0.001$). We found greater difference in lifetime risk of AF between Korea and UK white with increasing number of elevated risk factors (≥ 3 elevated risk factor; UK vs Korea, 27.2% vs 18.9%, $p<0.001$).

Conclusions: The overall higher lifetime risk of AF in UK white might be related with dramatic increased risk of incident AF in those with elevated risk factors compared to Korea. Our results potentially explain the observed higher incident AF in Western countries and emphasize on the importance of risk factor management for prevention of AF.

SUPPORTING DOCUMENTS



Efficacy and Safety Study of a Novel Three-dimensional-electrophysiological-imaging-and-navigation System to Guide Atrial Fibrillation Radiofrequency Ablation

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Objective

This study aimed to investigate the effectiveness and safety of the novel three-dimensional electrophysiological imaging and navigation system (KODEX-EPD™) to guide radiofrequency ablation of atrial fibrillation (AF).

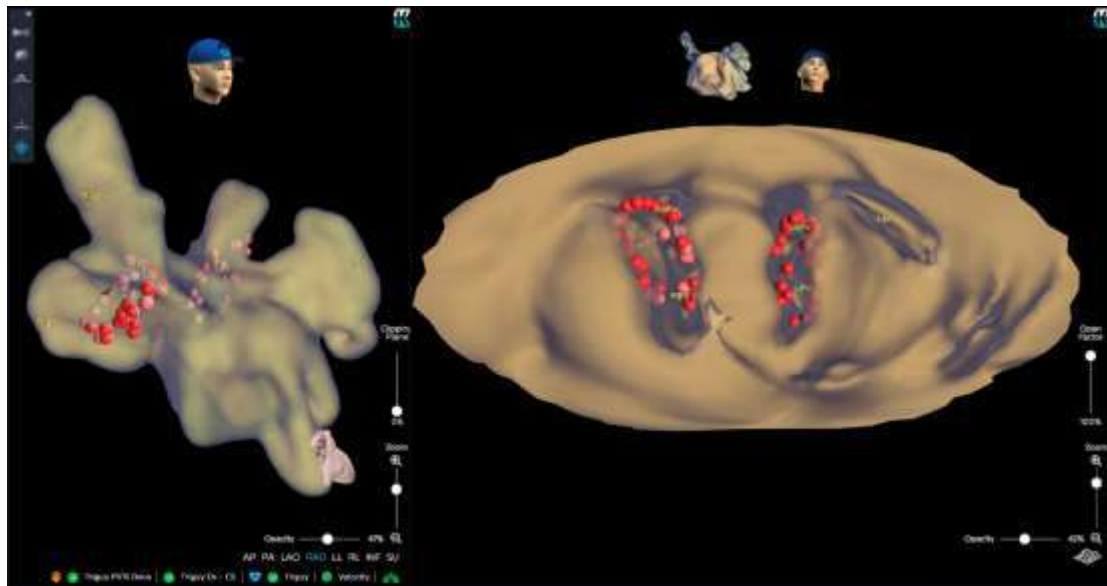
Methods

A total of 23 consecutive patients were enrolled at Fuwai Hospital, Chinese Academy of Medical Sciences, from Oct. 2020 to Jul. 2021 who underwent radiofrequency ablation of AF guided by the novel three-dimensional electrophysiological imaging and navigation system (KODEX-EPD™). The patients aged (58.3 ± 8.2) years, 17 of whom were male and 17 of whom were diagnosed with paroxysmal AF. The left atrial anteroposterior diameter was (41.3 ± 4.4) mm, and the left ventricular ejection fraction was 63.0 (56.0 ± 65.0) %. Pulmonary vein isolation was performed on all patients using the irrigated tip catheter without a contact force sensor. The acute pulmonary vein isolation rate, the duration of left atrial remodeling and ablation, complications, and follow-up results were analyzed retrospectively. Results All pulmonary veins of the 23 (100%, 23/23) patients were acutely isolated. The radiofrequency ablation time was (1823.4 ± 456.9) seconds. There were no steam pops, catheter retention, pericardial tamponade, atrioventricular esophageal fistula, or other complications perioperatively. At 12.2 (7.8, 13.0) months of follow-up, 16 patients had no recurrence of AF (69.6%, 16/23), and 17 (73.9%, 17/23) patients discontinued antiarrhythmic drugs as prescribed.

Conclusion

It is effective and safe to ablate AF using an irrigated tip radiofrequency catheter without a contact force sensor with the guidance of the novel three-dimensional electrophysiological imaging and navigation system (KODEX-EPD™).

SUPPORTING DOCUMENTS



Impact of Health Literacy and Its Interventions on Health Outcomes: a Systematic Review and Meta-Analysis OP-093-V-AF

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SUPPORTING DOCUMENTS

IMPACT OF HEALTH LITERACY AND ITS INTERVENTIONS ON HEALTH OUTCOMES: A SYSTEMATIC REVIEW AND META-ANALYSIS

LATHLEAN Timothy [1,2,3] ; KIEU Don [1] ; FRANKE Kyle [1] ; O'CALLAGHAN Nathan [2,3] ; BOYD Mark [1,2,4] ; **MAHAJAN Rajiv** [1,2,4].

1 – Adelaide Medical School, Faculty of Health and Medical Sciences, The University of Adelaide; 2 – South Australian Health and Medical Research Institute (SAHMRI), South Australia; 3 – The Commonwealth Science and Industrial Research Organisation (CSIRO), Precision Health. Adelaide, Australia; 4 – Lyell McEwin Hospital, Northern Adelaide Local Health Network, South Australia, Australia.

OBJECTIVES

To determine how the addition of health literacy interventions may generate additional benefits and impact quality of life and health outcomes for those with atrial fibrillation (AF)

MATERIALS AND METHODS

Searches were carried according to six databases (MEDLINE, EMBASE, Web of Science, CINAHL, Emcare, Cochrane library) alongside gray literature (Google Scholar). Studies were included if their evaluated interventions that improved any dimension, typology or aspect of health literacy. Citations were exported into Covidence for duplicate removal, and article screening. Extraction will occur using a standardised extraction tool and studies will be synthesised using best evidence synthesis. The Downs and Black's checklist will be used for risk of bias and assessment of overall quality of evidence will utilise the Grading of Recommendations, Assessment, Development, and Evaluation approach (GRADE).

RESULTS

A total of 2851 articles were identified for screening, with 59 were included for quality assessment according to the Downs and Black checklist. The majority of articles involved randomized controlled trials or pre-post studies. Health literacy interventions included brochures (n=3), web- (n=12), visual- (n=10), and smartphone-based (n=14), to group sessions (n=8) and specific integrated AF clinics (n=12). General themes from these articles involved mostly improvements in AF knowledge, adherence/activation, and quality of life/clinical outcomes.

CONCLUSION

This review extends the concept of precision health to also include health literacy interventions. Further research with aims to clarify the impact of specific modes of interventions will greatly assist in the application of health literacy interventions in conjunction with precision health in those with AF.

Clinical Outcome of Lesion Size Index-Guided High-Power Catheter Ablation in Patients with Atrial Fibrillation

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OBJECTIVES

Our study sought to assess the clinical efficacy of high-power (50W) ablation guided by lesion size index (LSI-guided HP) for pulmonary vein isolation (PVI) in atrial fibrillation (AF) patients and explore the potential predictors related to clinical outcome.

MATERIALS AND METHODS

We consecutively included 186 AF patients who received LSI-guided HP ablation for PVI at Fuwai hospital from June 2019 to October 2021. Baseline clinical characteristics, ablation data as well as long-term clinical outcome were evaluated.

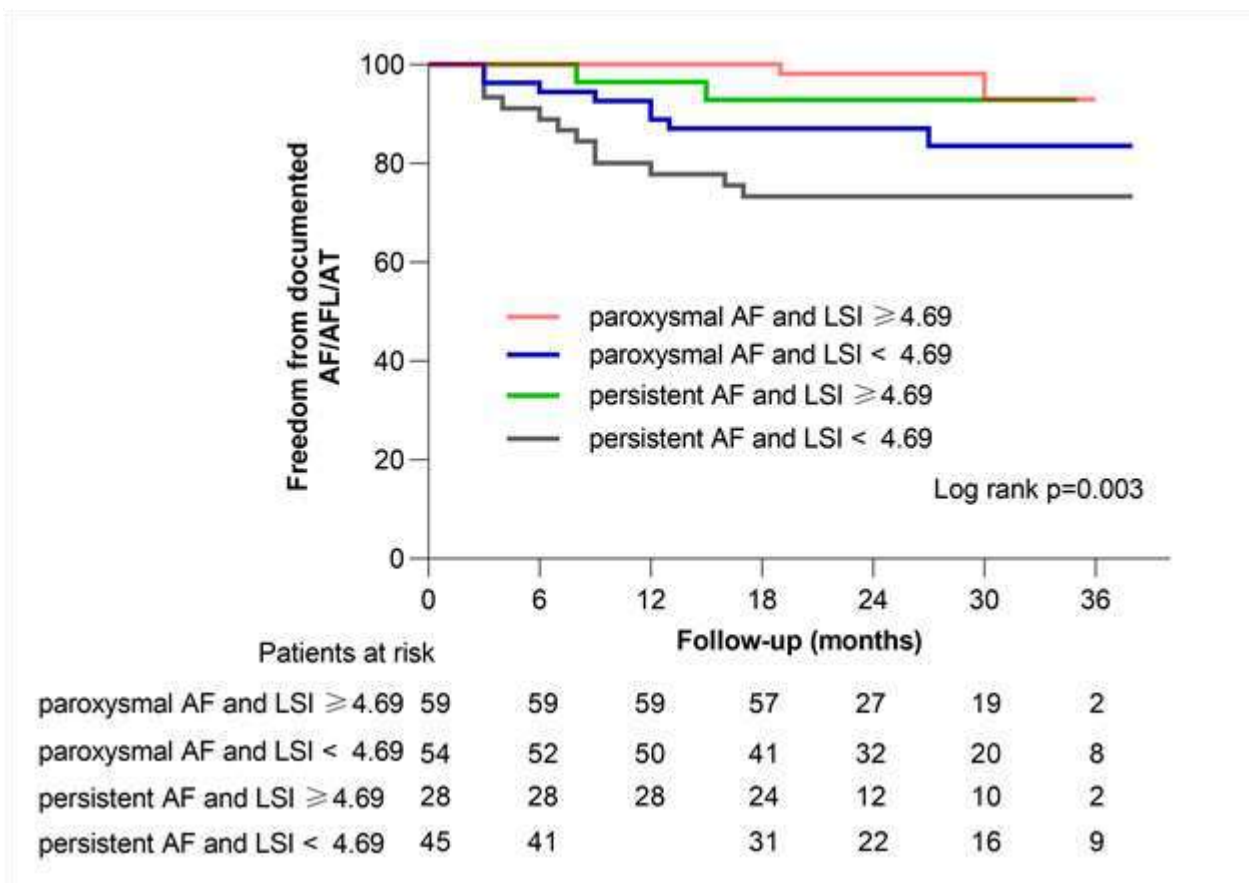
RESULTS

The incidence of overall first-pass PVI was 83.9% (156/186) and PVI was achieved in all patients. A total of 11883 lesions were analyzed, compared with ablation parameters of posterior walls, anterior walls had significantly lower contact force, longer ablation duration, larger Δ -Imp, longer ILD, higher LSI and FTI. The overall incidence of complications was 3.8%. During a mean follow-up of 24.0 ± 8.4 months, freedom from AF recurrence off AADs was 87.1%. After adjusting for known factors, LSI and paroxysmal AF were significantly associated with decreased AF recurrence. The best cut-off value of LSI for predicting AF recurrence was 4.69. Atrial arrhythmia-free survival was greatest (96.6%) among paroxysmal AF and LSI ≥ 4.69 subjects, intermediate in persistent AF and LSI ≥ 4.69 (92.9%) and paroxysmal AF and LSI < 4.69 (85.2%) patients, and worst (73.3%) in persistent AF and LSI < 4.69 patients.

CONCLUSION

LSI-guided HP ablation for PVI was efficient with relatively lower peri-procedure complications and favorable 2-year arrhythmia-free rate in AF patients. LSI ≥ 4.69 and paroxysmal AF are independently associated with decreased AF recurrence.

SUPPORTING DOCUMENTS



Iterative Computer Simulation Using Personalized-heart-models Based on LGE-MRI Enables Minimal Ablation for Non-paroxysmal Atrial Fibrillation

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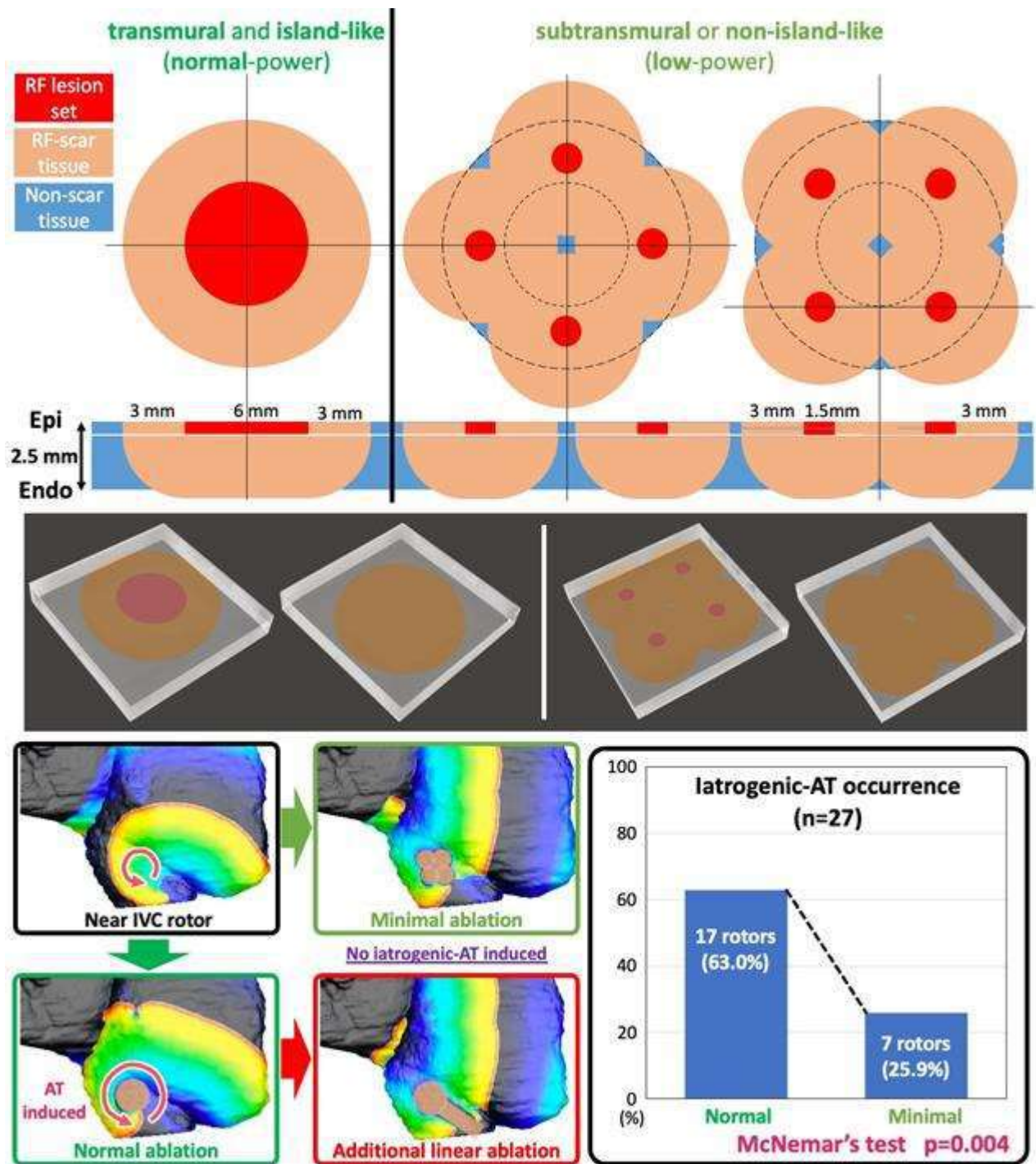
OBJECTIVES: Although pulmonary-vein-isolation (PVI) is often insufficient for termination of non-paroxysmal atrial fibrillation (Non-PAF), recently rotor modulation targeting AF drivers or substrates using LGE-MRI-based computer simulations has been described to improve a clinical outcome of Non-PAF ablation. However, how to create optimal ablation lesions is still not well established because of ablation-scar-related iatrogenic-atrial tachycardia (AT), often requiring additional linear-ablation. Our goal is to establish the optimal method for rotor modulation.

MATERIALS AND METHODS: Personalized computational modeling of AF ablation was performed in 12 Non-PAF patient models based on fibrosis data from LGE-MRI. All rotors induced after PVI were modulated with 1) substrate-elimination strategy mimicking normal-power ablation, creating transmural island-like lesions and 2) substrate-modification “trap” strategy, creating subtransmural or non-island-like lesions mimicking low-power minimal-ablation (figure). In each bi-atrial model, inducibility and the difference between the two strategies were investigated by burst pacing from the same 40 atrial sites in both strategies.

RESULTS: Nine patients had a total of 27 rotors after PVI. Ablations in both strategies were successful in rotor elimination. However, the incidence of iatrogenic-AT was significantly higher in normal-ablation than minimal-ablation (63% vs. 26%; $p=0.004$). All these iatrogenic-ATs were eliminated by adding linear-ablation connecting ablated lesion to non-conductive zone. Moreover, adding linear-ablation occasionally induced a new rotor or eliminated another rotor.

CONCLUSIONS: Minimal-ablation might be effective for both modifying rotor substrate and avoiding iatrogenic-AT. Iterative computer simulation of ablation leads the non-excessive optimal strategy by not only reducing unnecessary additional linear-ablation but achieving effective minimal-ablation.

SUPPORTING DOCUMENTS



Real-world Utilization of Non–vitamin K Antagonist Oral Anticoagulants in Asian Patients With Atrial Fibrillation

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¹*Daiichi Sankyo, Inc., Basking Ridge, United States of America*, ²*National Taiwan University, Taipei, Taiwan*

SUPPORTING DOCUMENTS

Objectives

This study examined the real-world utilization of non–vitamin K antagonist oral anticoagulants (NOACs) in Asian patients with atrial fibrillation (AF) to understand prescribing patterns of treatment for stroke prevention in clinical practice.

Materials and Methods

Using a large Taiwan national insurance database, adults with AF and ≥ 1 pharmacy claim for edoxaban, apixaban, rivaroxaban, or dabigatran between June 2012 and June 2019 were identified. The first NOAC pharmacy claim was designated the index claim. Baseline patient characteristics were input into multinomial logistic regression models to identify factors associated with different NOAC use; dabigatran was the reference treatment as it was the first approved NOAC.

Results

A total of 95,417 patients were eligible, including 10,087 edoxaban, 13,468 apixaban, 38,515 rivaroxaban, and 33,347 dabigatran-treated patients. Patients prescribed edoxaban or apixaban were more likely to be 85 years of age and older (OR [95% CI]: 1.20 [1.10–1.30] and 1.47 [1.37–1.59], respectively), have bleeding history or predisposition (OR [95% CI]: 1.22 [1.13–1.32] and 1.20 [1.12–1.28]), renal disease (OR [95% CI]: 1.59 [1.47–1.73] and 1.77 [1.65–1.90]), or diabetes with

chronic complications (OR [95% CI]: 1.23 [1.12–1.34] and 1.29 [1.19–1.39]) compared with patients prescribed dabigatran (**Table**).

Conclusion

In real-world practice, there are notable differences in prescribing patterns of NOACs for stroke prevention among patients with AF in Taiwan. These differences may affect the effectiveness and safety profile of NOACs, although further research on other Asian countries and clinical outcomes is needed.

Table. Determinants of NOAC use relative to dabigatran from multinomial logistic regression

	Edoxaban, OR (95% CI)		Apixaban, OR (95% CI)		Rivaroxaban, OR (95% CI)	
Age						
18–64	Reference		Reference		Reference	
65–74	0.87 [†]	(0.82–0.93)	0.95	(0.89–1.01)	0.91 [†]	(0.87–0.95)
75–79	0.79 [†]	(0.73–0.86)	0.92 [†]	(0.86–0.99)	0.90 [†]	(0.86–0.95)
80–84	0.81 [†]	(0.75–0.88)	1.06	(0.99–1.14)	0.96	(0.91–1.01)
≥85	1.20 [*]	(1.10–1.30)	1.47 [*]	(1.37–1.59)	1.19 [*]	(1.13–1.26)
Female	1.05	(1.00–1.10)	1.11 [*]	(1.06–1.16)	1.10 [*]	(1.06–1.13)
Selective key comorbidities						
Myocardial infarction	1.05	(0.86–1.28)	1.11	(0.94–1.32)	1.25 [*]	(1.11–1.42)
Congestive heart failure	0.87 [†]	(0.82–0.92)	0.94 [†]	(0.90–0.99)	1.04 [*]	(1.00–1.08)
Cerebral vascular disease	0.67 [†]	(0.61–0.74)	0.81 [†]	(0.74–0.88)	0.82 [†]	(0.77–0.87)
Dementia	1.07	(0.96–1.18)	1.09	(1.00–1.19)	1.08 [*]	(1.01–1.15)
Rheumatic disease	1.63 [*]	(1.44–1.84)	1.42 [*]	(1.27–1.59)	1.09	(1.00–1.20)
Peptic ulcer	0.82 [†]	(0.76–0.88)	0.88 [†]	(0.82–0.93)	0.97	(0.92–1.01)
Mild liver disease	1.12 [*]	(1.03–1.22)	1.05	(0.97–1.13)	1.04	(0.98–1.10)
Diabetes without chronic complication	0.88 [†]	(0.83–0.93)	0.95 [†]	(0.90–1.00)	0.95	(0.91–0.98)
Diabetes with chronic complication	1.23 [*]	(1.12–1.34)	1.29 [*]	(1.19–1.39)	1.05	(0.99–1.12)
Hemiplegia or paraplegia	0.78 [†]	(0.66–0.91)	0.93	(0.82–1.05)	1.01	(0.93–1.11)
Renal disease	1.59 [*]	(1.47–1.73)	1.77 [*]	(1.65–1.90)	1.29 [*]	(1.21–1.36)
Cancer	1.10 [*]	(1.01–1.21)	1.10 [*]	(1.02–1.19)	1.05	(0.99–1.12)
Severe liver disease	2.09 [*]	(1.30–3.35)	1.54	(0.97–2.43)	1.53 [*]	(1.06–2.21)
Metastatic cancer	1.17	(0.90–1.52)	1.17	(0.93–1.47)	1.22 [*]	(1.02–1.46)
Hypertension	0.92 [†]	(0.87–0.97)	0.98	(0.94–1.03)	0.98	(0.94–1.01)

Stroke/TIA	0.90	(0.81–1.00)	0.90 [†]	(0.82–0.98)	0.85 [†]	(0.79–0.90)
Bleeding history or predisposition	1.22*	(1.13–1.32)	1.20*	(1.12–1.28)	1.05	(0.99–1.10)

*Less likely with dabigatran; [†]More likely with dabigatran; CI, confidence interval; NOAC, non–vitamin K antagonist oral anticoagulant; OR, odds ratio; TIA, transient ischemic attack.

Electrophysiological Findings of Recurrent Tachyarrhythmias After Trans-thoracoscopic Left Atrial Appendage Excision Plus Atrial Fibrillation Ablation

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OBJECTIVES

This study aimed to describe the electrophysiological findings of recurrent atrial tachyarrhythmias (ATAs) after trans-thoracoscopic left atrial appendage excision (LAAE) plus atrial fibrillation (AF) ablation.

MATERIALS AND METHODS

This single-center prospective observational study enrolled non-valvular AF patients aged 18-80 years who underwent trans-thoracoscopic LAAE plus AF ablation, and received the re-do radiofrequency catheter ablation (RFCA) due to recurrence of ATAs.

RESULTS

Between 2014 and 2021, 22 patients (11 males, age 60±9 years) were included in the analysis. In 12 of them, reconnected conduction was identified along with the previous ablation lesions. Reconnection of right PV, left PV, and bilateral PVs was found in 1, 4, and 7 patients, respectively. In total, 27 PV gaps were identified. Eighteen PV gaps were located in the roof or at the bottom of the PV antrum. The residual PV gaps were eliminated with an additional ablation. Thirteen sustained ATs were mapped and ablated during the re-do procedure, including peri-mitral AT (n=7), cavotricuspid isthmus-dependent AT (n=3), the remnant LAA-related microreentrant AT (n=1), roof-dependent reentry AT (n=1) and focal AT (n=1). Two patients had non-PV triggers. All ATs were terminated by stepwise ablation.

CONCLUSION

After surgical AF ablation, reconnected PVs were common in patients with recurrent ATAs. The residual gaps were mainly located in the roof and at the bottom of PVs, which was difficult to be covered by bipolar ablation. Reentry was the main mechanism of ATs.

Pathological Characteristics of Thrombosis From Different

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OBJECTIVES

This study aimed to describe pathological characteristics of thrombosis from different origin and assess their clinical impact.

MATERIALS AND METHODS

Between July 2020 and January 2022, thrombi from intracranial large vessel, coronary artery, and chambers of the heart were prospectively collected and stained. The proportion of red blood cells (RBC), platelets (PLT), fibrin, white blood cells (WBC) in each thrombus was achieved using Orbit software. The modified Rankin scale score (mRS) at 90 days of patients with acute ischemic stroke (AIS) were recorded.

RESULTS

We collected 146 thrombi from intracranial artery, 12 from coronary artery and 9 from intracardiac chambers. Among 146 AIS patients, 38 had atherosclerotic occlusion (LAA), 83 had cardiogenic embolism (CE), and 25 had CS. Compared with CE, thrombi in LAA had a higher proportion of platelets ($22.7 \pm 13.7\%$ vs. $29.4 \pm 17.0\%$, $P=0.024$) and a lower proportion of red blood cells (RBC, $44.4 \pm 19.3\%$ vs. $32.4 \pm 22.0\%$, $P=0.003$). There was no significant correlation of component proportion in thrombosis between CS and CE or LAA. CE and intracardiac thrombi had similar proportion of each component and so as in LAA and coronary artery thrombi. The good functional outcome (mRS 0-2) was achieved in 45.8% patients with platelet-riched thrombosis, 40.7% patients with fibrin-riched thrombosis and 40.8% with RBC-riched thrombosis, respectively.

CONCLUSION

CE had a higher proportion of RBC, while LAA was rich in platelet. Different proportions of each component in thrombus may also have an impact on prognosis.

Risk Factors Associated With Major Gastrointestinal Bleeding in Patients With Atrial Fibrillation

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OBJECTIVES

This study aimed to determine risk factors associated with major gastrointestinal bleeding (MGIB) in patients with atrial fibrillation (AF).

MATERIALS AND METHODS

This was a single-center retrospective cross-sectional study. From January 2012 to March 2021, Hospitalized AF patients with GIB were identified via electronic medical records. The antithrombotic strategy that patients received preceding GIB included no antithrombotic treatment, and treatment with oral anticoagulants (OACs), platelet inhibitors, and combinations of antithrombotic medications. The primary outcome measure was MGIB, which was defined as a decrease in the hemoglobin level of ≥ 2 g/dl or transfusion of ≥ 2 units of packed red cells or causing death. Potential risk factors associated with MGIB were evaluated using multivariable regression analysis.

RESULTS

Of the 102 patients (mean age was 74.3 ± 11.1 years and 49.0% male), 13 (12.7%) were with valvular AF, and another 89 (87.3%) were with non-valvular AF (mean CHA₂DS₂-VASc score 3.5 ± 1.9 and mean HAS-BLED score 2.5 ± 1.2). Before GIB, 59 (57.8%) patients used OACs, 34 (33.0%) used platelet inhibitors, and 19 (18.6%) received no antithrombotic therapy. Endoscopic examination in 67 patients confirmed peptic ulcers in 22 patients, new-onset cancers in 8, and active cancers in 2. MGIB occurred in 61 (59.8%) patients. Peptic ulcer was significantly associated with MGIB (Odds ratio: 4.51, 95% CI 1.41-14.42, $p=0.007$).

CONCLUSION

Peptic ulcer and gastrointestinal cancer were commonly identified in AF patients with GIB. Peptic ulcer was significantly associated with MGIB. Further investigation is needed to confirm whether antithrombotic treatment could increase the MGIB.

The Abnormal Activation of Renin-angiotensin-aldosterone System in Patients With Idiopathic Atrial Fibrillation

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OBJECTIVES

To explore the relationship between RAAS and idiopathic atrial fibrillation (iAF).

MATERIALS AND METHODS

This single-center prospective observational study included patients with iAF. The subjects referred for catheter ablation (CA) due to PSVT during the same study period were served as controls with normal sinus rhythm (NSR). All participants aged 18-60 years had no conventional cardiovascular risk factors and comorbidities. Adrenal adenomas were ruled out using CT scan. Upright plasma aldosterone concentration (PAC), plasma renin activity (PRA), angiotensin I and II concentrations were measured. ARR was the aldosterone-renin ratio. All patients with iAF underwent CA. The primary outcome was the difference in RAAS activation between the two groups. The secondary outcome was the 6-month recurrence of AF.

RESULTS

Totally, 56 patients with iAF and 97 with NSR were included. Patients with iAF were older (48.0 ± 8.2 y vs. 39.0 ± 11.5 y, $P < 0.001$) and more likely to be male (76.8% vs. 46.4%, $P < 0.001$) than controls. Patients with iAF had lower level of PRA ($3.1 \mu\text{g/L}\cdot\text{h}$ vs. $5.3 \mu\text{g/L}\cdot\text{h}$, $P = 0.034$) and angiotensin I ($0.5 \mu\text{g/L}$ vs. $0.9 \mu\text{g/L}$, $P = 0.048$), and higher ARR (3.7 vs. 2.5 , $P = 0.026$). Differences in PAC and angiotensin II levels between the two groups were not significant. After adjusting for gender and age, logistic regression analysis showed that $\text{PRA} < 1 \mu\text{g/L}\cdot\text{h}$ was associated with iAF (OR=0.23, 95% CI: 0.07-0.75, $P = 0.015$). Baseline ARR was non-significantly higher in 11 patients with recurrent AF.

CONCLUSION

Concealed activation of RAAS might be associated with iAF. Further research is needed to confirm this observation.

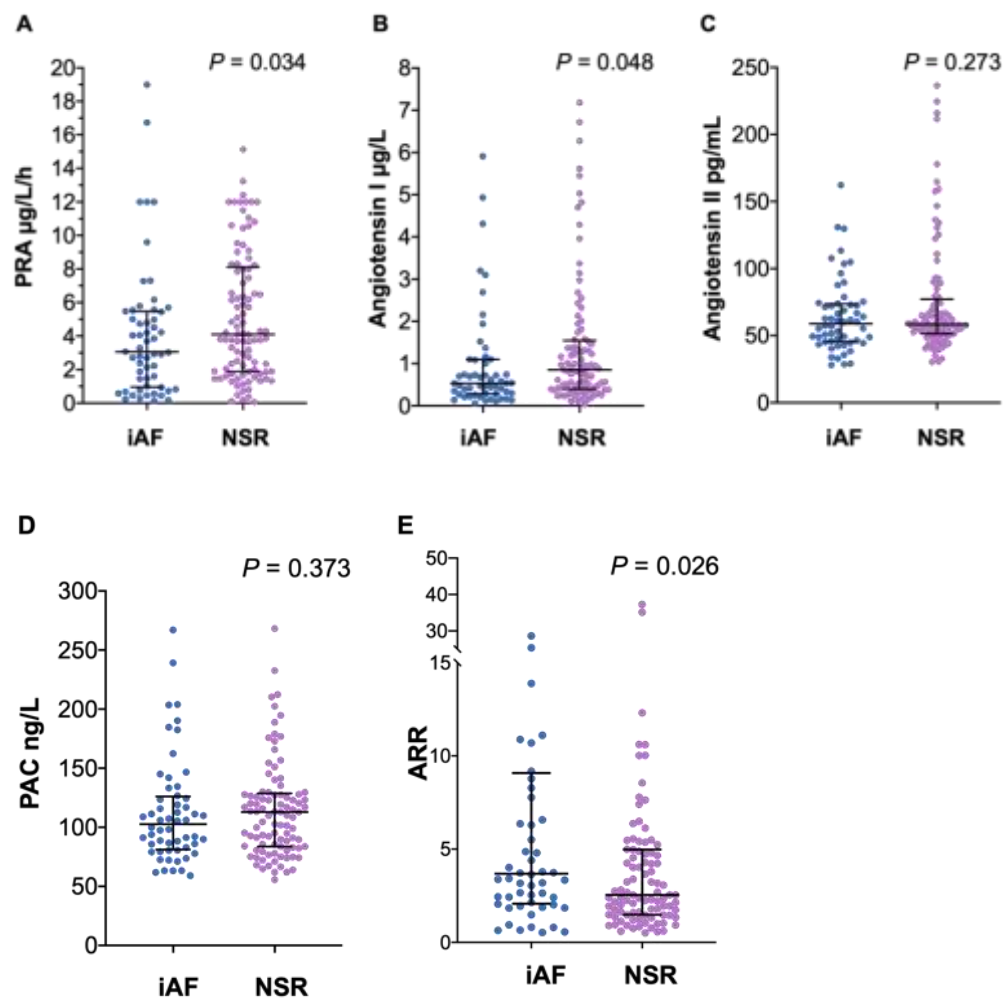
SUPPORTING DOCUMENTS

Table Baseline characteristics between patients with iAF and NSR. *Normally distributed continuous variables are expressed as mean $\pm$ standard deviation. Nonnormally distributed continuous variables are expressed as medians (interquartile range); †Categorical variables are expressed as n (%). Abbreviations, iAF, idiopathic atrial fibrillation; NSR, normal sinus rhythm; PRA, plasma renin activity; PAC, plasma aldosterone concentration; ARR,

aldosterone-renin ratio; LAD, left atrial diameter; LVDd, left ventricular diastolic diameter; LVEF, left ventricular ejection fraction.

	iAF (n = 56)	NSR (n = 97)	P 值
Age, years*	48.0 ± 8.2	39.0 ± 11.5	< 0.001
Male, n (%) †	43 (76.8)	45 (46.4)	< 0.001
Current drinker, n (%) †	0 (0.0)	0 (0.0)	NA
PRA, µg/L·h*	3.1 (1.0, 5.5)	5.3 (1.9, 8.1)	0.034
PRA<1µg/L·h, n (%)	15 (26.8)	7 (7.2)	0.001
Angiotensin I, µg/L*	0.5 (0.3, 1.1)	0.9 (0.4, 1.5)	0.048
Angiotensin II, pg/ml*	58.8 (45.4, 73.5)	58.3 (51.5, 77.1)	0.273
PAC, µg/L*	102.6 (81.1, 126.1)	112.9 (83.7, 128.8)	0.373
ARR*	3.7 (2.1, 9.1)	2.5 (1.5, 5.0)	0.026
ARR>30, n (%) †	3 (5.4)	5 (5.2)	0.957
ARR>10, n (%) †	13 (23.2)	10 (10.3)	0.031
Serum potassium, mmol/L*	4.1 ± 0.3	4.1 ± 0.3	0.292
LAD, mm*	37.2 ± 5.2	31.3 ± 4.0	0.021
LVDd, mm*	47.7 ± 3.5	45.7 ± 3.7	0.599
LVEF, %*	63.0 ± 3.4	64.3 ± 2.1	0.162

Figure The difference in RAAS activation between patients with iAF and NSR.



USE OF ORAL ANTICOAGULANTS BEFORE THE FIRST THROMBOEMBOLIC EVENT IN PATIENTS WITH ATRIAL FIBRILLATION

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OBJECTIVES

This study aimed to investigate the status of anticoagulant use in patients with atrial fibrillation (AF).

MATERIALS AND METHODS

This single-center cross-sectional study consecutively enrolled patients with non-valvular AF and a history of thromboembolism from January 2017 to September 2021. A questionnaire survey of the patients/their family members was conducted to record data including clinical characteristics, the awareness of AF diagnosis, use of oral anticoagulants (OAC) before first-ever thromboembolic event, and reasons for not/discontinuation of using OACs. The index date was defined as the date of first-ever thromboembolic event.

RESULTS

A total of 752 patients (mean age was 67.8±10.6 years and 36.0% male) were enrolled in this study. Based on the awareness of the AF diagnosis before the index date, patients were divided into Group A (n=443) with the awareness and Group B (n=309) without the awareness. Among 402 patients at high stroke risk before their index date in Group A, 24.6% (99/402) of them had ever been treated with OACs. Of them, 43 had already discontinued OAC mainly due to minor bleeding. The majority of patients who were continuously anticoagulated only received the inappropriate treatment of OACs. In group A, 75.4% (303/402) patients at high stroke risk never received anticoagulant therapy. The main reason was that patients was never informed that AF increased the risk of stroke.

CONCLUSION

Non-valvular AF at high stroke risk was still undertreated with OACs. Measures should be taken for patients and doctors to increase the awareness of AF and AF-related risk of stroke.

Regional Voltage and Left Atrial Wall Thickness of Extra-pulmonary Vein Triggers in Left Atrium

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OBJECTIVES:

The mechanism of extra-pulmonary vein trigger (ExPVT) is not clearly defined. We investigated whether the voltage and left atrial wall thickness (LAWT) of each region of left atrium (LA) is associated with ExPVT.

MATERIALS AND METHODS:

We included 1,696 patients who underwent de novo catheter ablation, isoproterenol provocation, LA voltage mapping during procedure and protocol-based rhythm follow-up. ExPVT was observed in 181 patients (10.7%; 60 LA, 99 RA, 15 biatrial, and 7 unmappable). Among 75 patients who showed ExPVT[LA] and ExPVT[Biatrial], 62 patients had LA voltage data and bipolar, unipolar LA voltage, LAWT were compared by the presence of ExPVT in each LA region.

RESULTS:

The existence of ExPVT was independently associated with low LA voltage (OR 0.68 [0.47-0.98], $p=0.0399$). The existence of ExPVT showed significantly higher AF recurrence than their counterpart (HR 1.87 [1.48-2.37], $p<0.001$, Log-rank $p<0.001$). The presence of ExPVT did not show any statistical significance in terms of bipolar, unipolar LA voltage in any of the total 9 LA regions (septum, posterior-inferior, LA appendage, peri-mitral, veno-atrial, anterior, right LA roof, left LA roof, septum plus posterior-inferior plus anterior), nor in terms of LAWT in total 6 regions (anterior, LA appendage, posterior, posterior-inferior, LLI, septum).

CONCLUSION:

The presence of ExPVT was associated with low LA voltage and poor rhythm outcome after AFCA, but LA voltage and LAWT did not show any regional difference in LA, respectively.

SUPPORTING DOCUMENTS

Figure 1. Comparison of Bipolar LA Voltage by the existence of ExPVT in each LA region

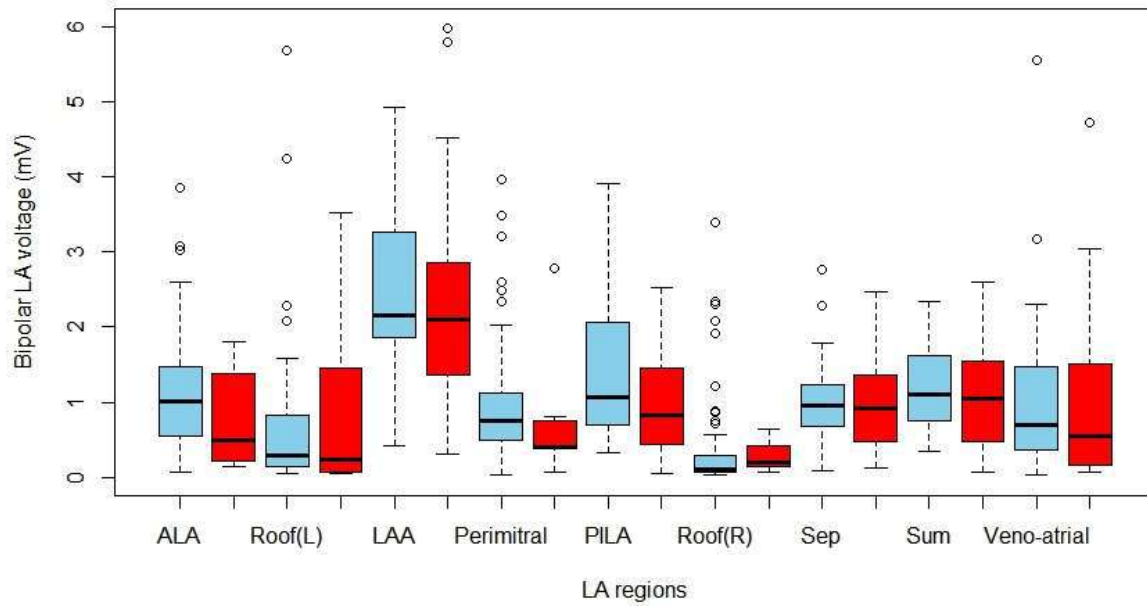


Figure 1. Comparison of Unipolar LA Voltage by the existence of ExPVT in each LA region

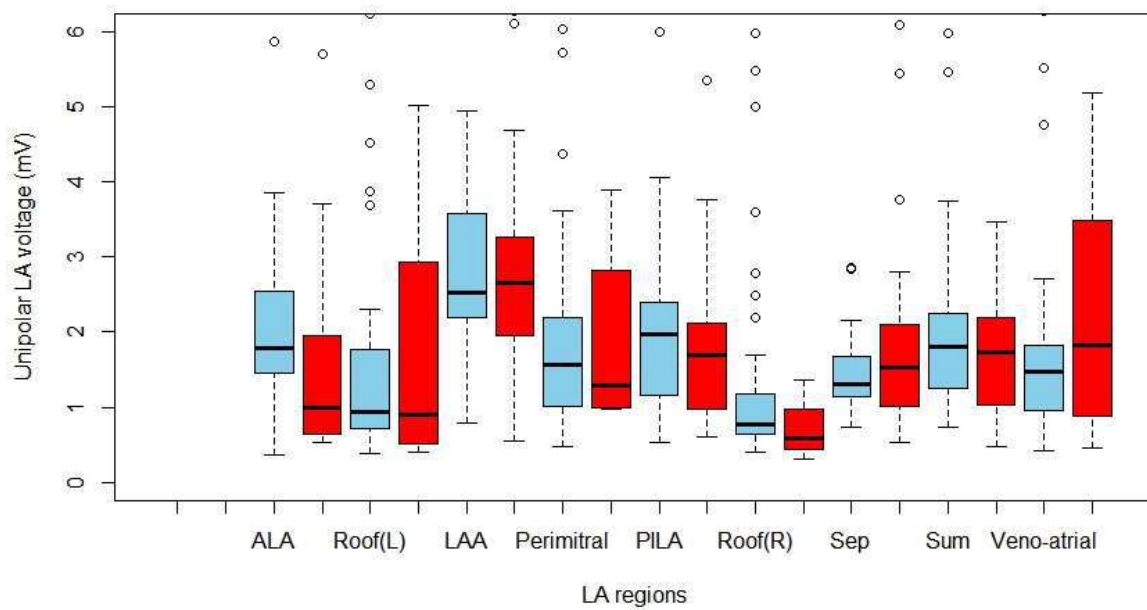


Figure 3. Comparison of LA wall thickness by the existence of ExPVT in each LA region

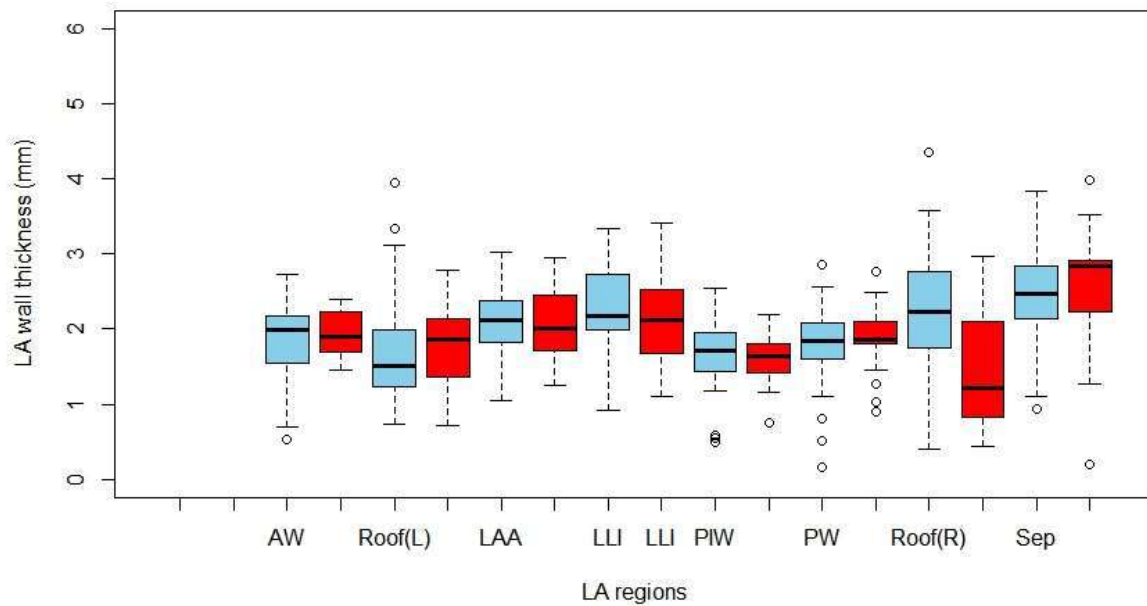


Table 1. Baseline clinical and echocardiographic characteristics of patients who underwent AFCA with isoproterenol provocation, left atrial (LA) voltage mapping (Vm), and protocol-based rhythm follow-up.

	Overall (n=1,696)	No-ExPVT (n=1,515)	ExPVT (n=181)	p-value
Age, (years)	60.0 [52.0;67.0]	60.0 [52.0;67.0]	62.0 [55.0;68.0]	0.016
Male, n (%)	1222 (72.1)	1111 (73.3)	111 (61.3)	0.001
Paroxymal Atrial Fibrillation, n (%)	1091 (64.7)	980 (65.0)	111 (62.0)	0.474
Comorbidities, n (%)				
Heart failure	236 (13.9)	209 (13.8)	27 (14.9)	0.765
Hypertension	768 (45.3)	683 (45.1)	85 (47.0)	0.688
Diabetes mellitus	267 (15.74)	237 (15.62)	30 (16.6)	0.828
Stroke	202 (11.9)	182 (12.07)	20 (11.0)	0.797
CHA ₂ DS ₂ -VASc score	1.0 [1.0;3.0]	1.0 [1.0;3.0]	2.0 [1.0;3.0]	0.189
Echocardiography				
LA dimension, mm (n=1,696)	41.0 [37.0;46.0]	41.0 [37.0;46.0]	41.0 [37.0;45.0]	0.736
LA volume index, ml/m² (n=1,696)	35.3 [28.3;44.6]	35.0 [28.2;44.1]	39.2 [29.7;48.3]	0.001
LV ejection fraction, % (n=1,696)	64.0 [59.0;68.0]	64.0 [59.0;68.0]	64.0 [59.0;67.0]	0.742
EEm (n=1,696)	9.1 [7.6;12.0]	9.0 [7.4;12.0]	9.4 [8.0;12.0]	0.126

LV mass index, g/ m ² (n=1,696)	91.5 [79.4;104.2]	91.5 [79.4;104.3]	92.3 [79.4;104.0]	0.430
Pericardial fat volumes (n=1,696)	102.6 [71.5;143.9]	103.5 [72.0;146.2]	94.0 [65.6;134.1]	0.052
LA voltage	1.4 [1.0;1.9]	1.5 [1.0;2.0]	1.3 [0.8;1.7]	0.001
LA pressure				
Peak pressure, AF (n=1,696)	22.0 [17.0;28.0]	22.0 [17.0;28.0]	22.0 [16.0;28.0]	0.902
Mean pressure, AF (n=1,696)	12.0 [9.0;16.0]	12.0 [9.0;16.0]	12.0 [8.0;16.0]	0.529
Peak pressure, SR (n=1,696)	21.0 [15.0;28.0]	21.0 [15.0;27.0]	21.0 [16.0;29.0]	0.192
Mean pressure, SR (n=1,696)	12.0 [8.0;16.0]	11.0 [8.0;16.0]	12.0 [8.0;17.0]	0.295
RVSP	26.0 [22.0;30.0]	26.0 [22.0;30.0]	26.0 [23.0;30.0]	0.158

ExPVT, extra pulmonary vein trigger; LA, left atrium; LV, left ventricle; Eem, ratio of the early diastolic mitral inflow velocity (E) to the early diastolic mitral annular velocity (Em); AF, atrial fibrillation; SR, sinus rhythm; RVSP, right ventricle systolic pressure

Table 2. Univariate and multivariate analysis of predictors for the existence of ExPVT

	Univariate		Multivariable	
	OR (95% CI)	p value	OR (95% CI)	p value
Age, (years)	1.02 (1.00-1.03)	0.0109	1.01 (0.99-1.03)	0.4146
Male, n (%)	0.58 (0.42-0.79)	<0.0001	0.75 (0.47-1.20)	0.2288
Paroxymal Atrial Fibrillation, n (%)	0.88 (0.64-1.21)	0.4245		
Comorbidities, n (%)				
Heart failure	1.10 (0.71-1.69)	0.6803		
Hypertension	1.08 (0.79-1.47)	0.6313		
Diabetes mellitus	1.07 (0.71-1.62)	0.7452		
Stroke	0.91 (0.56-1.48)	0.7053		
CHA ₂ DS ₂ -VASc score	1.06 (0.97-1.17)	0.2032		
Echocardiography				
LA dimension, mm	1.00 (0.97-1.02)	0.7055		
LA volume index, ml/m ²	1.02 (1.01 -1.03)	0.0025		
LV ejection fraction, %	1.00 (0.98-1.02)	0.6923		
EEm	1.03 (0.99-1.06)	0.1505		
LV mass index, g/m ²	1.00 (1.00-1.01)	0.4001		
Pericardial fat volumes	1.00 (0.99-1.00)	0.0438	1.00 (0.99-1.00)	0.1796
LA voltage	0.70 (0.55-0.88)	0.0027	0.68 (0.47-0.98)	0.0399
LA pressure				
Peak pressure, AF	1.00 (0.98-1.02)	0.8003		
Mean pressure, AF	0.99 (0.96-1.02)	0.5352		
Peak pressure, SR	1.01 (1.00-1.03)	0.1582		
Mean pressure, SR	1.01 (0.98-1.03)	0.5014		

RVSP	1.01 (0.99-1.03)	0.4605		
HRV (post-AFCA 3 mo)				
LF	1.01 (1.00-1.02)	0.1340		
HF	1.03 (1.00-1.05)	0.0211	1.02 (0.99-1.04)	0.1914
LF/HF	0.91 (0.62-1.35)	0.6512		

ExPVT, extra pulmonary vein trigger; LA, left atrium; LV, left ventricle; Eem, ratio of the early diastolic mitral inflow velocity (E) to the early diastolic mitral annular velocity (Em); AF, atrial fibrillation; RVSP, right ventricle systolic pressure; HRV, heart rate variabilities; LF, low frequency component; HF, high frequency component

Table 3. Clinical rhythm outcome comparison between no ExPVT and ExPVT group

	Overall (n=1,696)	No-ExPVT (n=1,515)	ExPVT (n=181)	p-value
Follow-up duration, mo	42.0 [21.0;78.0]	43.0 [21.0;80.0]	32.0 [17.5;54.0]	0.001
AAD use				
AADs use at discharge, n (%)	325 (19.2)	247 (16.3)	78 (43.1)	<0.001
AADs after 3 mo, n (%)	535 (32.8)	427 (29.3)	108 (61.0)	<0.001
AADs at the final follow-up, n (%)	486 (29.3)	403 (27.2)	83 (46.1)	<0.001
Early recurrence, n (%)	470 (28.3)	375 (25.3)	95 (52.8)	<0.001
Recurrence type, AF; n (% in early recur)	284 (60.4)	218 (58.0)	66 (69.5)	0.054
Recurrence type, AT; n (% in early recur)	187 (39.8)	158 (42.0)	29 (30.5)	0.054
Clinical recurrence, n (%)	562 (33.8)	479 (32.3)	83 (46.1)	<0.001
Recurrence type, AF; n (% in recur)	385 (68.5)	332 (69.3)	53 (63.9)	0.390
Recurrence type, AT; n (% in recur)	177 (31.5)	147 (30.7)	30 (36.1)	0.390
Cardioversion, n (% in recur/% overall)	226 (40.2/13.6)	187 (39.0/12.6)	39 (47.0/21.7)	0.001
HRV (post-AFCA 3 mo)				
Mean heart rate, bpm	74.0 [66.0;81.0]	74.0 [67.0;82.0]	70.0 [63.0;80.0]	0.001
HF	5.2 [3.7;8.3]	5.1 [3.7;8.1]	6.1 [4.1;11.1]	0.015
rMSSD	15.0 [11.0;23.0]	14.0 [11.0;23.0]	17.0 [11.0;34.0]	0.010
LF	5.5 [3.3;9.9]	5.4 [3.3;9.7]	6.5 [3.6;11.6]	0.037
LF/HF	1.0 [0.8;1.4]	1.0 [0.7;1.4]	1.0 [0.8;1.3]	0.917

ExPVT, extra pulmonary vein trigger; atrial fibrillation; AAD, antiarrhythmic drug; AF, atrial fibrillation; AFCA, atrial fibrillation catheter ablation; AT, atrial tachycardia; HF, high-frequency

component; HRV, heart rate variabilities; rMSSD, root-mean-square of differences between successive NN intervals; LF, low-frequency component.

Table 4. Comparison of baseline clinical and echocardiographic characteristics of ExPVT_[LA], ExPVT_[RA], and ExPVT_[Biatrial] groups.

	LA (n=60)	RA (n=99)	Biatrial (n=15)	p value
Age, (years)	62.6 ± 9.3	60.4 ± 10.4	60.5 ± 11.2	0.398
Male, n (%)	41 (68.3)	58 (58.6)	9 (60.0)	0.464
Paroxymal Atrial Fibrillation, n (%)	34 (56.7)	63 (64.9)	9 (60.0)	0.579
Comorbidities, n (%)				
Heart failure	10 (16.7)	14 (14.1)	3 (20.0)	0.805
Hypertension	31 (51.7)	50 (50.5)	2 (13.3)	0.020
Diabetes mellitus	18 (30.0)	7 (7.1)	3 (20.0)	0.001
Stroke	6 (10.0)	14 (14.1)	0 (0.0)	0.251
CHA ₂ DS ₂ -VASc score	2.0 [1.0; 3.0]	2.0 [1.0; 3.0]	1.0 [1.0; 2.0]	0.472
Echocardiography				
LA dimension, mm (n=1,575)	41.7 ± 7.1	41.5 ± 5.9	40.8 ± 7.0	0.893
LA volume index, ml/m ² (n=1,575)	37.2 [28.8;47.1]	39.7 [31.6;49.0]	39.9 [34.0;48.0]	0.805
LV ejection fraction, % (n=1,575)	63.0 [58.0;67.0]	64.0 [58.5;67.0]	66.0 [63.5;69.5]	0.095
EEm (n=1,575)	9.3 [8.1;12.0]	9.9 [8.0;13.0]	9.4 [8.2;11.7]	0.907
LV mass index, g/m ² (n=1,575)	93.2 [81.1;107.8]	93.3 [78.6;103.3]	88.9 [70.2;102.8]	0.537
Pericardial fat volumes (n=1,575)	100.8 [61.6;140.0]	93.0 [67.6;129.3]	95.5 [73.7;124.8]	0.756
LA voltage	1.4 [0.8; 1.9]	1.3 [0.8; 1.7]	1.0 [0.8; 1.2]	0.153
LA pressure				
Peak pressure, AF	25.0 [20.0;33.0]	20.0 [14.0;26.5]	22.0 [17.5;26.5]	0.005
Mean pressure, AF	14.0 [11.0;17.0]	10.5 [7.5;14.5]	12.0 [10.5;17.0]	0.020
Peak pressure, SR	26.5 [18.0;33.5]	19.0 [15.0;26.0]	22.0 [20.0;30.0]	0.001
Mean pressure, SR	14.0 ± 6.4	11.1 ± 5.6	14.9 ± 5.9	0.004
RVSP	28.0 [23.0;31.5]	26.0 [23.0;29.0]	25.5 [21.0;35.0]	0.385

ExPVT, extra pulmonary vein trigger; LA, left atrium; LV, left ventricle; Eem, ratio of the early diastolic mitral inflow velocity (E) to the early diastolic mitral annular velocity (Em); AF, atrial fibrillation; SR, sinus rhythm; RVSP, right ventricle systolic pressure

Table 5-1. Comparison of bipolar LA voltage of LA sections by the presence of ExPVT

	ExPVT (mV)	No ExPVT (mV)	p-value
Septum (n=62)	0.9 [0.5;1.4] (n=29)	1) [0.7;1.2] (n=33)	0.769
Posterior-inferior LA (n=62)	0.8 [0.4;1.5] (n=18)	1.1 [0.7;2.1] (n=44)	0.116
LA appendage (n=60)	2.1 [1.4;2.9] (n=34)	2.1 [1.9;3.3] (n=26)	0.519
Peri-mitral area (n=62)	0.4 [0.4;0.8] (n=7)	0.8 [0.5;1.1] (n=55)	0.306
Veno-atrial (n=62)	0.6 [0.2;1.5] (n=17)	0.7 [0.4;1.5] (n=45)	0.819
Anterior LA (n=62)	0.5 [0.2;1.4] (n=14)	1.0 [0.6;1.5] (n=48)	0.070
LA Roof, right (n=62)	0.2 [0.1;0.4] (n=3)	0.1 [0.1;0.3] (n=59)	0.555
LA Roof, left (n=62)	0.2 [0.1;1.4] (n=10)	0.3 [0.1;0.8] (n=52)	0.626
Septum, Posterior-inferior LA, Anterior LA (n=62)	1.1 [0.5;1.6] (n=44)	1.1 [0.8;1.6] (n=18)	0.385

Table 5-2 Comparison of unipolar LA voltage of LA sections by the presence of ExPVT

	ExPVT (mV)	No ExPVT (mV)	p-value
Septum (n=51)	1.5 [1.0;2.1] (n=28)	1.3 [1.1;1.7] (n=23)	0.646
Posterior-inferior LA (n=51)	1.7 [1.0;2.1] (n=14)	2.0 [1.2;2.4] (n=37)	0.493
LA appendage (n=51)	2.7 [2.0;3.3] (n=31)	2.5 [2.2;3.6] (n=19)	0.843
Peri-mitral area (n=51)	1.3 [1.0;2.8] (n=6)	1.6 [1.0;2.2] (n=45)	0.804
Veno-atrial (n=51)	1.8 [0.9;3.5] (n=14)	1.5 [1.0;1.8] (n=37)	0.409
Anterior LA (n=51)	1.0 [0.6;2.0] (n=14)	1.8 [1.5;2.5] (n=37)	0.061
LA Roof, right (n=51)	0.6 [0.4;1.0] (n=3)	0.8 [0.6;1.2] (n=48)	0.368
LA Roof, left (n=51)	0.9 [0.5;2.9] (n=10)	0.9 [0.7;1.8] (n=41)	0.898
Septum, Posterior-inferior LA, Anterior LA (n=51)	1.7 [1.0;2.2] (n=26)	1.8 [1.2;2.2] (n=25)	0.510

Table 5-3. Comparison of LA wall thickness of LA sections by the presence of ExPVT

	ExPVT (mm)	No ExPVT (mm)	p-value
Anterior wall (n=62)	1.9 [1.7;2.2] (n=14)	2.0 [1.5;2.2] (n=48)	0.926
LA appendage (n=60)	2.1 ± 0.4 (n=34)	2.1 ± 0.5 (n=26)	0.667
Posterior wall (n=62)	1.9 [1.8;2.1] (n=17)	1.8 [1.6;2.1] (n=45)	0.636
Posterior-inferior wall (n=62)	1.6 [1.4;1.8] (n=18)	1.7 [1.4;2.0] (n=44)	0.566
LLI (n=62)	2.1 ± 0.5 (n=35)	2.3 ± 0.5 (n=26)	0.265
Septum (n=62)	2.8 [2.2;2.9] (n=29)	2.5 [2.1;2.8] (n=33)	0.129

New Mini-pigs Atrial Fibrillation Model With Endocardial Approach by CRT Bi-electrode Atrial Pacing

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OBJECTIVES

To evaluate the model of atrial fibrillation (AF) in mini-pigs with endocardial approach implantation of CRTp using bi-electrodes pacing through RV/LV connectors. However the existing method using epicardial stimulation needs open heart surgery and a long recovery of the animals.

MATERIALS AND METHODS

All surgical interventions were mini-invasive and were conducted under general anesthesia. CRTp was implanted endocardial using X-ray. First electrode was fixed in the right atrial appendage. The second one - in the interatrial septum. Both of them were connected with CRTp through RV/LV. Bi-electrode atrial stimulation was realized during a week with a basic pace of 150 bpm and a delay between electrodes of 80 ms (mean 450 bpm), which corresponds to the heart rate (HR) of AF. Electrophysiological study was performed during the experiment to analyzed the cardiac conduction system. AF inducibility was evaluated before and after stimulation.

RESULTS

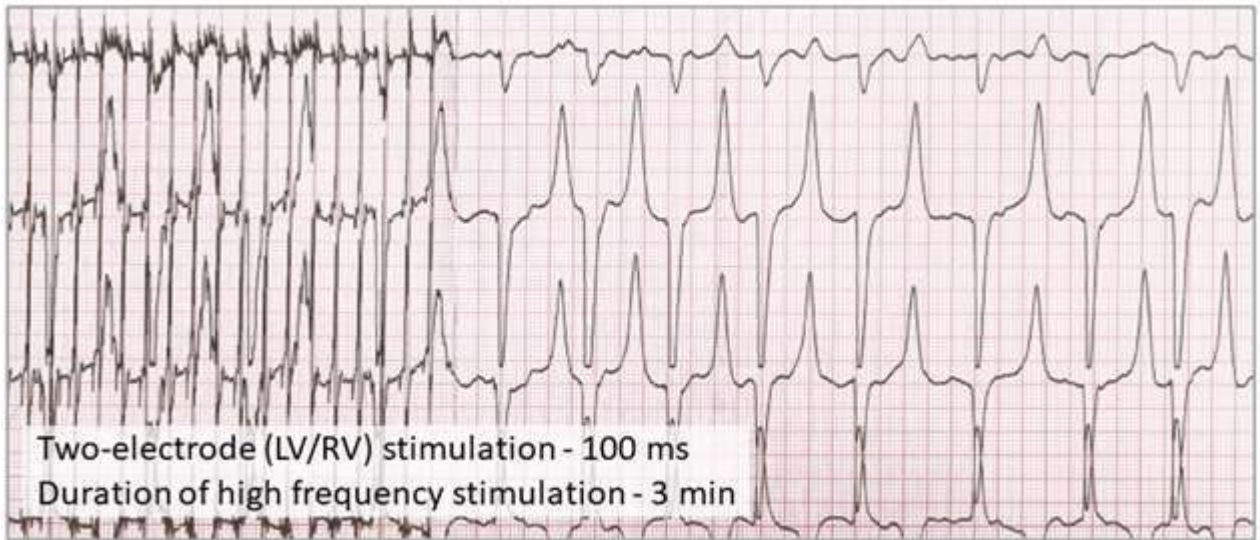
A series of experiments demonstrated that there were no complications. One of three pigs was able to induce a non-sustained paroxysm of AF before permanent pacing. After pacing we noted a tendency to increase the baseline HR (average frequency from 94±8 to 98±8 bpm). Non-sustained paroxysm of AF were able to induce in all cases. The sustained AF with 92 min burden were induced in one pig.

CONCLUSION

Endocardial bi-electrode pacing of the atria in mini-pigs has proven to be safe. The above AF model increases AF inducibility. The proposed model can be considered as an alternative to epicardial stimulation.

RSF № 22-25-00672

SUPPORTING DOCUMENTS



Benefit From Additional Substrate Modification in Older Female Patients With Paroxysmal Atrial Fibrillation

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Abstract submitted under supporting document.

SUPPORTING DOCUMENTS

OBJECTIVES:

Female gender has long been recognized to present a higher burden of low-voltage area (LVA), and tend to have an increased recurrence rate than male after circumferential pulmonary vein isolation (CPVI). However, benefit from additional LVA modification in female patients with atrial fibrillation remains unknown. This report describes outcomes according to sex at entry STABLE-SR-III trial.

METHODS:

Patients aged 65-80 years were randomly assigned to either CPVI plus LVA modification during sinus rhythm (STABLE-SR) group or “golden-standard” CPVI alone group. The primary outcome was freedom from atrial arrhythmias lasting for ≥ 30 s after a single ablation procedure.

RESULTS:

Of 414 patients included in the STABLE-SR-III, 204 (49.3%) were female, mean age was 70.5 ± 4.7 years. Females demonstrated significant higher LVA prevalence (51.5% vs. 32.9%, $P=0.000$) and burden [5.6% (2.6-11.3) vs. 2.6% (1.7-5.0), $P=0.000$] than males. Female sex, age and large left atrial diameter were independent predictors of LVA. For the primary outcome, additional LVA ablation was associated with a 62% reduction in atrial arrhythmias recurrence for females (adjusted hazard ratio 0.38; 95% CI 0.19-0.76). Females with LVA who received CPVI alone had significantly

higher recurrence rate than those females without LVA (HR 2.31 [95% CI, 1.17-4.59], $P=0.019$) and those females with LVA receiving substrate modification (HR 3.88 [95% CI, 1.77-8.50], $P=0.003$).

CONCLUSIONS:

Female sex was found to have a higher LVA prevalence, LVA burden, and greater benefit of additional LVA modification than male. Additional LVA ablation has emerged as a promising solution to improve the success rate in this population.

Key words: Paroxysmal atrial fibrillation; Catheter ablation; Low voltage area; Female gender

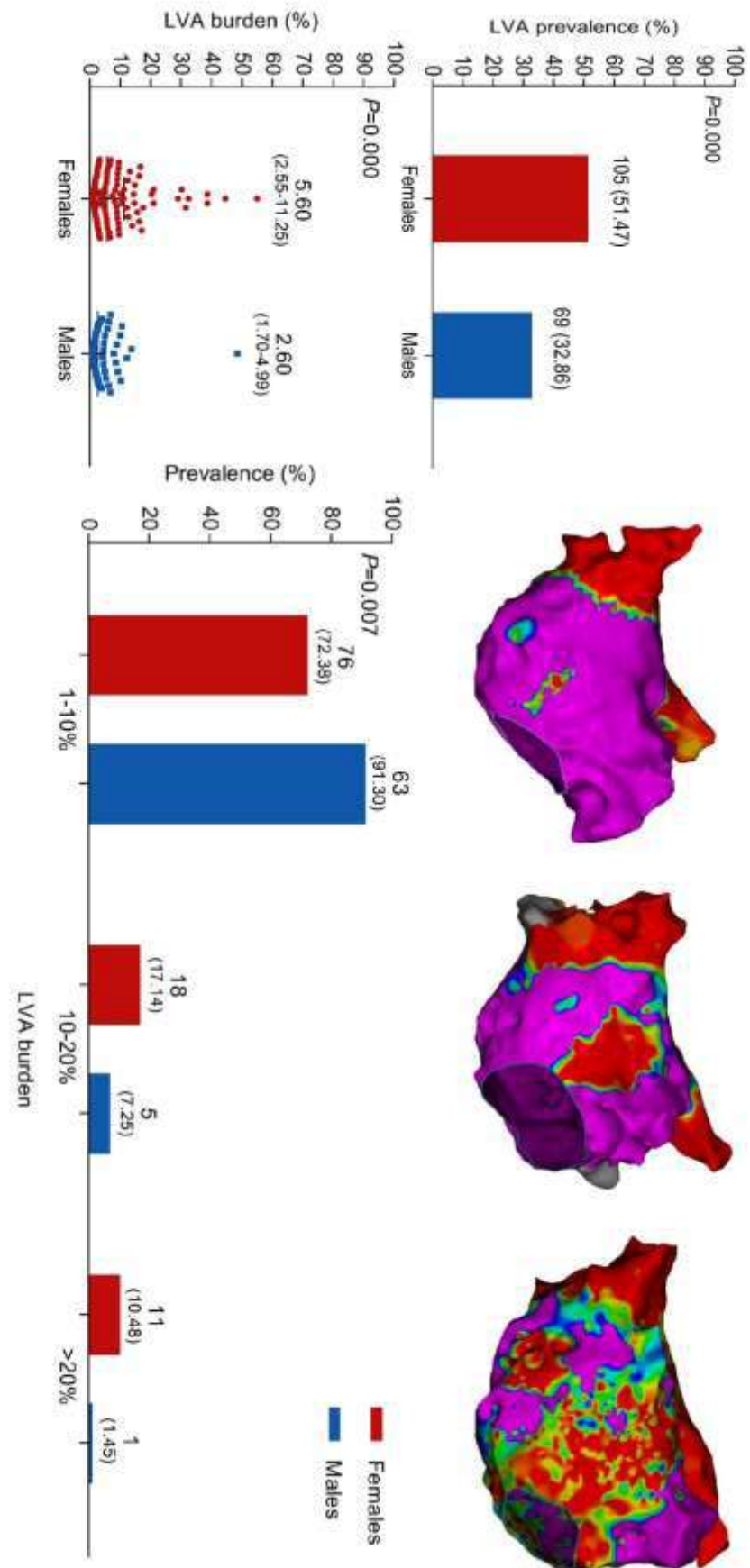
Table 1. Baseline Characteristics

Characteristics	Females, n=204	Males, n=210	P Value
Age, years	70.5±4.7	70.6±3.9	0.744
AF duration, months	24 (6.0-48.0)	12 (3.0-36.0)	0.028
BMI, kg/m ²	24.7±3.2	24.4±3.1	0.698
<25, n (%)	120 (60.6)	125 (62.5)	
≥25, n (%)	78 (39.4)	75 (37.5)	
Comorbidities, n (%)			
Hypertension	127 (62.3)	128 (61.0)	0.785
Diabetes	32 (15.7)	37 (17.6)	0.598
CAD	47 (23.0)	49 (23.3)	0.943
Stroke or TIA	11 (5.4)	25 (11.9)	0.019
Congestive heart failure	1 (0.5)	2 (1.0)	1.000
COPD	1 (0.5)	6 (2.9)	0.122
OSAS	2 (1.0)	1 (0.5)	0.248
NYHA functional class			0.399
I	189	192	
II	7	4	
III	0	1	
CHA ₂ DS ₂ -VA score, n (%)			0.773
1	49	46	
2	80	77	
3	48	53	
>3	27	34	
LAD, mm	38.5±5.2	39.0±5.5	0.307
LVEF, %	62.6±4.9	62.3±5.7	0.652
Medication use, n (%)			
Class I AAD	38	36	0.693
Class III AAD	54	62	0.489
ACEI or ARB	56	61	0.718
Beta blocker	65	69	0.829
CCB	38	28	0.141
Digoxin	1	3	0.623

* Plus-minus values are means ±SD.

AAD, denotes antiarrhythmic drugs; ACEI, angiotensin-converting enzyme inhibitors; AF, atrial fibrillation; ARB, angiotensin receptor blocker; BMI, body mass index; CAD, coronary artery disease; CCB calcium channel blocker; COPD, chronic obstructive pulmonary disease; CPVI, circumferential pulmonary vein isolation; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association heart failure classification; OSAS, obstructive sleep apnoea syndrome; TIA, transient ischaemic attack

Figure 1.



Properties of low-voltage area in females and males

Table 2. Risk Factors for the prevalence of low voltage area

Characteristics	Univariate Regression			Multivariate Regression		
	OR	95% CI	P Value	OR	95% CI	P Value
Age	1.060	1.011-1.111	0.017	1.057	1.002-1.115	0.042
Female sex	2.167	1.456-3.226	0.000	2.355	1.547-3.584	0.000
AF duration	0.999	0.996-1.002	0.572			
BMI ≥ 25 kg/m ²	0.697	0.461-1.054	0.087	0.096	0.448-1.068	0.096
Hypertension	1.225	0.819-1.834	0.323			
Diabetes	1.526	0.908-2.563	0.110			
CAD	1.524	0.963-2.411	0.072	1.404	0.797-2.471	0.240
Stroke or TIA	0.667	0.324-1.373	0.271			
COPD	1.859	0.411-8.413	0.421			
NYHA functional class	0.645	0.209-1.986	0.445			
CHA ₂ DS ₂ -VA score, n (%)	1.160	0.973-1.384	0.098	1.022	0.808-1.291	0.858
LAD, mm	1.042	1.004-1.082	0.030	1.044	1.004-1.087	0.031
LVEF, %	0.979	0.944-1.016	0.264			

AF, atrial fibrillation; BMI, body mass index; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association heart failure classification; OSAS, obstructive sleep apnoea syndrome; TIA, transient ischaemic attack.

Table 3. Recurrence of atrial tachyarrhythmia between STABLE-SR group and CPVI alone group across gender subgroup.

Subgroup*	Model 1	Model 2	Model 3	Model 4	P for Interaction
Gender					0.028
Female	0.366 (0.183-0.731)	0.373 (0.186-0.750)	0.372 (0.185-0.747)	0.371 (0.184-0.746)	
Male	1.032 (0.550-1.934)	1.026 (0.544-1.936)	1.035 (0.549-1.953)	1.031 (0.546-1.946)	

*. Results are reported as the hazard ratio (95% confidence interval) for values of STABLE-SR group compared to CPVI alone group

Model 1: adjusted [AF duration](#).

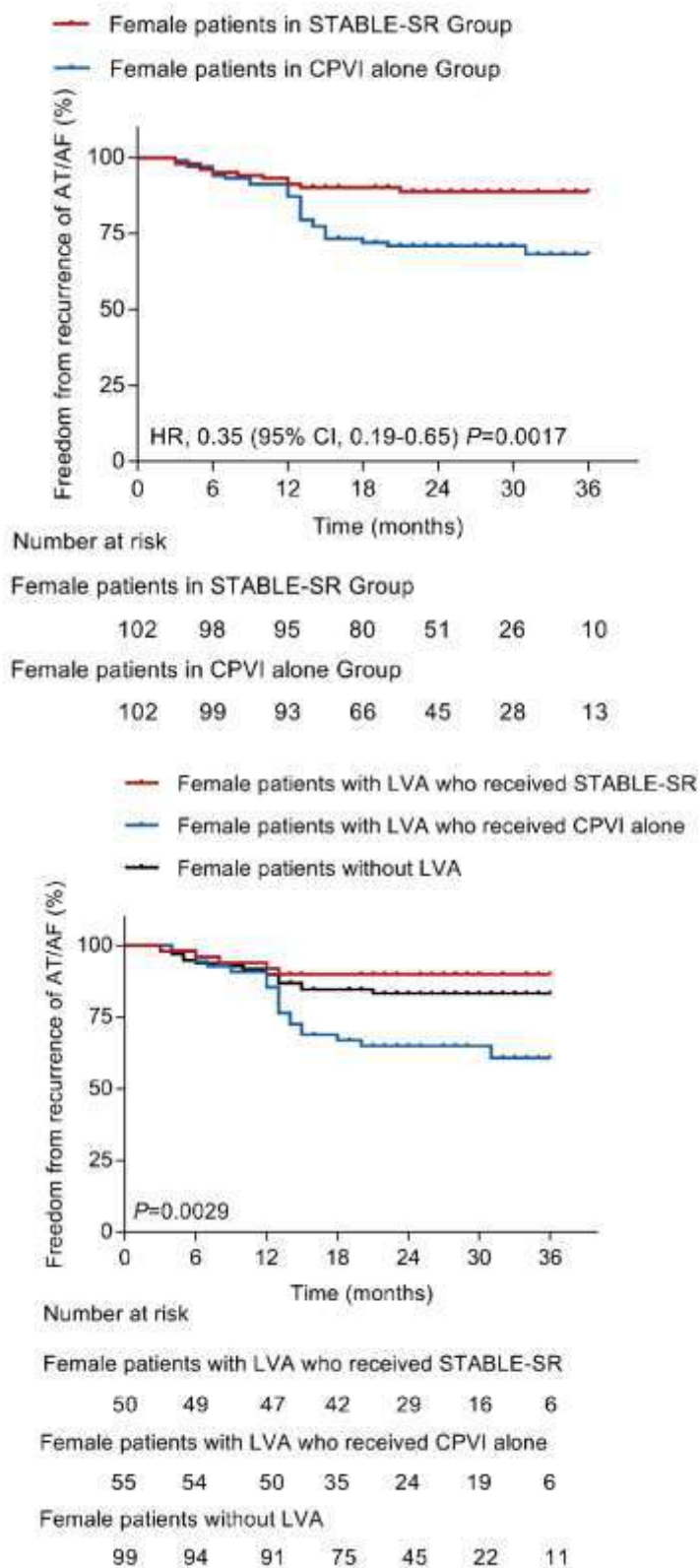
Model 2: adjusted for model 1 covariates plus baseline stroke, COPD and [OSAS](#).

Model 3: adjusted for model 2 covariates plus baseline [LAD](#).

Model 4: adjusted for model 3 covariates plus baseline [CCB](#).

Interactions tested using model 1.

Figure 2. Kaplan-Meier survival curve of the freedom from atrial tachyarrhythmia recurrence after single procedure



Supplementary Table 1. Baseline Characteristics in Female Patients.

Characteristics	STABLE-SR, n=102	CPVI alone, n=102	P Value
Age, years	70.0 (67.4-74.01)	69.3 (66.8-73.3)	0.308
AF duration, months	24 (6.0-60.3)	24 (6.8-37.3)	0.257
BMI, kg/m ²	24.2±3.4	24.6±3.0	0.361
<25, n (%)	38 (39.2)	40 (39.6)	
≥25, n (%)	59 (60.8)	61 (60.4)	
Comorbidities, n (%)			
Hypertension	58 (56.9)	69 (67.7)	0.112
Diabetes	14 (13.7)	18 (17.7)	0.441
CAD	22 (21.6)	25 (24.5)	0.618
Stroke or TIA	5 (4.9)	6 (5.9)	0.757
Congestive heart failure	0 (0.0)	1 (1.0)	1.000
COPD	0 (0.0)	1 (1.0)	1.000
OSAS	0 (0.0)	0 (0.0)	/
NYHA functional class			0.445
I	96 (98.0)	93 (94.9)	
II	2 (2.0)	5 (5.1)	
III	0 (0.0)	0 (0.0)	
CHA ₂ DS ₂ -VA score, n (%)			0.169
1	31 (30.4)	18 (17.7)	
2	35 (34.3)	45 (44.1)	
3	24 (23.5)	24 (23.5)	
>3	12 (11.8)	15 (14.7)	
LAD, mm	39 (35-42)	38 (35-42)	0.978
LVEF, %	62.75±4.58	62.37±5.27	0.587
Medication use, n (%)			
Class I AAD	17 (16.7)	21 (20.6)	0.472
Class III AAD	27 (26.5)	27 (26.5)	1.000
ACEI or ARB	24 (23.5)	32 (31.4)	0.209
Beta blocker	33 (32.4)	32 (31.4)	0.881
CCB	19 (18.6)	19 (18.6)	1.000
Digoxin	0 (0.0)	1 (1.0)	1.000

* Plus-minus values are means ±SD.

AAD, denotes antiarrhythmic drugs; ACEI, angiotensin-converting enzyme inhibitors; AF, atrial fibrillation; ARB, angiotensin receptor blocker; BMI, body mass index; CAD, coronary artery disease; CCB calcium channel blocker; COPD, chronic obstructive pulmonary disease; CPVI, circumferential pulmonary vein isolation; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association heart failure classification; OSAS, obstructive sleep apnoea syndrome; TIA, transient ischaemic attack.

Supplementary Table 2. Hazard ratio for freedom from atrial tachyarrhythmia

recurrence after adjustment of baseline characteristics in female patients.

	CPVI alone	STABLE-SR	<i>P</i> Value
HR (95% CI), Model 1	1 (reference)	0.366 (0.183-0.731)	0.004
HR (95% CI), Model 2	1 (reference)	0.368 (0.183-0.737)	0.005
HR (95% CI), Model 3	1 (reference)	0.379 (0.189-0.762)	0.006

Model 1: adjusted for AF duration;

Model 2: adjusted for model 1 covariates plus baseline hypertension;

Model 3: adjusted for model 2 covariates plus baseline CHA₂DS₂-VA score.

Supplementary Table 3. Baseline Characteristics in Female Patients.

Characteristics	Subgroup A, n=50	Subgroup B, n=55	Subgroup C, n=99	P Value
Age, years	71.5 (67.6-74.5)	71.1 (66.6-74.7)	68.5 (66.8-72.0)	0.042
AF duration, months	25.5 (12-74.5)	24 (6-48)	24 (6-48)	0.175
BMI, kg/m ²	23.4 (21.2-26.7)	24.3 (22.9-27.1)	24.4 (22.1-26.5)	0.266
<25, n (%)	17 (35.4)	21 (38.9)	40 (41.7)	
≥25, n (%)	31 (64.6)	33 (61.1)	56 (58.3)	
Comorbidities, n (%)				
Hypertension	35 (70.0)	33 (60.0)	59 (59.6)	0.429
Diabetes	10 (20.0)	10 (18.2)	12 (12.1)	0.384
CAD	16 (32.0)	15 (27.3)	16 (16.2)	0.065
Stroke or TIA	1 (2.0)	6 (10.9)	4 (4.0)	0.092
Congestive heart failure	0 (0.0)	0 (0.0)	1 (1.0)	0.587
COPD	0 (0.0)	0 (0.0)	1 (1.0)	0.587
OSAS	0 (0.0)	0 (0.0)	0 (0.0)	/
NYHA functional class				0.124
I	47 (100.0)	52 (98.1)	90 (93.8)	
II	0 (0.0)	1 (1.9)	6 (6.3)	
III	0 (0.0)	0 (0.0)	0 (0.0)	
CHA ₂ DS ₂ -VA score, n (%)				0.197
1	9 (18.0)	10 (18.2)	30 (30.3)	
2	17 (34.0)	23 (41.8)	40 (40.4)	
3	17 (34.0)	12 (21.8)	19 (19.2)	
>3	7 (14.0)	10 (18.2)	10 (10.1)	
LAD, mm	41 (35.8-42.0)	38 (35.8-42.0)	39 (34.8-41.0)	0.381
LVEF, %	62.3 (59-65)	61.2 (58.8-64.0)	63.9 (59-66.3)	0.080
Medication use, n (%)				
Class I AAD	10(20.0)	18 (32.7)	10 (10.1)	0.002
Class III AAD	15 (30.0)	18 (32.7)	21 (21.2)	0.243
ACEI or ARB	15 (30.0)	14 (25.5)	27 (27.3)	0.872
Beta blocker	20 (40.0)	15 (27.3)	30 (30.3)	0.338
CCB	12 (24.0)	7 (12.7)	19 (19.2)	0.327
Digoxin	0 (0.0)	1 (1.8)	0 (0.0)	0.256

* Plus-minus values are means ±SD.

Subgroup A, females with LVA who received additional substrate modification; Subgroup B, females with LVA who received CPVI alone; Subgroup C, females without LVA.

AAD, denotes antiarrhythmic drugs; ACEI, angiotensin-converting enzyme inhibitors; AF, atrial fibrillation; ARB, angiotensin receptor blocker; BMI, body mass index; CAD, coronary artery disease; CCB calcium channel blocker; COPD, chronic obstructive pulmonary disease; CPVI, circumferential pulmonary vein isolation; LAD, left atrial diameter; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association heart failure classification; OSAS, obstructive sleep apnoea syndrome; TIA, transient ischaemic attack.

Supplementary Table 4. Hazard ratio for freedom from atrial tachyarrhythmia recurrence in female patients.

	Subgroup B	Subgroup A	Subgroup C	P Value
HR (95% CI), Model 1	1 (reference)	0.276 (0.103-0.740)	0.412 (0.212-0.803)	0.006
HR (95% CI), Model 2	1 (reference)	0.305 (0.112-0.831)	0.445 (0.224-0.884)	0.016
HR (95% CI), Model 3	1 (reference)	0.333 (0.122-0.908)	0.399 (0.195-0.815)	0.014
HR (95% CI), Model 4	1 (reference)	0.323 (0.188-0.884)	0.389 (0.188-0.803)	0.012
HR (95% CI), Model 5	1 (reference)	0.327 (0.119-0.900)	0.399 (0.188-0.849)	0.019

Subgroup A, females with LVA who received additional substrate modification; Subgroup B, females with LVA who received CPVI alone; Subgroup C, females without LVA.

Model 1: adjusted for age and AF duration;

Model 2: adjusted for model 1 covariates plus baseline CAD and stroke/TIA;

Model 3: adjusted for model 2 covariates plus baseline NYHA;

Model 4: adjusted for model 3 covariates plus baseline LVEF

Model 5: adjusted for model 4 covariates plus baseline class I AAD.

Randomized controlled study protocol: Shensong Yangxin in persistent atrial fibrillation after radiofrequency catheter ablation (SS-ADJUST)

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Introduction

Atrial fibrillation (AF) is one of the most common forms of arrhythmia in the clinic. There are about 10 million AF patients in China, of which 1/3 are paroxysmal AF, and the remaining 2/3 are persistent or permanent AF. Long-term AF impairs cardiac function and leads to heart failure and thromboembolism. Moreover, AF increases the risk of mortality and ischemic stroke. Drug therapy and radiofrequency catheter ablation (RFCA) are still the mainstream treatment for AF patients. However, the drug therapy has its drawbacks due to the high recurrence rate and side effects. Therefore, the current antiarrhythmic drugs could not meet all the clinical needs of patients with AF.

RFCA is superior to antiarrhythmic drugs in maintaining sinus rhythm, improving symptoms and exercise tolerance, and improving quality of life. The role of RFCA in the treatment of persistent AF has gradually been recognized and affirmed. Although RFCA has been progressively used in the treatment of AF, there is still a high recurrence rate of AF after RFCA, especially in patients with persistent AF. Hence, it is meant to solve the high recurrence rate of AF after RFCA.

Shensong Yangxin (SSYX) capsule has been proven to treat arrhythmia both in animal studies and clinical research. SSYX capsule could regulate multi-ion channels, improve cardiomyocyte metabolism and regulate autonomic nervous function. In addition, randomized, double-blind, multicenter clinical research indicated that the SSYX capsule exhibited good clinical efficacy in treating ventricular premature beats and paroxysmal AF. However, the effect of SSYX on recurrence after RFCA for patients with persistent AF remains unclear. High-level randomized controlled trials (RCTs) could offer clinicians high-quality evidence regarding the usage of SSYX capsule, especially in persistent AF patients who received RFCA. Hence, the RCTs aim to evaluate the effect of SSYX capsules on the prognosis in patients with persistent AF after RFCA through multicenter, double-blind RCTs.

Methods

This trial will be conducted with a total of 920 participants diagnosed with persistent AF who received RFCA. The participants will be randomized (1:1) into groups receiving either SSYX or Placebo for 1 year. The primary endpoint includes recurrence of AF within 1 year after RFCA. The

secondary outcome measures include changes of AF load at 3 months, 6 months, 9 months, and 1 year after treatment, the time of first atrial flutter/AF, the incidence of cardioversion 1 year after treatment, changes of transthoracic echocardiographic parameters 1 year after treatment, the incidence of stroke and thromboembolism at 6 months and 1 year after treatment, the score of SF-36 within 1 year after treatment.

Application

The trial is ongoing. The trial started in September 2019 and recruiting patients. Data collection will be completed after all participants have completed the treatment course and follow-up assessments (expected 2022, pending COVID-19).

Next Steps/Future

The SS-ADJUST study is a randomized control study of TCM in persistent AF after RFCA. It will determine the place of SSYX capsule as a new treatment approach and provide additional and innovative information regarding TCM and the specific used of SSYX in persistent AF after RFCA. SS-ADJUST is registered at ChiCTR (ChiCTR1900026912).

Characteristics and Risk Scores in Asian Atrial Fibrillation Patients on Edoxaban: ETNA-AF Registry 1-year Snapshot

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OBJECTIVES

Stroke and bleeding risk scores are being used to determine the indication for oral anticoagulation in atrial fibrillation (AF) patients. This analysis from the ETNA-AF Global registry shall contribute to the better understanding of edoxaban therapy in AF patients from East Asia when considering stroke and bleeding risk scores at baseline.

MATERIALS AND METHODS

Enrolled were 3359 AF patients treated with edoxaban from South Korea, Taiwan, Hong Kong, and Thailand, extracted from the ETNA-AF Global integrated database of more than 30,000 patients. Baseline characteristics and 1-year outcomes were descriptively analysed according to CHA2DS2-VASc and HAS-BLED scores.

RESULTS

The patient history data as displayed in the table below change in the same direction with increasing scores. The CHA2DS2-VASc compared with the HAS-BLED score covers a wider range of values for all parameters. The one-year clinical event rates also cover a wider range for all parameters when using the CHA2DS2-VASc vs the HAS-BLED score for both, efficacy and safety addressing parameters.

CONCLUSION

When using categories for the CHA2DS2-VASc and HAS-BLED scores, it appears that the former may be the choice in clinical practice to better predict both, efficacy and safety events in atrial fibrillation patients from South Korea, Taiwan, Hong Kong, and Thailand when considering oral anticoagulation with edoxaban.

SUPPORTING DOCUMENTS

	CHA ₂ DS ₂ -VASc			HAS-BLED	
	0-1 387 (11.5%)	2-3 1712 (50.1%)	≥4 1260 (37.5%)	<3 2369 (74.6%)	≥3 808 (25.4%)
Age [years], mean ± SD	60.0 ± 8.4	70.3 ± 8.5	77.1 ± 7.3	70.7 ± 9.9	74.4 ± 8.1
Body Weight (kg), mean ± SD	72.6 ± 11.9	67.2 ± 12.2	62.3 ± 11.8	66.1 ± 12.6	65.5 ± 11.8
CrCl [mL/min], mean ± SD	82.2 ± 23.1	66.4 ± 22.4	52.2 ± 20.6	64.2 ± 24.2	58.9 ± 22.2
CHA ₂ DS ₂ -VASc score, mean ± SD	0.8 ± 0.4	2.5 ± 0.5	4.7 ± 0.9	2.9 ± 1.4	3.9 ± 1.5
Medical history, n(%)					
Ischaemic stroke	0 (0.00)	94 (5.49)	413 (32.78)	207 (8.74)	281 (34.78)
Major or CRNM bleeding	5 (1.29)	42 (2.45)	59 (4.68)	46 (1.94)	56 (6.93)
Clinical events at 1 year, n(%/year) [95% CI]					
Major bleeding (ISTH)	3 (0.79) [0.25; 2.45]	21 (1.27) [0.83; 1.95]	19 (1.58) [1.01; 2.48]	25 (1.09) [0.74; 1.61]	16 (2.08) [1.28; 3.40]
Fatal bleeding	0 (0.00) [0.00; NA]	2 (0.12) [0.03; 0.48]	2 (0.17) [0.04; 0.66]	2 (0.09) [0.02; 0.35]	2 (0.26) [0.06; 1.03]
Major GI bleeding	1 (0.26) [0.04; 1.86]	5 (0.30) [0.13; 0.72]	12 (1.00) [0.57; 1.76]	10 (0.43) [0.23; 0.81]	7 (0.91) [0.43; 1.90]
Intracranial Hemorrhage	0 (0.00) [0.00; NA]	7 (0.42) [0.20; 0.88]	5 (0.41) [0.17; 1.00]	7 (0.30) [0.15; 0.64]	4 (0.52) [0.19; 1.37]
Haemorrhagic stroke	0 (0.00) [0.00; NA]	5 (0.30) [0.13; 0.72]	4 (0.33) [0.12; 0.88]	6 (0.26) [0.12; 0.58]	3 (0.39) [0.12; 1.20]
Ischemic stroke or TIA	2 (0.53) [0.13; 2.10]	20 (1.21) [0.78; 1.87]	23 (1.92) [1.28; 2.90]	25 (1.09) [0.74; 1.61]	20 (2.61) [1.69; 4.05]
All-cause mortality	3 (0.79) [0.25; 2.44]	25 (1.50) [1.01; 2.22]	30 (2.48) [1.74; 3.55]	37 (1.61) [1.16; 2.22]	13 (1.67) [0.97; 2.88]
Cardiovascular mortality	1 (0.26) [0.04; 1.86]	8 (0.48) [0.24; 0.96]	13 (1.08) [0.62; 1.85]	15 (0.65) [0.39; 1.08]	6 (0.77) [0.35; 1.72]
Net clinical outcome at 1 year					
Ischemic or haemorrhagic stroke, SEE, MI, major bleeding (ISTH), all-cause mortality	8 (2.11) [1.06; 4.22]	60 (3.65) [2.83; 4.70]	64 (5.40) [4.22; 6.89]	81 (3.55) [2.86; 4.42]	42 (5.54) [4.10; 7.50]

Synchronizing Systolic Calcium Release with Azumolene following ischemic ventricular fibrillation

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Background: Post-defibrillation myocardial contractile dysfunction adversely affects the survival of patients after cardiac arrest. Attenuation of diastolic calcium (Ca²⁺) overload by stabilization of the cardiac ryanodine receptor (RyR2) is found to reduce refibrillation after long-duration ventricular fibrillation (LDVF). In the present study, we explored the effect of RyR2 stabilization by azumolene on systolic Ca²⁺ release synchrony and myocardial contractility.

Methods: After completion of baseline optical mapping, Langendorff-perfused rabbit hearts were subjected to global ischemia followed by reperfusion with azumolene or deionized distilled water. Following reperfusion, LDVF was induced with burst pacing. In the first series of experiments (n=16), epicardial Ca²⁺ transient was analyzed for Ca²⁺ transient amplitude alternans and dispersion of Ca²⁺ transient amplitude alternans index (CAAI). In the second series of experiments following the same protocol (n=12), ventricular contractility was assessed by measuring the LV pressure.

Results: Ischemic LDVF led to greater CAAI (0.06±0.02 at baseline vs 0.12±0.02 post-LDVF, p<0.01) and magnitude of dispersion of CAAI (0.04±0.01 vs 0.09±0.01, p<0.01) in control hearts. In azumolene-treated hearts, no significant changes in CAAI (0.05±0.01 vs 0.05±0.01, p=0.84) and dispersion of CAAI (0.04±0.01 vs 0.04±0.01, p=0.99) were noted following ischemic LDVF. Ischemic LDVF was associated with reduction in LVDP (100% vs. 36.8±6.1%, p=0.002) and dp/dtmax (100% vs. 45.3±6.5%, p=0.003) in control hearts, but these reductions were mitigated (LVDP: 100% vs. 74.0±8.1%, p=0.052, dp/dtmax: 100% vs. 80.8±7.9%, p=0.09) in azumolene-treated hearts.

Conclusion: Treatment with azumolene is associated with improvement of systolic Ca²⁺ release synchrony and myocardial contractility following ischemic LDVF

A 3D Culture System Enhances the Therapeutic Efficacy of MSCs-Derived Extracellular Vesicles for Heart Repair

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Background

Extracellular vesicles (EVs) derived from mesenchymal stem cells (MSCs), due to their inner functional substances, have shown great value in treating acute myocardial infarction (AMI). However, their clinical application is limited by a low yield. In the present study, we cultured EVs using a hollow fiber bioreactor-based three-dimensional (3D) system, and assessed their therapeutic effectiveness on AMI.

Methods

The MSCs separated from fresh human umbilical cord were planted into the flasks of two systems: two-dimensional (2D) culture and hollow-fiber-bioreactor based 3D culture. EVs were extracted from the culture supernatants. Characteristics and yields of EVs from two culture systems, namely 2D-EVs and 3D-EVs, were compared. A rat model of AMI was built up to assess their therapeutic efficacy on AMI.

Results

The yield of 3D-EVs was higher, with biofunctions similar to those of 2D-EVs. 3D-EVs repressed the apoptosis of cardiomyocytes, facilitated angiogenesis, and regulated the transition of macrophage subpopulations after myocardial infarction, and eventually improved cardiac function in the AMI rats.

Conclusion

The hollow fiber 3D culture system can increase the production of MSCs-derived EVs showing strong cardioprotective effect in AMI rats.

Correction of SCN5A splicing error of Brugada syndrome patient by antisense oligonucleotides

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[Objective] Brugada syndrome is a well-known lethal arrhythmic disease associated with loss-of-function SCN5A variants. We identified single nucleotide substitution c.1338 G>A at the last codon of SCN5A-Exon10 which did not change coding amino acid (p.E466E) in a patient with Brugada syndrome. The aim of this study is 1) to elucidate the consequence of this newly identified splice site variant, and 2) to correct the induced splice alteration by using anti-sense oligonucleotides.

[Method] Splicing alteration by the SCN5A c.1338 G>A was predicted by Splice AI. Minigene splicing reporter assay was performed by using iPS-cardiomyocytes (iPS-CMs) and HEK293 cells. Three different antisense nucleotides were designed and tested by splice reporter assay in HEK293 and iPS-CMs.

[Results] Splice reporter assay in both HEK293 cells and iPS-CMs demonstrated dominant selection of an alternative splice site in 4bp downstream from the authentic splice site between exon 10 and 11 which corresponded well with the in silico prediction by Splice AI. Three differently designed ASO suppressed total minigene reporter expression in a dose dependent manner. Among them, ASO1 effectively corrected the splice alteration at the final concentration of 0.3μM in which it did not suppressed the total minigene reporter expression.

[Conclusion] In this study, we confirmed splice site alteration by single nucleotide alteration SCN5A c.1338G>A identified in a Brugada syndrome patient. Correction by ASO was effective in the minigene reporter assay. Further experiments using patient derived iPS-CMs or gene edited iPS-CMs would be the future step.

Lamp2-Y228* Knock-in Mouse Models Successfully Simulated Clinical Manifestations of Patient With Danon Disease

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OBJECTIVES

Danon disease (DD) is a rare X-linked lysosomal storage disorder caused by mutations in the gene encoding the lysosome-associated membrane protein 2 (LAMP2). It is characterized by glycogen accumulation, cardiac and skeletal myopathy, and intellectual disability. LAMP2 is a key mediator of the lysosome-mediated autophagy degradation pathway, which is required for lysosome biogenesis. Although abnormal macroautophagy has been implicated in the pathogenesis of DD, its pathogenesis has remained largely unknown.

MATERIALS AND METHODS

DNA samples from a young patient with DD and his family members were analyzed by whole-exome sequencing and the key findings were confirmed by Sanger sequencing. A knock-in mouse model carrying the homologous Lamp2-Y228 was generated.*

RESULTS

The proband was a 17-year-old boy presenting with severe left ventricular hypertrophy, heart failure, and skeletal myopathy. A c.669T>G de novo nonsense variant in the LAMP2 gene, which generated a premature stop codon (p. Tyr223Ter). Knock-in of the mutation into the mouse Lamp2 gene (Lamp2Y228) led to a phenotype resembling the typical DD, including the short PR interval, pre-excitation pattern on electrocardiogram, a smaller body size, lower body weight and higher mortality. Transmission electron microscopy and immunofluorescence assay showed an aberrant accumulation of autophagolysosome and glycogen in the heart tissue.*

CONCLUSION

Our findings suggest that Lamp2-Y228 mouse models successfully reproduce clinical manifestations of patient with Danon disease, which will further be used to explore the exact role of LAMP2 in an impaired autophagy causing Danon disease.*

Electrical Considerations for Left Bundle Area Pacing

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Objectives: Left bundle area pacing (LBaP) has been demonstrated as a physiological pacing modality better than conventional right ventricular pacing (RVP). Current implant techniques begin with identifying the critical target area but base exclusively on anatomy. We hypothesize electrical signals can be useful markers to guide LBaP.

Materials and Methods: We retrospectively analyzed patients who received LBaP in a tertiary medical center in 2021. Patient characteristics, ECG before and after septal screwing were recorded. QRS patterns were categorized into 5 common subtypes, including R, Rs, rs, rS, S, which were further score as 1-5. Precordial transition zones were also identified. We compared the electrical features in patients with post-screw QRS duration (QRSd) <120ms and ≥120ms.

Results: Total 59 patients (age 70.7 ± 11.4 years, male 57.6%) were enrolled. The baseline intrinsic QRSd was 108.3 ± 27.6 ms and RV paced QRSd was 144.6 ± 23.0 ms. After screwing the lead, LBaP QRSd became 129.5 ± 23.0 ms. The target area showed score in lead II 1.9 ± 1.0 , lead III 3.8 ± 1.2 , and aVF 2.9 ± 1.3 , indicating inferior discordant pattern. The precordial transition zone was after 3.4 ± 1.2 . Comparing electrical parameters in post-screw QRSd <120ms and ≥120ms groups, significantly less pre-screw QRSd ($p=0.001$), pLVAT ($p<0.001$), and higher V1 r' ($p=0.016$) were observed in QRSd <120ms group.

Conclusions: Electrical signals are useful markers to guide LBaP. Inferior discordant pattern, short QRSd and pLVAT during pre-screw pacing and V1 r' in post-screw pacing are associated efficient left ventricular activation

Dual-Chamber Leadless Pacing Maintains Atrioventricular Synchrony Throughout Various Scenarios in a Preclinical Model

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SUPPORTING DOCUMENTS

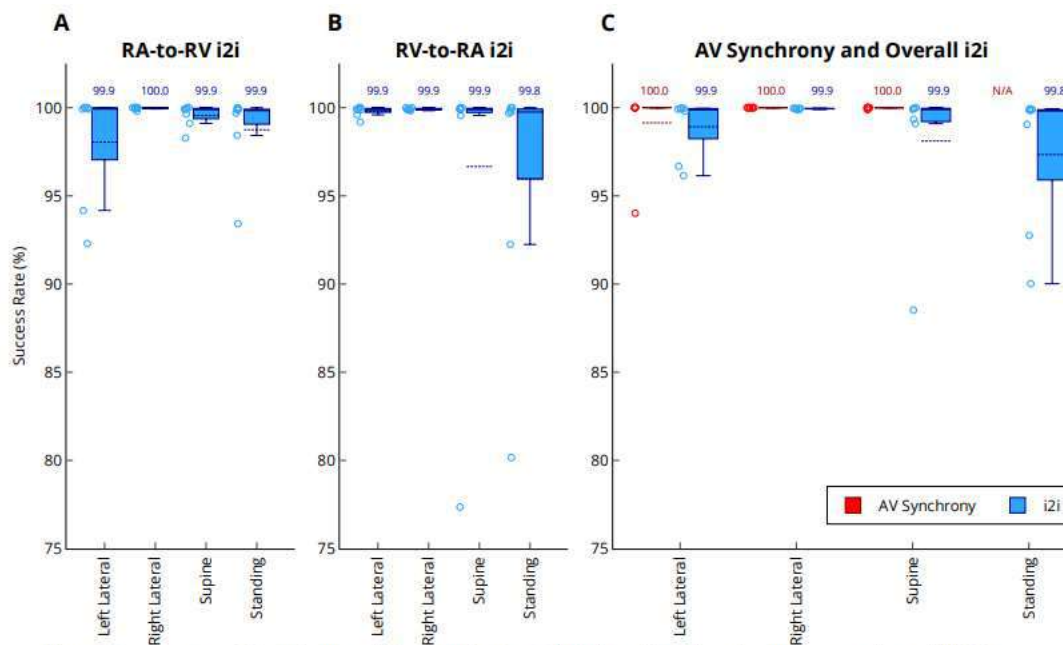


Figure 1. Success rates of AV synchrony and i2i communication while placing subjects in various postures on-demand. (A) RA-to-RV i2i, (B) RV-to-RA i2i, and (C) AV Synchrony and Overall i2i (average of RA-to-RV and RV-to-RA i2i). For each posture is shown a boxplot of interquartile range; median (solid line and noted atop); mean (dotted line); and individual samples (circles). Some plots appear compacted due to narrow ranges of AV synchrony and i2i results. Holter recording for AV synchrony was not performed for standing posture.

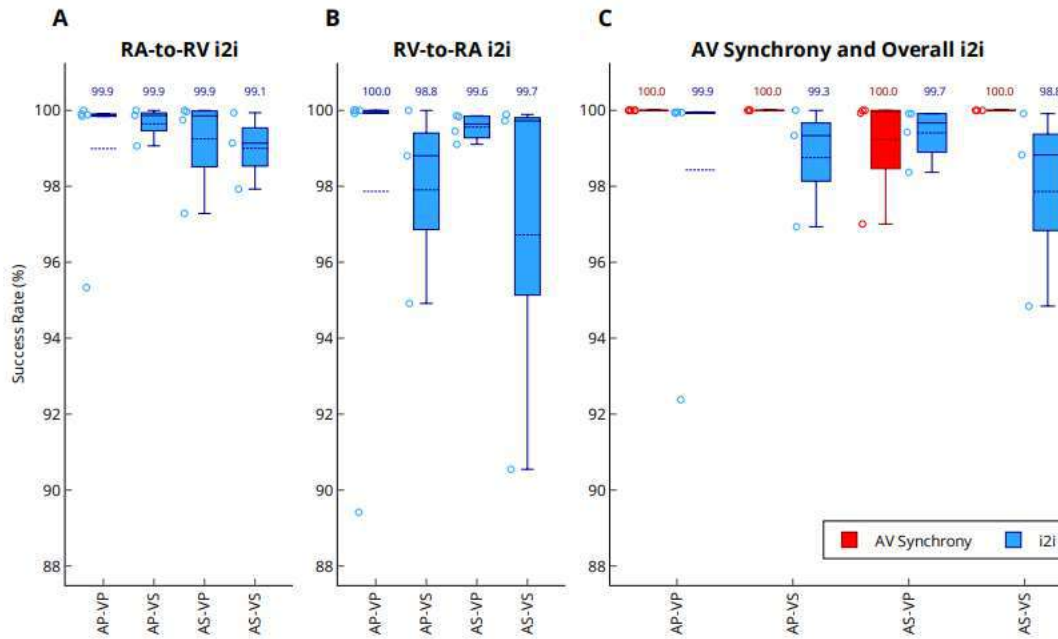


Figure 2. Success rates of AV synchrony and i2i communication while inducing various pacing rhythms on-demand. (A) RA-to-RV i2i, (B) RV-to-RA i2i, and (C) AV Synchrony and Overall i2i (average of RA-to-RV and RV-to-RA i2i). For each rhythm is shown a boxplot of interquartile range; median (solid line and noted atop); mean (dotted line); and individual samples (circles). Pacing rhythms: AP-VP (atrial pace-ventricular pace), AP-VS (atrial pace-ventricular sense), AS-VP (atrial sense-ventricular pace), and AS-VS (atrial sense-ventricular sense). Some plots appear compacted due to narrow ranges of AV synchrony and i2i results.

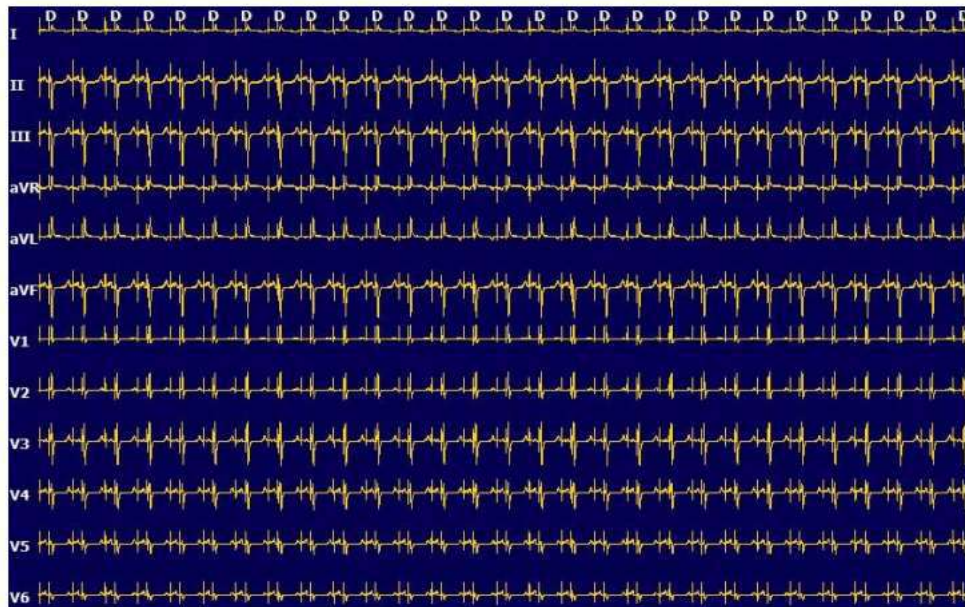


Figure 3. 12-lead holter 15-second strip while subject was placed in right lateral recumbent and received synchronous dual-chamber pacing (DDD 115bpm).

More Severe Complications in TV-ICD's Compared to S-ICD's: A Secondary Analysis of the PRAETORIAN Trial

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Objectives:

The subcutaneous ICD (S-ICD) is developed to overcome lead-related complications and systemic infections, inherent to transvenous ICD (TV-ICD) therapy. The PRAETORIAN trial demonstrated that the S-ICD is non-inferior to the TV-ICD with regard to inappropriate shocks and complications. This prespecified secondary analysis evaluates all complications in the PRAETORIAN trial.

Materials and Methods:

The PRAETORIAN trial is an international, multicenter, randomized trial in which 849 patients with a class I or IIa indication for ICD therapy were randomized to receive an S-ICD (N=426) or TV-ICD (N=423) and followed for a median of 49 months. Endpoints were device-related complications, lead-related complications, systemic infections and the need for invasive interventions.

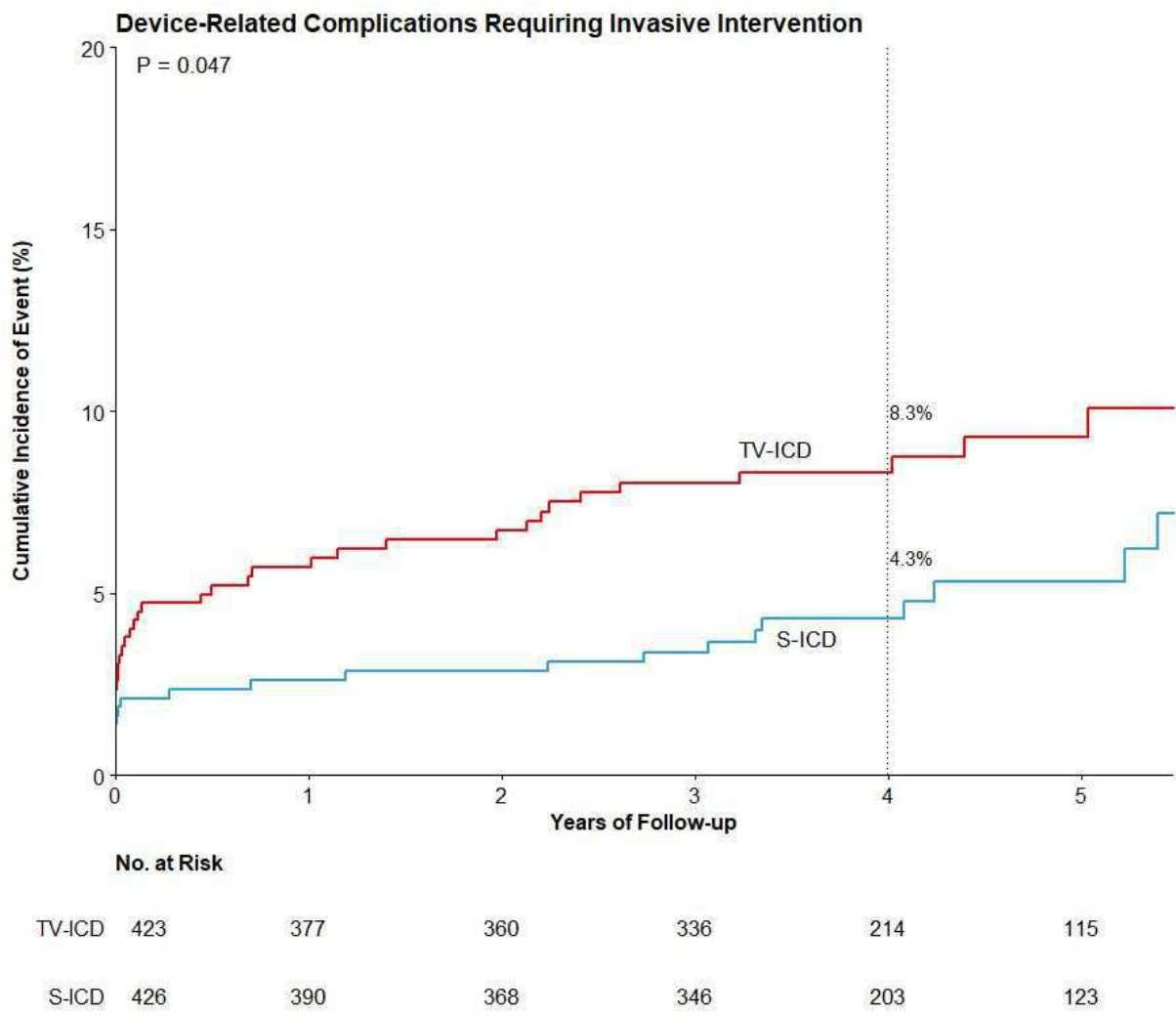
Results:

A total of 36 device-related complications occurred in 31 patients in the S-ICD group versus 49 device-related complications in 44 patients in the TV-ICD group (HR 0.69; 95% CI 0.44-1.09; p=0.11). Fewer lead-related complications occurred in the S-ICD group compared to the TV-ICD group (HR 0.24; 95% CI 0.10-0.54; p<0.001). No patients in the S-ICD group versus 5 patients in the TV-ICD group had a systemic infection (p=0.03). The incidence of device-related complications that required invasive interventions was higher in the TV-ICD group compared to the S-ICD group (8.3% vs. 4.3%, HR 0.59; 95% CI 0.35-0.99; p=0.047).

Conclusion:

This secondary analysis shows that lead-related complications and systemic infections are more prevalent in the TV-ICD group compared to the S-ICD group. In addition, device-related complications in the TV-ICD group were more severe as they required significantly more invasive interventions.

SUPPORTING DOCUMENTS



A RARE cause for Pacemaker Mediated Tachycardia

Dr Wei Shen Chee¹, Dr Soot Keng Ma², Dr Abd Raqib Abd Ghani¹, Dr Nor Halwani Habizal¹, Dr Hartini Mohd Yusof¹, Dr Kamaraj Selvaraj¹, Dr Asri Ranga Abdullah Ramaiah¹, Dr Abd Kahar Abd Ghapar¹

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Objective: To demonstrate a rare cause for pacemaker mediated tachycardia(PMT)

Materials and Methods: Using PubMed and google search engine, there are so far no publications on rate responsive PVARP causing PMT and here we illustrate 2 cases of Rate responsive PVARP of different sensitivity causing PMT.

Results: PMT was thought mainly caused by inadequate PVARP and most of the times the physicians adjusted the PVARP by extending it. For our first case we changed the RR PVARP from high to low and for the second case we turned off the RR PVARP .

Conclusion: PMT happens for a reason and in this case we demonstrate the rare cause of rate responsive PVARP being the culprit for her PMT. We reset the rate responsive PVARP and since then they have no more PMT episodes

SUPPORTING DOCUMENTS

Parameters

Basic Operation		Refractories & Blanking	
Mode	DDDR	PVARP	275 ms
V. Triggering	Off	Post-Vent. Atrial Blanking	150 ms
Magnet Response	Battery Test	Rate Responsive PVARP/V Ref	High
V. Noise Reversion Mode	DOO	Shortest PVARP/V Ref	175 ms
Sensor	On	A/V Pace Refractory	190/250 ms
Threshold (Measured Avg.)	Auto (+0.0) (2.0)	A/V Sense Refractory	93/250 ms
Slope (Measured Auto)	Auto (+2) (5)	Ventricular Blanking	44 ms
Max Sensor Rate	130 min ⁻¹	Ventricular Safety Standby	On
Reaction Time	Fast	PVC Response	Off
Recovery Time	Medium	PMT Response	Atrial Pace
		PMT Detection Rate	130 min ⁻¹
Rates		AT/AF Detection & Response	
Base Rate	60 min ⁻¹	Auto Mode Switch	DDIR
Rest Rate	60 min ⁻¹	A. Tachycardia Detection Rate	180 min ⁻¹
Max Sensor Rate	130 min ⁻¹	AMS Base Rate	80 min ⁻¹
Max Track Rate	130 min ⁻¹	AF Suppression™	Off
Hysteresis Rate	Off		
2:1 Block Rate	149 min ⁻¹		
Delays			
Paced AV Delay	250 ms		
Sensed AV Delay	225 ms		
Rate Responsive AV Delay	Off		
Ventricular Intrinsic Preference (VIP™)	On		
VIP™ Extension	100 ms		
Search Interval	1 min		
Search Cycles	1		
Negative AV Hysteresis/Search	Off		

Methodology of ventricular septal implantation using stylet-driven lead

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Background: Right ventricular septal pacing based on stylet-driven lead (SDL) is facilitated by recently-introduced three-dimensionally curved guiding-catheter. The present study is performed to investigate the multiple method to install pacing leads on the interventricular septum.

Methods: We retrospectively analyzed the consecutive patients who underwent implantation of Biotronik Solia S leads, both including apical implantation and initial experience of septal implantation. The paced QRS duration was compared between 4 groups: G1 apical implantation, G2 septal with fluoroscopic guidance, G3 septal with echo-guidance, G4 septal with echo-guidance and lead-body rotation. Body rotation was performed to manage deep septal pacing.

Results: In total, 57 patients were analyzed. Biotronik Selectra 3D catheter was exclusively used to install leads into septum. The number of patients in G1, G2 G3, and G4 were 18, 12, 20, and 7, respectively. Dislodgement of septal lead was less frequently in G2/G3 compared to G1(21% vs. 3.7%). The QRS duration were 163±15, 146±13, 143±11, and 127±20ms, respectively. In G3, half of patients exhibited QRS duration less than 120ms.

Conclusion; Combination of echocardiographic guidance and body-rotation could be effective to improve procedural and clinical results after catheter-guided septal implantation of SDLs.

Axillary Venous Spasm during Pacemaker Implantation: A Rare but Serious Phenomenon

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Background

Venous spasm during pacemaker implantation is a rare phenomenon. Larger proportion of muscle fibres in the tunica media and elastic fibers in the tunica intima of veins predisposes to contraction.

Case Presentation

A 55-years-old female presented with presyncope, recurrent palpitation and chest pain. She had history of hypertension. Physical examination showed heart rate 55 bpm, blood pressure 124/72 mmHg, with a normal heart sounds and no murmur. Electrocardiogram showed Mobitz I Second-degree atrioventricular block. Electrocardiogram and echocardiogram did not show any evidence of ischaemia. A Holter monitoring showed several bradycardia episodes with the lowest rate around 40 bpm. Patient was diagnosed with Sick Sinus Syndrome and dual chamber pacemaker implantation (DDD) was planned. The left axillary vein was selected for venous access. A venogram was performed and showed a good vein access. The axillary vein could not be cannulated despite multiple attempts. The second venography showed a spasm in both axillary and subclavian vein. A bolus of intravenous 10 mg isosorbide dinitrate was given. After 15 minutes, third venogram showed the spasm had been relieved partially. Single-chamber pacemaker was implanted because of the spasm.

Discussion

The mechanism of venous spasm is not clearly understood, it may be related to direct mechanical vascular injury, compression by surrounding tissues, temperature and chemical factors. Intravenous isosorbide dinitrate, nitroglycerine, calcium channel blocker, and sedatives might have role in shortening the spasm duration.

Conclusion

Monitoring and precaution should be performed to prevent venous spasm during pacemaker implantation.

SUPPORTING DOCUMENTS



Figure 1. Venogram of Left Axillary Vein showed a good vein access



Figure 2. Spasm of Axillary and Subclavian Vein



Figure 3. After 10 mg Isosorbide dinitrate administration



Figure 4. Single Chamber was implanted

OP-117-2-CIED (TRACK 6 - CIED 3)

Extra-long Term Follow Up of Transvenous Lead Extraction Patients Without Device Re-implatation.

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Objective: To examine the primary outcomes of death and device reimplantation in extra-long term follow up of patients undergoing transvenous lead extraction (TLE) without early device reimplantation. The secondary outcome is incidence of cardiac death.

Materials and Methods: Patients (and their next-of-kin) were followed up via telephone interview in conjunction with review of electronic medical records and primary physician documentation +/- interview.

Results: Forty-three patients from the initial cohort (n=510) were identified. Data were available in 90.7% (n=39) with an average follow up 8.7 years [range 0.1-23.4 years]. Indication for TLE was infection in 86.0% (n=37) of patients. Cumulative mortality was 55.8% (n=24) with a mean time-to-death of 4.5 years [range 0.1-14.2 years]. Reimplantation incidence was 20.9% (n=9) with mean time-to-reimplantation of 4.3 years [range 0.6-12.0 years]. Average follow up in surviving non-re-implantation patients (18.6%, n=8) was 15.9 years [range 10.7-23.4 years]. Cardiac death occurred in 7.0% (n=3) of patients (none of whom underwent device re-implantation or had bradycardia/arrhythmia related deaths). Cause of death was not available in 17.4% (n=4) of all deaths.

Conclusion: The study represents the longest follow up of TLE patients published to date. Extra-long term death in this subset of TLE patients is high, and reflects the known high mortality of TLE patients in general. The incidence of device re-implantation in follow up is lower than expected; an important

observation in rationalising device re-implantation in these patients. The incidence of cardiac death is relatively low and is not contributed to by non-reimplantation or device preventable death.

First Indonesia Experience of HOT-CRT and Its Early Outcome

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Objective

This is to report the successful implantation of our first HIS-Optimized Cardiac Resynchronization Therapy (HOT-CRT) and its early outcome.

Case Illustration

A 50 years old male with intractable mixed-type cardiomyopathy on optimal medical therapy underwent HOT-CRT implantation. Surface ECG depicted atrial fibrillation, atypical LBBB with QRS duration (QRSd) of 182 ms. All chambers dilatation was appreciated as baseline echocardiography, with LVEDV 341 ml, LVESV 260 ms, LVEF 24%, TAPSE 10 mm, and GLS -4.7. LV lead uncomplicatedly placed at basal-mid lateral branch (1 V threshold using LV2-LV3) and biventricular pacing generated QRSd of 168 ms. Partially corrected non-selective HBP was noted (QRSd of 172 ms at 1 V) and His lead was connected to atrial port. HOT-CRT was optimized by changing LV lead polarity into LV3-LV4 (His-LV delay 50 ms), resulting largest LVOT VTI (13.9 cm) and narrowest QRSd (120 mm). A month after procedure, not only patient experienced better NYHA (fc I-II), but objective data of echocardiography also showed trend of geometry improvement (LVEDV 272 ml, LVESV 212 ms), RV function (TAPSE 15 mm), and GLS -5.4.

Conclusion

To the best of our knowledge, this is the first HOT-CRT in Indonesia. Despite HBP was found promising, LBBB or intraventricular conduction block became barrier on its usage. Hence, on this subset of patient, it is a place for HOT-CRT, wherein we appreciate better trend of short-term outcome through evidence of reverse remodeling. Long-term outcome is to be waited which we believe will also give further positive result.

SUPPORTING DOCUMENTS

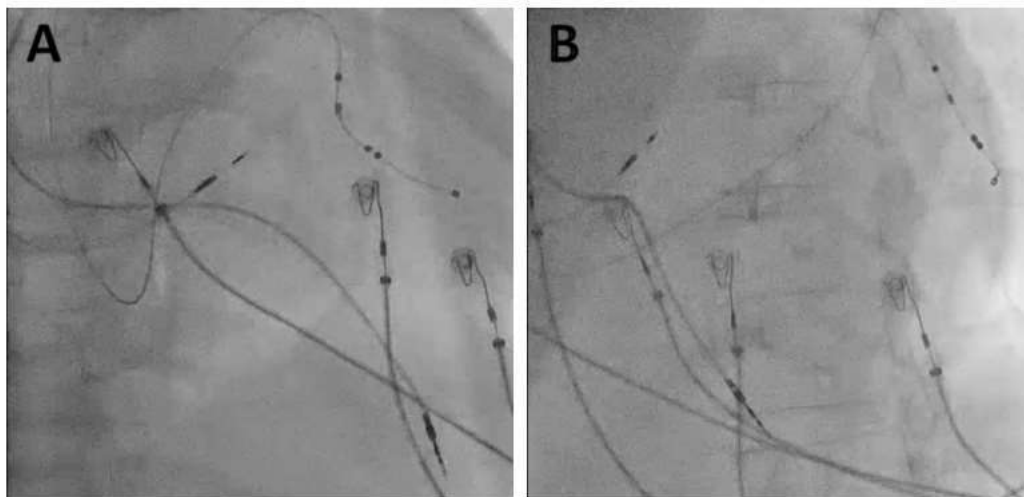


Figure 1. Final Fluoroscopy of His bundle, RV, and LV leads from RAO (A) and LAO (B) views.

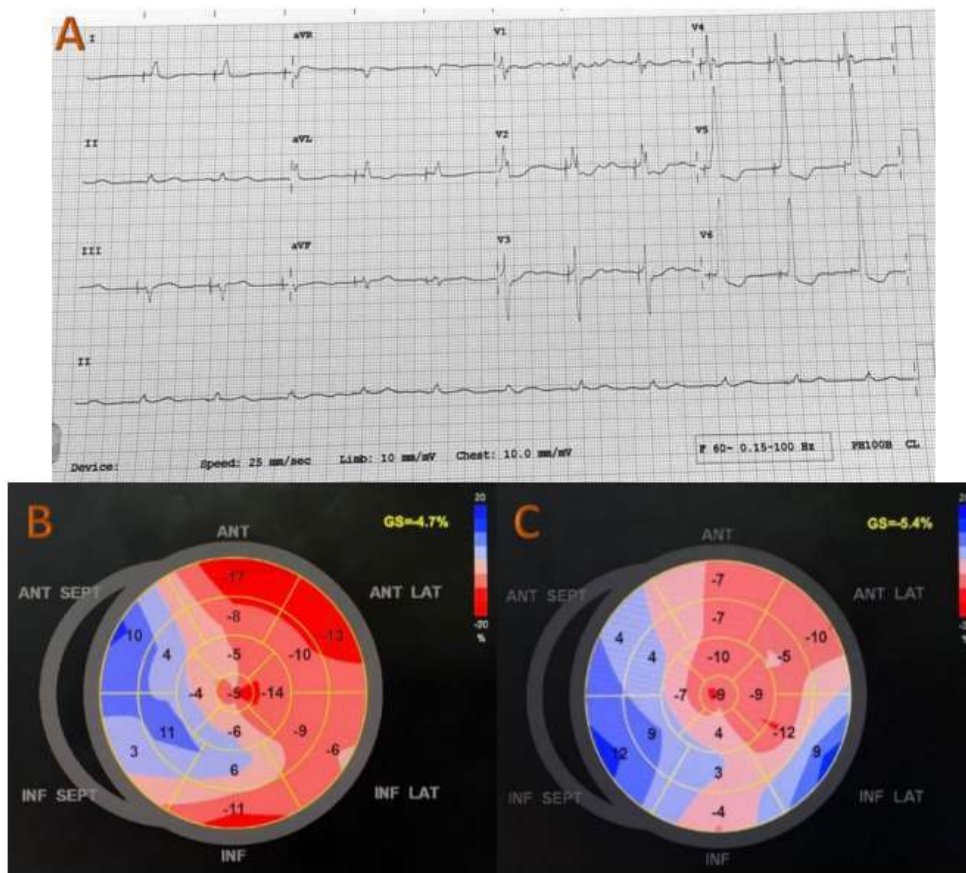


Figure 2. Surface ECG after HOT-CRT procedure (A) depicts narrow QRSd of 120 ms; and Echocardiographic GLS calculation before (B) and after (C) the procedure.

Left Bundle Branch Area Pacing in Patients With Structural Heart Disease

Dr Soonil Kwon¹, Dr. Hyo-Jeong Ahn¹, Asst Prof So-Ryoung Lee¹, Professor Eue-Keun Choi¹, Professor Seil Oh¹

¹*Seoul National University Hospital, Seoul, South Korea*

Background: Recently, left bundle branch area pacing (LBBAP) has been performed using style-driven extendable screw-in leads with pre-shaped delivery sheath in Korea. There are limited data on the feasibility of LBBAP in patients with structural heart disease (SHD).

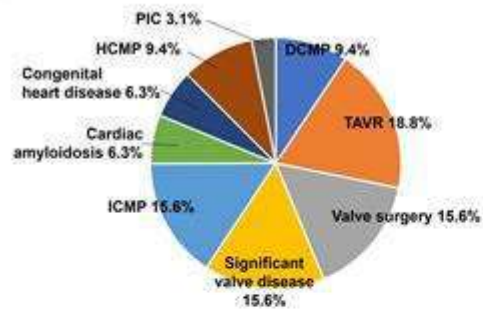
Methods: Patients, in which LBBAP was attempted, were consecutively enrolled. LBBAP was performed with stylet-driven lead (Solia S60, Biotronik) delivered through a delivery sheath (Selectra 3D, Biotronik). Procedure feasibility was evaluated in patients with or without SHD.

Results: A total of 69 patients were enrolled. Atrioventricular block was the most common indication (n=50, 72.5%). LBBAP success rate was 81.2% of total study population. Thirty-two patients (46.4%) were accompanied by SHD (Figure A). Patients with SHD had significantly lower left ventricular ejection fraction than those without SHD ($56 \pm 10\%$ vs. $61 \pm 6.7\%$, $p=0.016$). LBBAP success rate was not differ between the two groups (patients with SHD vs. without SHD, 83.8% vs. 78.1%, $p=0.549$, Figure B). There was no significant difference in total procedure time, fluoroscopic time, bipolar V sensing, V pacing threshold, and V impedance between the two groups (Figure C), except for left ventricular activation time (LVAT). Patients with SHD showed longer LVAT than those without SHD, but there was no statistically significant difference in the final QRS duration between the two groups (Figure C).

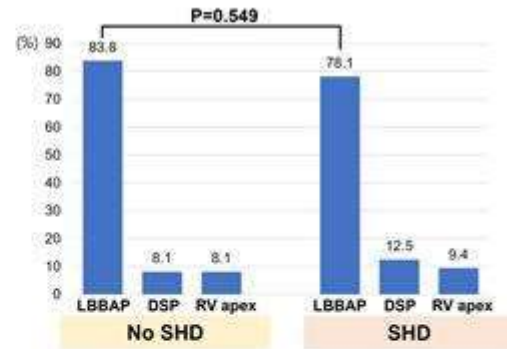
Conclusion: LBBAP using stylet-driven pacing leads in patients with SHD is feasible and safe as in patients without structural heart disease, even by an early experienced operator with LBBAP procedure.

SUPPORTING DOCUMENTS

(A) Type of SHD



(B) LBBAP success rate



(C)

	Patients without SHD	Patients with SHD	P-value
Total procedure time (min)	46.8±11.0	51.9±16.4	0.147
Fluoroscopy time (min)	15.2±9.9	15.9±10.6	0.799
V sensing (mV)	9.0±3.1	9.3±3.2	0.732
V threshold (V)	1.1±0.4	1.1±0.3	0.929
V impedance (ohm)	716±117	734±110	0.511
LVAT (msec)	71.9±9.4	82.1±15.3	0.007
Final QRS duration (msec)	110.9±25.7	119.2±26.1	0.202

Abbreviations: DCMP, dilated cardiomyopathy; DSP, deep septal pacing; HCMP, hypertrophic cardiomyopathy; ICMP, ischemic cardiomyopathy; LBBAP, left bundle branch area pacing; LVAT, left ventricular activation time; PIC, pacing induced cardiomyopathy; RV, right ventricle; SHD, structural heart disease; TAVR, transcatheter aortic valve replacement.

Inappropriate Mode Switch Leading to Underpacing in Patient With Hbp, What is the Etiology?

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Introduction: His bundle pacing (HBP) is one of the best methods to achieve physiologic electromechanical activation of the left ventricle. Reprogramming may be needed in case of low number of ventricular pacing. This case will elaborate troubleshooting in young patient with HBP.

Case Description: A 40-year-old male was referred to Hasan Sadikin General Hospital due to syncope. No history of prior cardiac disease is reported, and this was the first syncopal episode. The ECG obtained during hospitalization revealed a marked first-degree AVB and transient CHB. The patient was then managed with HBP implantation. At the following day, the patient's HBP was evaluated, unfortunately, the number of ventricular pacing in this patient is low, therefore further investigation was carried out.

Discussion: In this case, the presence of marked first-degree AVB and intermittent CHB was the primary consideration to give HBP to the patient. Recovery of AV synchrony is expected following HBP implantation in patient with marked PR prolongation. Even though initially HBP implantation in this case was claimed to be successful, it was later documented that half of the intrinsic atrial rhythm was not detected correctly as it fell at the post-ventricular atrial refractory period (PVARP) leading to pacing failure (Figure 1). Moreover, the close proximity between the atrial lead in RAA and RVOT can cause far field oversensing, which in turn activate inappropriate mode switch in this patient. Therefore, lowering the sensitivity of the HBP and shortening the PVARP served as a solution so that HBP can function appropriately.

SUPPORTING DOCUMENTS

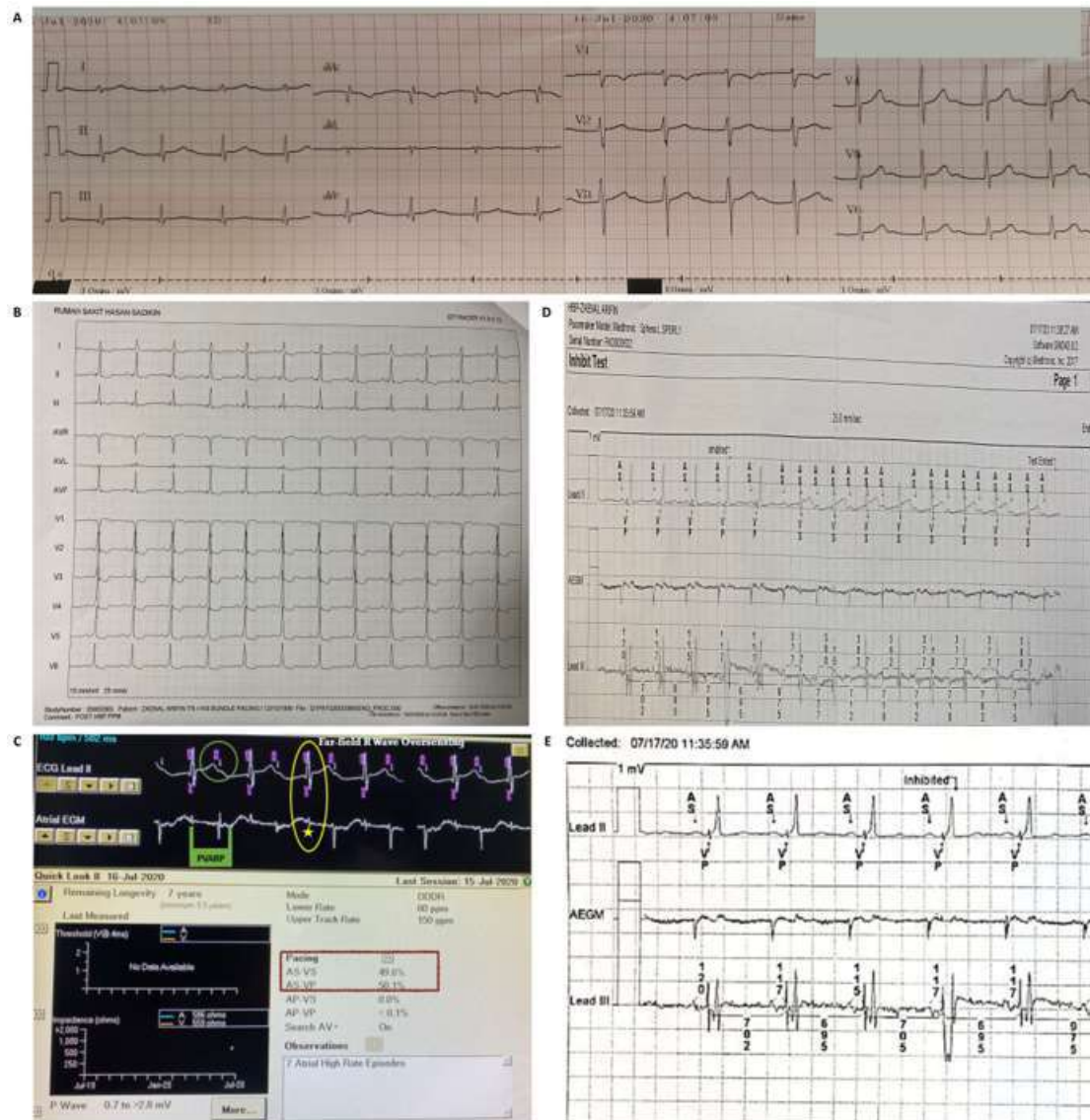


Figure 1. A. ECG obtained at the time of hospital admission; B. ECG obtained immediately after successful HBP implantation showing His capture characterized by spike before wide QRS complex with pseudo delta wave; C. Evaluation of the HBP showing undetected intrinsic atrial rhythm due to being fell at the PVARP depicted by green color box as well as far field R wave depicted by yellow circle; D. ECG obtained during HBP reprogramming showing far-field R Wave oversensing and extremely prolonged PR Interval causing Inappropriate Mode Switch; E. ECG obtained after lowering HBP threshold and shortening PVARP showing atrial sensing followed by HBP ventricular pacing.

Feasibility of Totally Leadless CRT with Leadless Pacemaker and Leadless LV Endocardial Pacing System

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Objective:

CRT upgrades count for a quarter of all CRT implants due to pacing induced heart failure. As the use of leadless devices such as Micra and Aveir continue to expand, the need to upgrade these patients to CRT will continue to increase. The objective of this study was to assess the technical feasibility of achieving totally leadless CRT using the Micra and WiSE-CRT Systems.

Methods:

For patients with a chronic Micra implant, the WiSE-CRT System was implanted in a one or two stage approach. For patients with an infection or de novo implant, the two systems were implanted over two stages. The indication for the Micra and WiSE-CRT implantation was infection of conventional CRT system in five patients, upgrade of a chronic Micra in six patients, de novo implant in two patients and high pacing thresholds in one patient.

Results:

All fourteen WiSE-CRT devices were able to detect the Micra pacing output and deliver synchronous LV endocardial pacing, resulting in successful CRT. No unforeseen device - device interactions were observed. The one acute complication recorded was due to premature detachment of an unanchored WiSE Electrode. Another Electrode was safely implanted without clinical sequelae.

Conclusions:

Achieving totally leadless CRT using a combination of a Micra and WiSE-CRT System is technically feasible. Further work is required to assess the efficacy and safety of this combination. Meanwhile, the WiSE-CRT System remains the only means to upgrade the expanding population of Micra and Aveir patients to CRT without replacing the leadless device.

SUPPORTING DOCUMENTS



Left Bundle Branch Area Pacing Using the 3830 Lumenless Lead: a Systematic Review and Meta-analysis

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³Geisinger Wyoming Valley Medical Center, Geisinger Heart Institute, Wilkes Barre, USA

Objectives: Although left bundle branch area pacing (LBBAP) has been shown to be a feasible option for delivering physiological pacing, data are largely limited to single-center reports and the safety and efficacy of the therapy have not been systematically examined.

Methods: PubMed, Embase, Cochrane Library, and Google Scholar were searched for full-text articles on LBBAP using the SelectSecure Model 3830 lead. Rates and means were estimated using random- and mixed-effects models.

Results: Of 3395 articles, 53 met inclusion criteria, representing 6061 patients undergoing an implant attempt. Average patient age was 68.1 years (95% CI: 66.6, 69.6) and 53.1% were male (95% CI: 50.5%, 55.7%). The average implant success rate among bradycardia indicated patients was 92.7% (95% CI: 89.5%, 94.9%). The overall estimated procedural adverse event rate was 2.5% (95% CI: 1.1%, 5.4%). The estimated septal perforation rate at implant was 1.6% (95% CI: 1.0%, 2.6%). Adverse clinical sequelae were not reported with septal perforation and events resolved with lead repositioning. Pacing thresholds were low at implant (0.67 V [95% CI: 0.64, 0.70]) and remained stable through 12 months (0.76 V [95% CI: 0.72, 0.80]). Among bradycardia indicated patients, LVEF remained stable from baseline to post-implant (60.0% [95% CI: 58.0%, 62.0%] vs. 60.3% [95% CI: 58.2%, 62.4%]).

Conclusion: This network meta-analysis including 6061 patients implanted with a Model 3830 lead for LBBAP found an average implant success rate of 92.7% and a procedural adverse event rate of 2.5% with stable electrical parameters and LVEF post-implant.

Development of Pacing-induced Cardiomyopathy Differed Based on the Time-interval After Pacemaker Implantation

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¹*Gangneung Asan Hospital, Gangneung, South Korea*

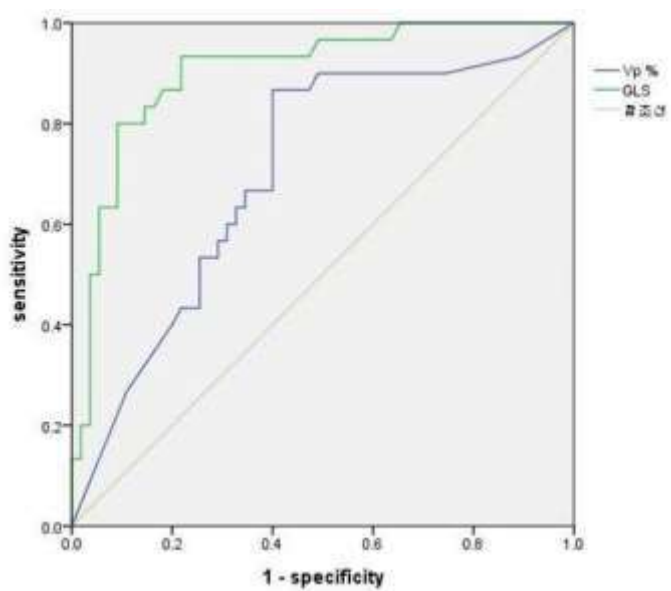
Backgrounds : Predicting which individuals will have a decline in left ventricular (LV) function after pacemaker implantation remains an important challenge. We investigated the real world risk of pacing-induced cardiomyopathy (PICMP) after pacemaker.

Methods and results: An analysis of consecutive patients receiving permanent pacemaker from 2000 to 2019 with LVEF >50% before pacemaker insertion. PICM was defined as <50% of LV ejection fraction (EF) in follow up with $\geq 10\%$ or 5 % decrease of EF, newly appeared regional wall motion abnormality irrelevant coronary artery disease without any other proven etiologies. among 829 patients in our pacemaker registry, 315 patients (mean age : 76 ± 7 years, M:F = 126 : 189) enrolled. Prevalence of PCIM was 87/315 (27.6%) with > 10% decrease and was 120/315 (38.1%) with > 5% decrease over mean follow-up of 65 ± 45 months.

The incidence of PICMP did not decrease over the follow-up period: 21% <6 months, 29% 6-12 months, 14.2% >12 months–2 years, 27% 2-3 years, 6.2% 4-5 years, and even 40% >5 years. Lower peak global systolic strain of LV and percent of ventricular pacing (Vp %) were the predictors for PICMP (GLS ; OR 1.831, 95% confidence interval [CI] 1.396-2.403, $p=0.001$, Vp% ; OR 1.025, 95% confidence interval [CI] 1.002-1.049, $p=0.037$). Vp% had an area under the receiver operating characteristic curve (AUC) of 0.704 (95% CI, 0.588-0.820) and GLS had AUC of 0.903 (95% CI, 0.834-0.971).

Conclusion: PICMP is not uncommon during follow-up and we suggested the echocardiographic evaluation in the follow-up protocol.

SUPPORTING DOCUMENTS



Very Low-Frame-Rate Digital Fluoroscopy In Biventricular Cardiac Device Implantation.

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¹*Dr. Baba Saheb Ambedkar Medical College, New Delhi, India,* ²*Holy Family Hospital, New Delhi, INDIA*

Fluoroscopic guidance is the standard tool used in cardiac electronic device implantation. Biventricular device (BivD) implantation is the most challenging and often involves high radiation exposure both to the patient and the operator.

The aim of our study was to investigate the radiation exposure during BivD implantation and feasibility and reliability of biventricular device implantation with modified fluoroscopy protocols.

Between June 2015 to June 2020, 41 patients with heart failure underwent implantation BivD. In September 2018 we changed our imaging protocols to reduce radiation exposure, this included lowering the Fluoroscopy frame rates from 15fps to 4fps, frequent use of 'flurosave' and decreasing cine frame rate from 15fps to 10fps.

Of the 41 patients, 24 procedures were done prior to the change in imaging protocol (PRE) and 17 procedures were done after (POST).

Mean flouroscopy time was 42.9 min in PRE and 38.5min in POST ($p=0.6$), Median Dose surface product (PKA) reduced from 2493.5 mGy to 787.5mGy ($p< 0.01$), and skin surface entry dose (KAR) reduced from 23020 μ Gym² to 7985 μ Gym² ($p<0.01$).

There was no significant difference in the fluoroscopy time suggesting that clinically acceptable imaging could be achieved even after using very low frame rates during fluoroscopy.

Conclusion:

Keeping the radiation exposure to 'as low as reasonable' (ALAR) is the philosophy behind all interventional procedures. Our study shows that biventricular device implantation can be done using very low frame rate fluoroscopy and the radiation exposure can be decreased by almost two-thirds when compared to default imaging settings.

Allergic Contact Dermatitis Related to CIED Implantation Mimicking Infection Response: A Rare Case in Indonesia

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OBJECTIVES

Allergic contact dermatitis related to CIED implantation was a rare condition. In this case, we report an allergic contact dermatitis that caused by conductor material that mimicking CIED infection.

MATERIALS AND METHODS

A 70 years old male with heart failure reduced ejection fraction (HFrEF) New York Heart Association (NYHA) III due to dilated cardiomyopathy with no coronary artery disease. Electrocardiography showed sinus rhythm with left bundle branch block and QRS duration was 200 ms. Echocardiography showed LV dilatation with EF 26%. Patient still symptomatic despite of guideline directed medical treatment (GDMT). During follow up sinus node dysfunction was found. Implantation of cardiac resynchronization therapy-pacemaker (CRT-P) was performed. Five months after the procedure, erythema and itching around pacemaker wound were complained. Five days later wound get worsen with purulent pus with the suspicious of pacemaker infection.

RESULTS

Blood, wound, and pus culture were taken preceded antibiotic therapy and it showed no microbial colonization. Patch test revealed Nickel (II) Sulphate Hexahydrate and Potassium Dichromate which was conductor material in device lead as allergen. The CRT-P system was explanted, and dual chamber pacemaker was implanted. Evaluation showed improvement of symptom. We reported an allergic contact dermatitis due to metallic component in CIED lead which causing desensitization hypersensitivity process.

CONCLUSION

Removal of the device and replacement with another model that not containing documented allergens is the best treatment

SUPPORTING DOCUMENTS

Image



Figure 1. Left: skin feature showed linear hypertrophic scar with mild erythema in surrounded wound at 5 months after CRT-P implantation, Middle: 5 days later it showed bullae at the edge of wound, Right: 6 days after the bullae disrupted and purulent discharge was productive.

Alergen	48 Hours	72 Hours	96 Hours	120 Hours	144 Hours	168 Hours	218 Hours	Results
Generator Pacemaker (X)	-	-	-	-	-	-	-	Negative
Generator Pacemaker (Y)	-	-	-	-	-	-	-	Negative
Potassium dichromate	+/-	+	+	+	+	+	+	A (Past)
Cobalt (II) chloride hexahydrate	+/-	+/-	+/-	+/-	+/-	+/-	+/-	Negative
Colophonium	-	-	-	-	-	-	-	Negative
Nickel (II) Sulfate hexahydrate	+	+	++	++	++	+	+	A (Past)
Epoxy resin	-	-	-	-	-	-	-	Negative
Toluenesulfonamide formaldehyde resin	-	+/-	-	-	-	-	-	Negative
Mercaptobenzothiazole	-	-	-	-	-	-	-	Negative
Thiuram Mix	-	-	-	-	-	-	-	Negative

Figure 2. Patch Test Using CIED Materials Showed Nickel (II) Sulphate Hexahydrate and Potassium Dichromate



Figure 3. Evaluation showed improvement of symptom

Model 3830 Lead Performance for Left Bundle Branch Area Pacing: Results from a Multi-Center Registry

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Objective: Left Bundle Branch Area Pacing (LBBAP) with the SelectSecure Model 3830 lead provides physiologic pacing and is an alternative for patients requiring ventricular pacing. The Medtronic Product Surveillance Registry (PSR) is an on-going global, multi-center registry that collects data from routine clinical practice. The purpose of this analysis was to characterize the performance of LBBAP with the Model 3830 lead among patients enrolled in the PSR.

Materials and Methods: This observational analysis included patients who underwent pacemaker implantations with LBBAP between May 2018 and February 2022. Patients were included in this analysis if they were implanted with a Model 3830 lead for LBBAP. The primary outcomes were lead-related complications and elevated pacing capture threshold (PCT). R wave amplitudes were summarized.

Results: A total of 312 patients were included across 25 centers (mean age 74, 41% male). At implant, the mean PCT was $0.63 \text{ V} \pm 0.34 \text{ V}$ and the mean R wave amplitude was $12.96 \text{ mV} \pm 7.32 \text{ mV}$. At 6 months post-implant, the lead complication rate was 3.0% (95% 1-sided upper limit 5.9%), and the mean PCT was $0.79 \pm 0.24 \text{ V}$. Out of 130 leads, 1 had a PCT $> 2.5 \text{ V}$ (0.8% with 95% 1-sided upper limit 3.6%). The mean R wave amplitude was $16.10 \text{ mV} \pm 8.63 \text{ mV}$.

Conclusions: In a multi-center cohort of pacemaker patients with Model 3830 LBBAP, the lead complication and elevated PCT rates were low through 6 months. These data suggest LBBAP with Model 3830 is viable for physiologic pacing.

Mid-term Feasibility of Left Bundle Branch Pacing With Standard Stylet-driven Leads and Predictors of Success

Asst Prof Ga-In Yu¹, Prof Tae-Hoon Kim², Prof Hee Tae Yu², Prof Boyoung Joung², Prof Hui-Nam Pak², Prof Moon-Hyoung Lee²

¹GyeongSang National University College of Medicine, South Korea , ²Yonsei University College of Medicine, South Korea

Objective: Initially, left bundle branch area pacing (LBBAP) was achieved through a lumen-less lead, and it has been reported that LBBAP using a standard stylet-driven lead (SDL) is also available. The purpose of this study is to establish the feasibility and mid-term outcome of LBBAP using SDL, and to investigate the predictors of success.

Methods: This study enrolled a total of 119 patients who underwent LBBAP from December 2020 to February 2022. LBBAP was performed with a 5.6Fr stylet-driven pacing lead with an extendable helix (Solia S60, Biotronik, SE & Co, KG). We analyzed the initial outcomes of the procedure, including the success rate and complications, and identified predictive factors that affect them. lead parameters were assessed in follow up.

Results: Total success rate of lead implantation of LBBAP with conventional stylet-driven lead was 95.8% for entire period. The larger the RA size, the greater the number of trials (Estimates = 1.770 [1.10 - 2.44], $p = <0.001$) and the smaller the RV size, the greater the number of trials (Estimates = -0.923 [-1.64 - -0.21], $p = 0.012$). The mean thresholds at implant, 2 months, 6 months were 0.90 ± 0.80 V at 0.5 ms, 0.80 ± 0.16 V at 0.5 ms, and 0.87 ± 0.28 V at 0.5 ms respectively in total period.

Conclusion: LBBAP with conventional stylet-driven lead is a feasible and safe pacing modality. It has a high success rate and fewer complications, satisfied and stable lead parameters in intermediate-term observations

Pitfall of Left Bundle Branch Area Pacing in Complete Heart Block and ASD Primum Post-closure

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CASE PRESENTATION

Conduction disorder is seen in some patients with atrial septal defect (ASD), therefore higher-grade AV nodal conduction abnormalities are frequently seen in patients with ostium primum ASD. We presented a case report of a young woman with ostium ASD primum, congenital complete heart block undergoing left bundle branch area pacing (LBBAP) implantation. We highlight the pitfall that might be encountered.

A 22-years old woman undergo elective ASD closure surgery, the defect was closed using a patch. During surgery, the patient was placed epicardial temporary pacemaker and planned to do permanent pacemaker (PPM). Because PPM was done after surgical closure, there were some pitfalls due to anatomical changes; 1) PPM lead might enter through a fenestrated patch or residual shunt to the left ventricle (LV), 2) Lead can enter coronary sinus, in this case, we get electrical signals but the PPM cannot be paced, 3) In the normal heart LBBB morphology obtain during RV septum before we screw in the septum, but in this case, RBBB morphology was shown during RV septum pacing due to RV enlargement. Contrast injection to confirmed lead position at right ventricular (RV) septum. After the lead penetrate the septum, we use LBBAP establish criteria to assure successful implantation of LBBAP.

CONCLUSION

Implantation of pacemaker in ostium primum ASD is challenging, because there have been anatomical changes especially after surgery. During the implantation procedure there are pitfalls that we must be aware of.

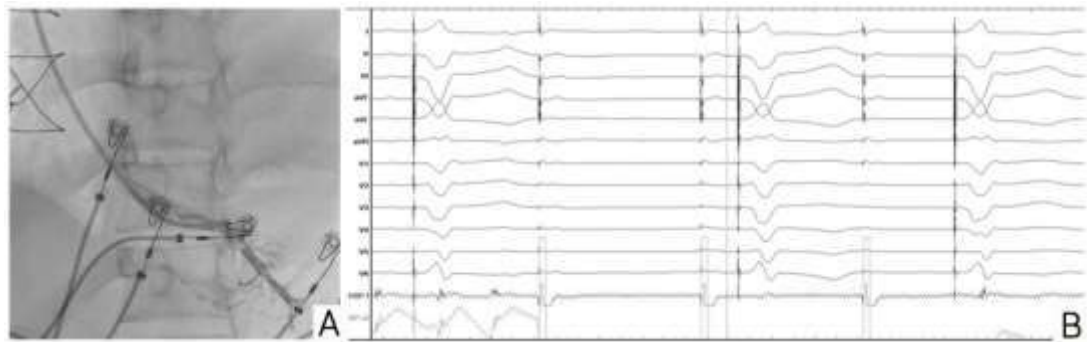


Figure 1. Contrast injection during LBBAP implantation; **A.** Contrast fills the coronary sinus, **B.** Electrocardiogram showed signal but cannot be paced.



Figure 2. Contrast injection to confirmed lead placement; **A.** Contrast provides an RV septum image, **B.** Electrocardiogram after LBBAP implantati

Impact of Proposed Pacing Guidelines on Current Practice

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OBJECTIVES

With emerging evidence in support of Left Bundle Branch Area Pacing (LBBAP), the Latin American Heart Rhythm Society proposed pacing guidelines ‘for the avoidance and mitigation of heart failure’ were released for public comment in March. They support transthoracic echocardiography (TTE) prior to all permanent pacemaker implants (Class 1, Level A) to select the most appropriate device. They also suggest that patients with a substantial burden of pacing – even with normal left ventricular function - should be considered for physiological pacing given the known incidence of right ventricle (RV) pacing induced cardiomyopathy. This study assesses our pacing practice and examines the potential impact of the proposed guidelines.

MATERIALS AND METHODS

Device insertions at a tertiary hospital for the first two months of 2022 were reviewed. Data collected included TTE details pre-procedure, device indication and type, and percentage pacing at review.

RESULTS

During the study period 64 new devices were implanted. Twelve of those patients (mean age 78) did not have a documented TTE prior to procedure. One patient who received traditional RV pacing had a TTE post device implant demonstrating significant LV dysfunction suggesting possible benefit from physiological pacing. Of the 58 patients who received traditional RV pacing, 31 subsequently received ‘substantial pacing’ suggesting physiological pacing may have been beneficial.

CONCLUSION

Adherence to proposed guidelines would place a greater emphasis on pre-assessment and may lead to a higher proportion of patients receiving physiological pacing; a change from current practice.

Leadless Left Bundle Branch Area Pacing: A Feasibility Study

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Objective:

The WiSE-CRT system (EBR systems, CA, USA) delivers leadless LV endocardial pacing. The system comprises a subcutaneous generator, intercostal transmitter and an LV endocardial electrode. The electrode is conventionally placed on the LV lateral wall, however positioning on the septum may allow capture of the left bundle branch. The objective of this study was to assess the feasibility of leadless left bundle branch area pacing (LBBAP) using the WiSE-CRT system.

Materials and Methods:

8 patients underwent WiSE-CRT implantation. Electrical mapping was performed by positioning a multipolar catheter along the LV septum to locate a Purkinje potential and assess temporary pacing at this site. The electrode was implanted on the LV septum via an inter-atrial transseptal approach using a deflectable sheath

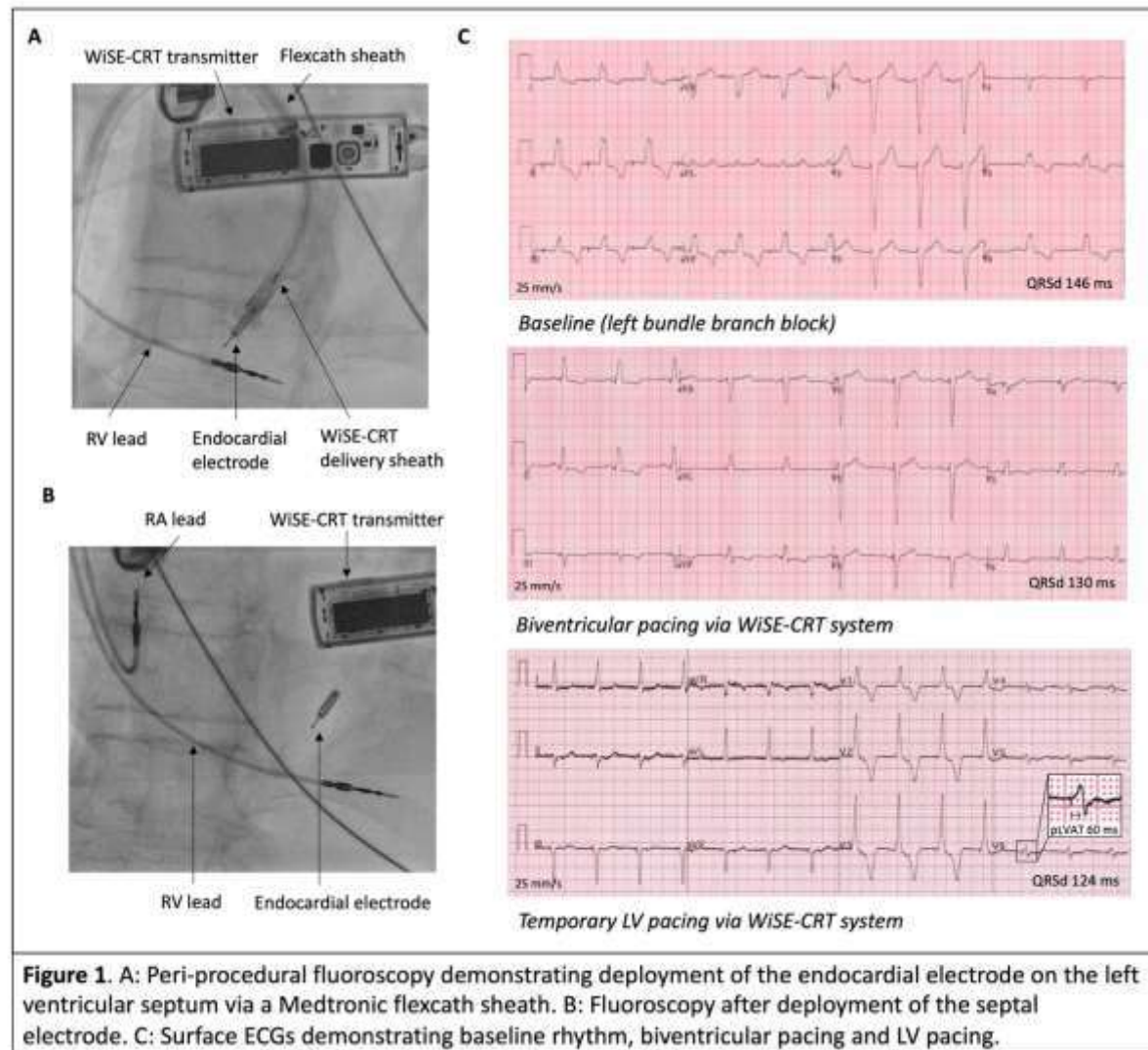
Results:

Implantation was successful in all 8 patients with biventricular capture confirmed on ECG. There was a significant reduction in QRS duration during biventricular pacing (187.1 ± 33.8 vs 149.5 ± 15.7 ms, $P=0.01$). During temporary LV pacing, QRS duration reduced further (139.8 ± 12.4 ms). In 4 patients the LV activation time in ECG leads V5/V6 was <90 ms, suggesting left bundle capture. At follow-up, median LV pacing percentage was 98.5% and 75% of patients improved symptomatically. Follow-up echocardiographic data was available for 6 patients, of whom 50% demonstrated evidence of LV reverse remodelling.

Conclusion:

We have demonstrated the technical feasibility of performing leadless LBBAP using the WiSE-CRT system. Further study is required to assess the safety and efficacy of this technique.

SUPPORTING DOCUMENTS



Septal Fibrosis is Associated With Attenuated Left Ventricular Resynchronization During Left Bundle Branch Area Pacing.

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Objective:

Left bundle branch area pacing (LBBAP) can provide effective cardiac resynchronization in patients with dyssynchronous heart failure. Around a third of patients with dilated cardiomyopathy have evidence of septal fibrosis on cardiac MRI. Myocardial infarction can also cause subendocardial fibrosis in this region. We aimed to assess the effect of septal fibrosis on LBBAP using electrocardiographic imaging (ECGi).

Materials and Methods:

8 patients who met clinical indications for CRT underwent cardiac MRI with late gadolinium enhancement prior to a temporary pacing procedure. LBBAP was performed with a decapolar catheter placed along the LV septum via the femoral artery and retrograde aortic access. Reconstructed epicardial potentials from a CardioInsight ECGi vest (Medtronic, MN, USA) were used to calculate LV activation time (LVAT-95) and LV dyssynchrony index (LVDI).

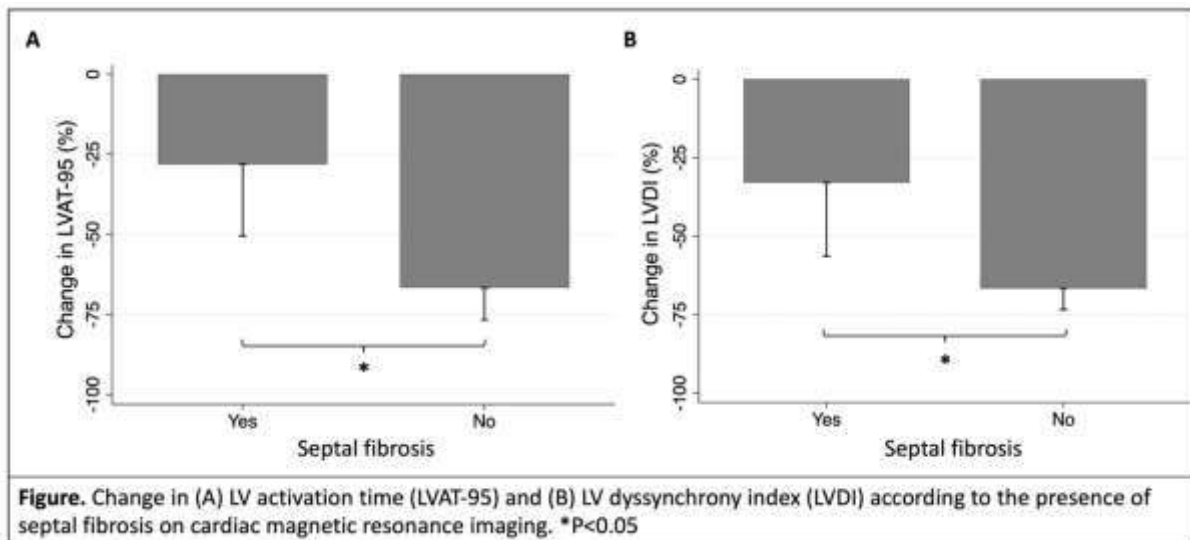
Results:

Non-ischemic septal fibrosis was present in 3 patients, and subendocardial ischemic fibrosis in 1 patient. 4 patients had no evidence of fibrosis in the septum. 5 patients had LBBB, 3 had an RV-paced rhythm, and 1 had RBBB. Mean LV ejection fraction was $27.4 \pm 6.0\%$. Overall, LBBAP reduced LVAT-95 by $49.5 \pm 23.7\%$ and LVDI by $52.9 \pm 22.3\%$ from baseline. Reductions in LVAT-95 and LVDI were lower in patients with septal fibrosis compared to those without ($28.1 \pm 22.4\%$ vs $66.6 \pm 10.0\%$; $P=0.02$ and $33.0 \pm 23.4\%$ vs $66.7 \pm 6.7\%$; $P=0.03$ respectively).

Conclusion:

Septal fibrosis on cardiac MRI is associated with attenuated LV resynchronization during LBBAP. Cardiac MRI may prove useful in selecting the optimal resynchronization strategy.

SUPPORTING DOCUMENTS



The First Totally Leadless CRT System in the US.

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¹*Nch Healthcare System, Naples , United States*, ²*Medicover Hospitals, Hyderabad, India*

Abstract submitted under supporting document

SUPPORTING DOCUMENTS

Objective

LV endocardial pacing (LVP) with the WiSE-CRT System is feasible. MICRA AV and LVP provide an option for totally leadless cardiac resynchronization (CRT). We describe the first completely leadless CRT system case performed in the US.

Methods

An 82-year-old male with non-ischemic cardiomyopathy, end-stage renal disease on hemodialysis, ejection fraction (EF) 40% was admitted for acute congestive heart failure, NYHA III. EF was depressed despite medical therapy for three months. Conventional CRT-P was precluded due to bilateral subclavian vein occlusion. After discussion with patient, MICRA AV and WiSE-CRT were planned for a completely leadless CRT (Fig. 1).

Results

MICRA was implanted successfully through the right femoral venous approach. WiSE-CRT subcutaneous Battery and Transmitter implantation were also uneventful. LV Electrode implantation was initially attempted by transseptal approach; however, it prematurely detached and subsequently embolized to a small pelvic artery without clinical sequelae. A transaortic approach was utilized the second time due to a more optimal approach to the target wall segment. Anchoring of the Electrode was confirmed in multiple fluoroscopic views prior to detachment. The procedure was completed successfully with acceptable thresholds (Fig. 2). At five months follow-up, EKG demonstrated QRS width decrease from 184 to 144 msec (Fig. 3), EF increased to 55%.

Conclusion

Fully leadless CRT implantation using the MICRA and WiSE-CRT is feasible and provides a valuable alternative in patients with venous occlusions. Careful attention to technique, especially in the initial learning curve is warranted to improve implantation safety.

Figure 1: The WiSE-CRT Electrode in LV is stimulated by ultrasonic waves. LV stimulation is timed off the sensed pulse from MICRA



Figure 2. Fluoro image demonstrating MICRA in the RV, WISE-CRT Electrode in LV, subcutaneous battery and subcutaneous Electrode.

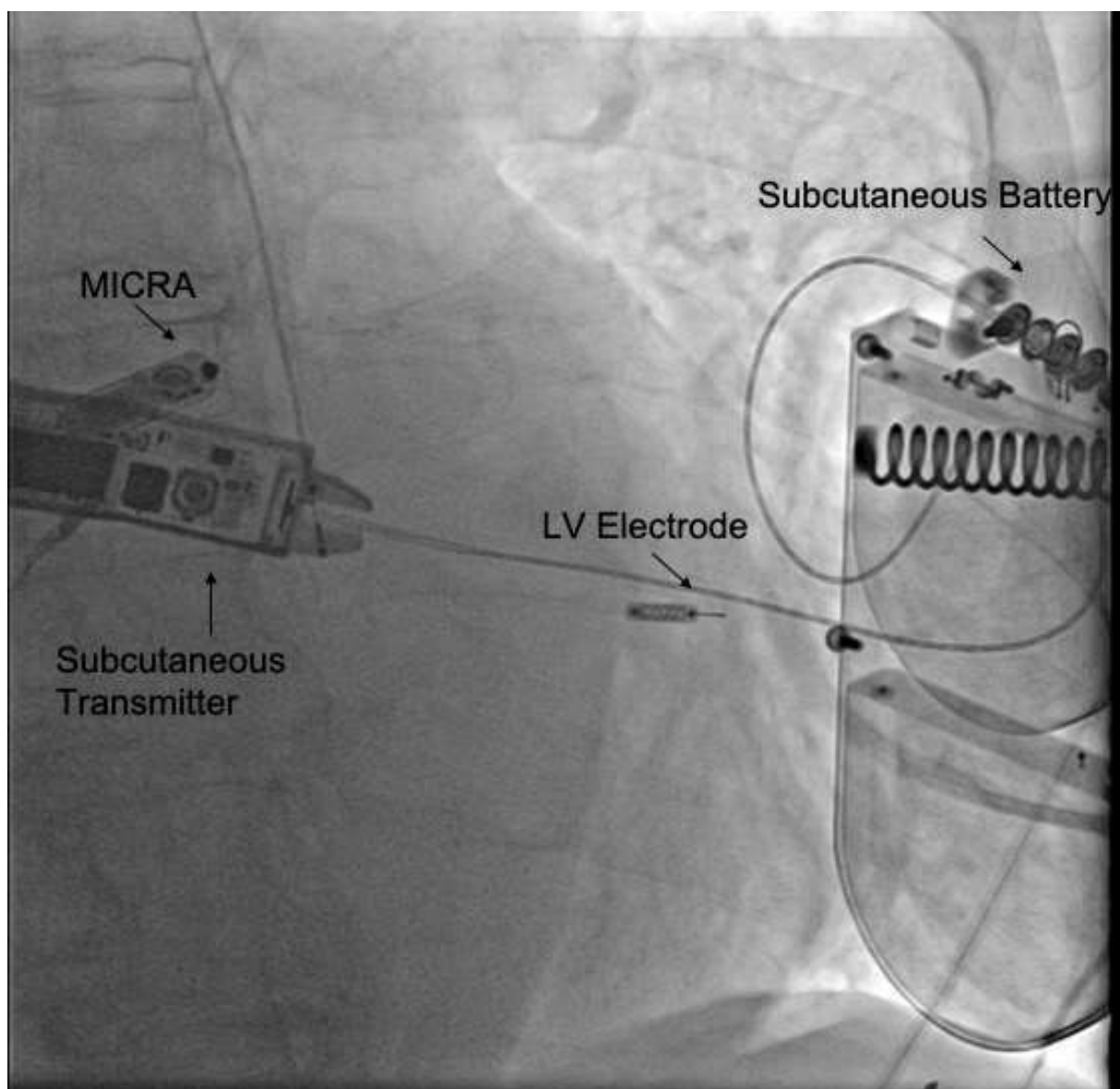
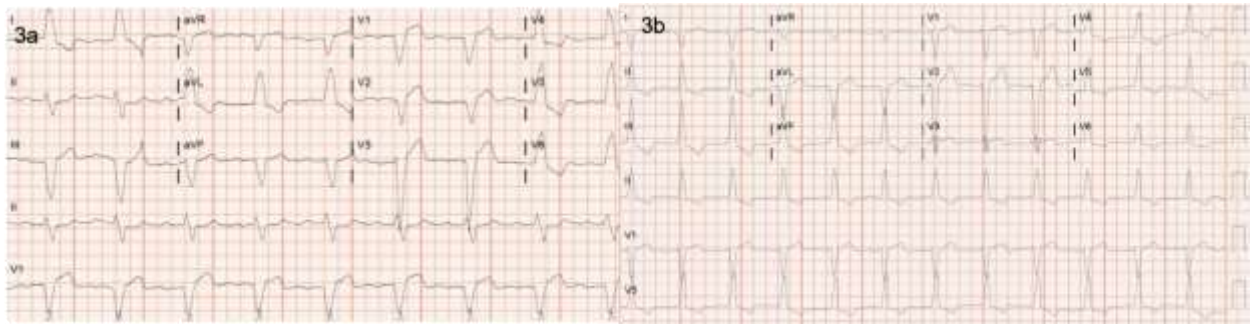


Figure 3. (a) EKG pre procedure (b) EKG post CRT



Outcomes of His-bundle Pacing in Patients With Complete Heart Block: a Propensity Score-matching Study

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His bundle pacing (HBP) can be technically challenging compared to conventional right ventricular pacing. Utilization of an electrophysiology recording system (EPRS) can aid visualization of intracardiac signals, in particular His signals. We sought to evaluate the acute procedural and medium-term outcomes of HBP in patients with complete heart block (CHB), comparing those with or without EPRS in a propensity score-matched (PSM) cohort.

This was a PSM multicenter study on consecutive patients with CHB who underwent HBP between August 2018 to December 2020. The primary outcome was the acute HBP procedural success defined as either selective or non-selective His bundle capture with a threshold of $\leq 2.0V$ at 1ms at the end of procedure implantation. Secondary outcomes included acute procedural complications and medium-term follow-up outcomes of HBP lead performance, heart failure hospitalization and all-cause mortality.

A total of 130 CHB patients were recruited for the study, of which HBP was performed with HPRS in 37 patients (28.5%) and without HPRS in 93 patients (71.5%). After PSM, the acute success rate of HBP was similar between both groups (ATT= -0.367; SE=0.218, p=0.09). Acute procedure complication rate was also similar. After a mean follow-up duration of 238.1 $\pm$ 210.6 days, there were no significant differences in HBP lead performance, in particular incidence of high pacing threshold >3V at 1ms (ATT= -0.110; SE=0.199, p=0.58), heart failure hospitalization (ATT= -0.015; SE=0.013, p=0.23) or all-cause mortality (ATT= 0.038; SE=0.079, p=0.63).

HBP in CHB patients in centers with or without HPRS showed similar acute procedure success and complication rates.

A Case of Right-sided Permanent Pacemaker Implantation After Venoplasty of the Superior Vena Cava Stenosis

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¹*Philippine General Hospital, Ermita, Philippines*

OBJECTIVES

To present a case of a right-sided permanent pacemaker implantation after balloon venoplasty of the superior vena cava stenosis with development of acute cardiac tamponade.

MATERIALS AND METHODS

RESULTS

A 42-year-old Filipino female, hypertensive, CKD stage V on hemodialysis, presented with dizziness and loss of consciousness. Electrocardiogram showed sinus rhythm in third degree AV block with junctional escape rhythm. She was advised for permanent pacemaker implantation (PPI) with right-sided implant due to the presence of arteriovenous (AV) fistula on the left arm. However, her venogram showed stenosis of the superior vena cava (SVC). Patient underwent successful venoplasty of the SVC and right-sided single chamber PPI. Intraoperatively she developed acute cardiac tamponade due to RV perforation, emergent ventriculorrhaphy with subxiphoid pericardial window was done. Patient was sent home after five days improved and stable.

SVC stenosis is a common complication among patients with hemodialysis access. In PPI, the left subclavian vein is accessed and advanced to the SVC to position the leads in the right atrium and right ventricle. Pacemaker implantation after balloon venoplasty of SVC stenosis is uncommon and there are few published case reports.

CONCLUSION

We have demonstrated that balloon venoplasty of a superior vena cava stenosis to facilitate a right-sided permanent pacemaker implantation may be done successfully and that acute cardiac tamponade secondary to right ventricle perforation during lead insertion is one of the risks that should be anticipated which required urgent evaluation and treatment.

A Case of Wolff-Parkinson-White Syndrome in Ebstein Anomaly

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Objective

We present a case of a 25 year old female with known Ebstein Anomaly presenting with palpitations who underwent successful radiofrequency ablation.

Results

A 25 year old female consulted at outpatient clinic due to palpitations, lightheadedness and near-syncope. Resting ECG showed Wolff-Parkinson-White Pattern with a negative delta wave on V1, an R/S ratio of <0.5 in V1 and V2 and <1 in aVF pointing to a right-sided posterior or posterolateral accessory pathway (AP). 2D-echo showed apical displacement of the tricuspid valves towards the right ventricular apex and right ventricle atrialization suggestive of Ebstein Anomaly. She eventually underwent electrophysiological study where inducible orthodromic atrioventricular reentrant tachycardia was noted. Conventional radiofrequency ablation of AP was successfully done at 7 o'clock of the tricuspid valve with loss of antegrade conduction and at 6 o'clock position with loss of retrograde conduction. She improved with no pre-excitation on ECG.

One week post-RFA, she complained of palpitations and had incessant supraventricular tachycardia. Redo radiofrequency ablation of AP in the tricuspid valve annulus at the 6 o'clock position guided by 3D mapping was done. She was sent home improved and planned for definitive surgery.

Conclusion

Accessory conduction pathways are common in patients with Ebstein Anomaly. It may be due to the expanded tricuspid annular region caused by displacement of the tricuspid valve. Electrophysiologic testing followed by ablation therapy is recommended. Early recurrence of arrhythmia post-RFA might be related to multiple accessory pathways and use of fluoroscopy without a 3-dimensional electroanatomic mapping system.

Conduction System Pacing using Stylet Driven Lead guided by Deflectable Mapping catheter: Single Centre Experience

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¹*The Madras Medical Mission Hospital, Chennai, India, Chennai, India*

OBJECTIVES

Conduction system pacing (CSP) in the recent years is being considered as an ideal pacing strategy. Lumenless leads (LLLs) have been the only used technology since the inception of CSP until recently. We herein share the largest single centre experience of SDL using deflectable mapping sheath, a recent technology for conduction system pacing at both HB and LB areas, and their medium-term outcomes.

MATERIALS AND METHODS

Patients with pacing indications according to the ESC guidelines enrolled between June 2021 - July 2022. The aim of this study to evaluate safety and feasibility of CSP using SDL guided by mapping and deflectable delivery sheath by analyzing the implant tools, electrical parameters during implant and follow- up.

RESULTS

A total of 30 patients with mean age of 67.16 +/- 9.89 years (16males, 53.3%), The indications were SSS (7 patients, 23.0%) and CHB (23 patients, 76.6%), CSP was achieved in 80% of the patients (11 His bundle pacing, 11 Left bundle pacing). Acute procedural failure is 20% (5 Septal pacing, 2 RV apical pacing, 1 LLL). The mean fluoroscopy time was 45mins .The QRS width pre and post-procedure was 118.9ms and 116.8ms, respectively. The average implant electrical parameters were pacing threshold 1.08V; R wave amplitude; 7.09 +/- 3.36 m, pacing impedance 632+/- 183ohms remained stable at 3 months follow-up.

CONCLUSION

The use of SDL is adequate for both HB and LB areas. Reshaping the catheter can help in achieving better results in CSP and also lower the overall procedure time.

SUPPORTING DOCUMENTS

No	Age/ Gender	Underlying structural heart disease	PDM Initiation	DID	LVEF	CSP +/- CRT	Result	His/LB signal on lead	R-wave (mV)	Bipolar threshold @0.4 ms	Intrinsic QRSd	Paced QRSd	Procedure time (min)
1	68M	Ischemic cardiomyopathy	CHB with RBBB escape	Yes	28%	HO/CRT	S-13P	Yes	4.0	2.75V	150ms	130ms	180
2	68M	Brugada/Long QT Syndrome	Asymptomatic CHB	No	66%	BBP	NO/BBP	No	10.0mV	1.8V	140ms	110ms	88
3	70F	None	Intermittent LAF block	No	58%	BBP	NO/BBP	Yes	6.0mV	1.8V	80ms	100ms	94
4	57M	Non-ischemic cardiomyopathy	Sinus bradycardia LBBB	No	28%	HO/CRT	S-13P	Yes	5.0mV	1.5V	150ms	110ms	100
5	69F	None	S-1 AV block, intrinsic over-QRS	Yes	68%	BBP	NO/BBP	Yes	6.0mV	1.8V	130ms	110ms	80
6	69F	None	S-1 AV block, intrinsic over-QRS	No	68%	BBP	NO/BBP	Yes	10.0mV	2.0V	130ms	80ms	88
7	57M	None	Degenerative high grade AVB	No	66%	BBP	NO/BBP	Yes	6.0mV	1.1V	130ms	110ms	90
8	76M	None	S-1 AV block	Yes	68%	LBBAP	S-13BP	No	7.0mV	2.0V	110ms	100ms	106
9	69F	None	Sick sinus syndrome	Yes	68%	LBBAP	NO-LBBAP	Yes	9.0mV	1.8V	130ms	100ms	70
10	69F	Hypertensive heart disease	Permanent AF, Post-AMMI dilation	No	68%	BBP	NO/BBP	Yes	6.0mV	1.8V	130ms	110ms	84
11	68M	None	Sick Sinus Disease	No	68%	BBP	NO/BBP	Yes	9.0mV	1.1V	80ms	80ms	90
12	68M	Ischemic Cardiomyopathy	Sick sinus syndrome	Yes	20%	HO/CRT	S-13BP	No	8.0mV	1.3V	150ms	110ms	160
13	68M	Ischemic cardiomyopathy/TVD	VT (rare)	Yes	28%	LOTT/CRT (changed to MOD/LL)	NO-LBBAP	No	7.0mV	2.5V	160ms	140ms	108
14	60F	None	CHB with LBBB escape	Yes	68%	LBBAP	NO-LBBAP	No	8.0mV	2.75V	160ms	110ms	108
15	70F	None	CHB with RBBB escape	No	68%	RBBAP	RBBAP	No	N/A	N/A	140ms	140ms	104
16	55M	None	High grade AV block with RBBB escape	Yes	68%	LBBAP	Depnd	No	5.0V	N/A	140ms	140ms	120
17	70F	None	CHB with RBBB escape	No	68%	RBBAP	RBBAP	No	7.0mV	N/A	110ms	140ms	108
18	53M	None	CHB with junctional escape	No	68%	BBP	NO/BBP	No	5.0mV	1.25V	130ms	110ms	65
19	68M	None	Sick Sinus syndrome	No	68%	LBBAP	NO-LBBAP	No	6.0mV	1.1V @ 1ms	80ms	110ms	70
20	68M	None	CHB with RBBB escape	No	68%	Depnd	Depnd	No	6.0mV	N/A	130ms	110ms	84
21	66F	None	High grade AV block with Nonover QRS escape	No	68%	LBBAP	NO-LBBAP	No	6.0mV	2.25	110ms	110ms	91
22	76M	None	CHB with RBBB escape	No	27%	LBBAP	S-LBBAP	No	4.0mV	1.1V	110ms	110ms	70
23	69F	None	CHB with RBBB escape	No	68%	BBP	NO-LBBAP	No	8.0mV	0.7V	130ms	110ms	104
24	68M	HCM	CHB with RBBB escape	No	40%	BBP	NO/BBP	No	8.0mV	0.7V	150ms	110ms	90
25	68M	ICMP	CHB with nonover escape	Yes	68%	BBP	Depnd	No	N/A	N/A	80ms	100ms	110
26	52F	None	High grade AV block with Nonover QRS escape	No	68%	LBBAP	S-LBBAP	Yes	11.0mV	2.7V	80ms	110ms	100
27	60F	None	Sick Sinus Disease	No	68%	LBBAP	NO-LBBAP	Yes	1.0mV	0.75V	110ms	100ms	108
28	60F	None	Paroxysmal AVF block	No	68%	LBBAP	NO-LBBAP	Yes	10.0mV	0.7V	140ms	100ms	118
29	70M	None	Intermittent CHB	No	58%	Depnd	Depnd	No	10.0mV	0.7V	110ms	100ms	80
30	45F	None	Exaggerated degenerative high degree AVF block	No	68%	Depnd	Depnd	No	1.0mV	0.75V	110ms	100ms	108

Left Bundle Optimized Implantable Cardioverter Defibrillator In-Lieu of Cardiac Resynchronization Therapy – Defibrillator

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OBJECTIVES

To discuss the feasibility and efficacy of Left Bundle Branch Area Pacing (LBBAP) Optimized Implantable Cardioverter Defibrillator (LOT-ICD) in patients indicated for Cardiac Resynchronization Therapy Defibrillator (CRT-D).

MATERIALS AND METHODS

Patients with LBBB, LVEF<35%, and NYHA class II-III qualify for CRT-D. We discuss the population of people in which the conventional Coronary Sinus (CS) lead was replaced with LBBAP lead due to challenges associated with CS anatomy. During the procedure 1 (10%) CS dissection, 3 (30%) Sub-Optimal CS tributaries, 4 (40%) Difficult CS anatomy, 2 (20%) High LV threshold, and Phrenic Nerve Stimulation were noted. Due to these challenges, we opted for a Left bundle Optimized ICD (LOT-ICD) using Lumenless Leads for 9 (90%) and Stylet-Driven Lead for 1 (10%) patients. 5 patients were followed up using Remote Monitoring (RM). Procedural success and adverse event from RM were analyzed.

RESULTS

A total of 10 patients (Male: 6 (60%), Female: 4 (40%), Mean age: 65±10.5 years), ICMP: 4 (40%), NICMP: 6 (60%), Mean LVEF: 25.6±5.56%, were selected for CRT-D but underwent LOT-ICD implantation due to procedural difficulties. 6 (60%) patients had been implanted for primary prevention and 4 (40%) for secondary prevention. The average Intrinsic QRS: 147.8ms, Paced QRS: 134.2ms and R wave: 9.45mV were noted. 4 (40%) Selective LB capture, 4 (40%) Non-Selective LB capture, 2 (20%) Myocardial capture, LB threshold: 0.75V. 1 (10%) Therapy were noted.

CONCLUSION

Procedural difficulties and CS anatomy limit the outcomes of CRT-D implantation. LOT-ICD implantation in these patients helps in achieving resynchronization with adequate procedural outcomes.

Short Term in Hospital Results of CIED Extraction: a Retrospective Single Center Observational Study

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OBJECTIVES: To study the spectrum of indications, Procedural and In Hospital outcomes of CIED extraction.

MATERIALS AND METHODS: This is a retrospective single centre study done at our centre. The patients who underwent CIED extraction (Complete or incomplete) from September 2019 to August 2022 were included in the study. The procedural and post procedural outcomes in these patients was studied.

RESULTS: 26 patients with mean age of 61.8±13.9yrs were included in the study. 19 (73%) of them were males. Hypertension (69.2%) was the commonest risk factor. Most of them underwent extraction for CIED infection except in two subjects. Mean duration from implantation to explantation was 86.84 months. 8 Were CRT (2 CRT-P, 6 CRT-D), 3 were ICD and 15 were pacemakers. 16 underwent complete extraction. Lead removal was not attempted in 3 subjects due to high risk. In 07 subjects, extraction was failed. Extraction tools were used in 11 subjects. Tools used were Endovascular Spectranics Tight Rail Rotating Dilator Sheath extraction kit and Snare from the femoral site (3 cases). The success was more with Screwing leads (80%) when compared to tined leads (64%). One patient died during extraction of ICD due to cardiac tamponade.

CONCLUSION: CIED Extraction is a complicated procedure but results are good if planned well. We have a very good Success rate with procedural and In hospital mortality rate of 3.8%. Our study is limited being a single centred and retrospective in nature.

Electrocardiographic Characteristics of Left Bundle Branch Area Pacing versus Left Bundle Optimized Cardiac Resynchronization Therapy

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SUPPORTING DOCUMENTS

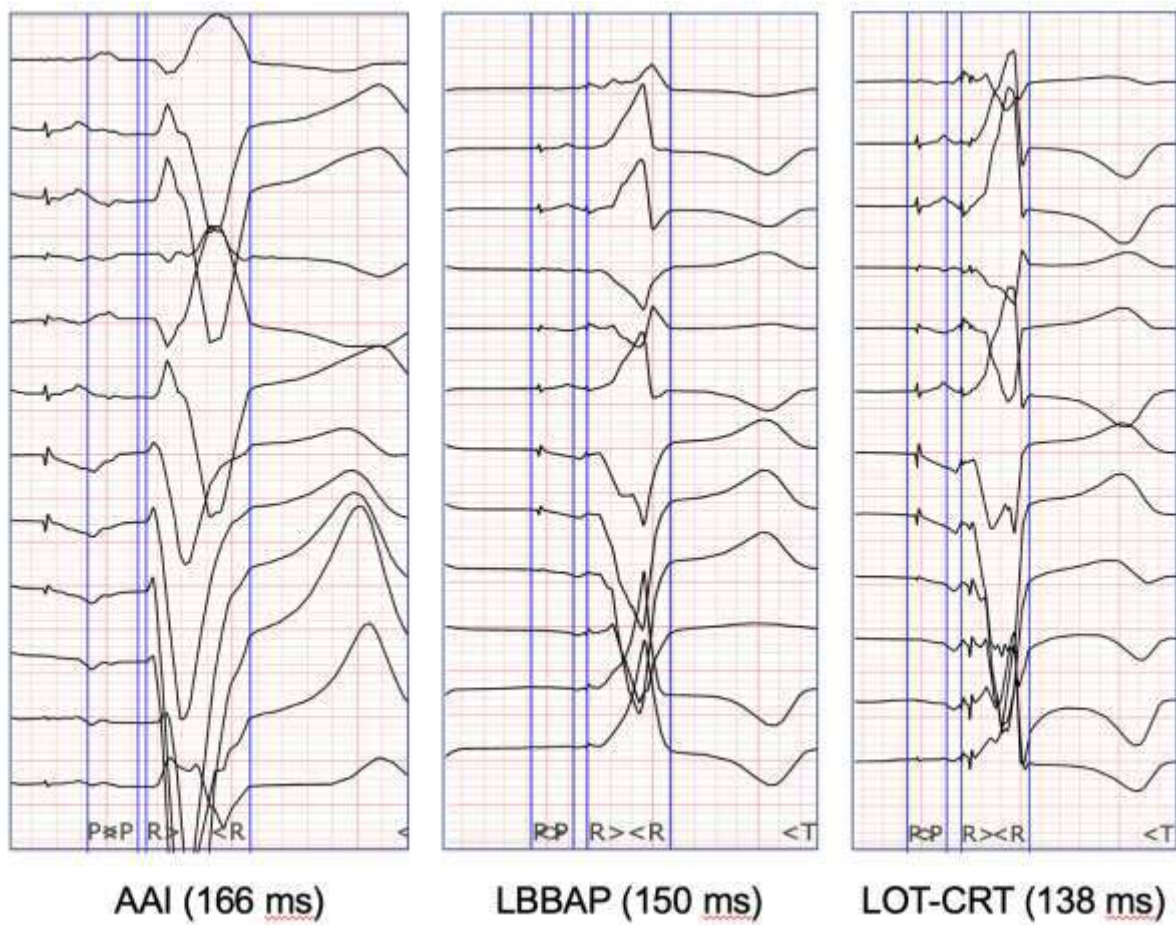
Objectives: To compare the electrocardiographic characteristics between Left Bundle Branch Area Pacing (LBBAP) and Left Bundle Optimized Cardiac Resynchronization Therapy (LOT-CRT).

Materials and Methods: Patients with non-ischemic cardiomyopathy and left bundle branch block with left ventricular ejection fraction < 35% who underwent LOT-CRT with implantation of an atrial lead, a left bundle lead and a coronary sinus lead were included in this prospective observational study. Digital 12 lead electrocardiograms were recorded in three pacing modes – AAI, DDD with pacing from the left bundle lead (LBBAP) and DDD with pacing from both left bundle and left ventricular leads (LOT-CRT). QRS duration (QRSd), QT, JT and T peak–T end (TpTe) intervals were compared between the three modes.

Results: 11 patients (Mean age 52 years; 63% males) were included in this study. LOT-CRT resulted in a narrower QRS compared to LBBAP and a significant reduction of QRSd compared to AAI (175.8 ± 29.6 ms to 152.3 ± 19 ms; $P=0.04$), unlike LBBAP (163 ± 27.9 ms; $P=0.26$). Patients with a wider QRS at baseline had a greater incremental reduction in QRSd with LOT-CRT ($R=0.76$, $P=0.02$). There was no difference in QT and JT intervals between the three groups. Compared to baseline and LBBAP, TpTe interval was significantly reduced with LOT-CRT (97, 83.7 and 72.9 ms respectively; $P=0.04$)

Conclusions: An additional left ventricular lead over and above left bundle branch area pacing alone for cardiac resynchronization therapy results in a narrower QRS. This is likely to result in better long term outcomes.

Figure 1 : Representative image from one of the patients showing a baseline QRS width of 166 ms, which reduced to 150 ms with LBBAP and to 138 ms with LOT-CRT



Initial Real-world Experience With a Helix-based Ventricular Leadless Pacemaker: Single Center Experiences

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Objectives: Approximately 1 in 6 conventional, transvenous pacemaker patients experience complications within the first 3 years post-implant. Many of these complications, specifically those involving the lead or subcutaneous pocket, may be avoided with leadless pacemakers (LPs) implanted entirely within the target chamber. This study evaluated the initial commercial experience of a novel single-chamber, ventricular LP (Aveir VR, Abbott), designed with a helix-based fixation mechanism.

Methods: Patients implanted with an Aveir VR device were consecutively included in this evaluation after the commercial release of the product in the United States. Implant procedural durations and electrical parameters were measured, along with any acute procedure related complications.

Results: Patients from a single center (N=27, 56% male) were implanted with an Aveir VR LP. The median [interquartile range] total procedure duration was 23 [20-29] min, with a fluoroscopy duration of 4 [4-6] min. By employing Aveir's electrical mapping capability prior to fixation (1 site mapped in 74% of patients, 2 sites in 26%), repositioning after fixation that can potentially lead to clinical complications was avoided in 96% of pts. LPs were implanted in the lower (96%) or mid (4%) RV septum. Pacing capture threshold @ 0.4 ms, R-wave amplitude, and pacing impedance were 0.8 [0.5-1.3] V, 10.0 [8.1-12.7] mV, and 750 [623-955] Ω . No acute complications were observed in this initial cohort.

Conclusion: The initial, real-world, single-center experience of Aveir VR leadless pacemakers with mapping capability demonstrated safe and efficient implantation with minimal repositioning, viable electrical metrics, and no acute complications.

SUPPORTING DOCUMENTS



Cardiac Resynchronization Therapy with 2-leads: A Comparison with the Conventional 3-lead System in Clinical Practice

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OBJECTIVES

Our aim was to compare electrical parameters, pacing percentages, and lead-related complications among patients treated with a conventional 3-lead cardiac resynchronization therapy defibrillator (CRT-D) or a 2-lead system (CRT-DX) with an atrial sensing dipole integrated into the right ventricular lead.

MATERIALS AND METHODS

We retrospectively analyzed consecutive patients without indication for atrial pacing who underwent CRT implantation at our institution. We included devices from a single manufacturer provider of the DX technology to avoid this potential confounding factor in device diagnostics comparison. Study endpoints were assessed at 1-month follow-up.

RESULTS

Forty-seven heart failure patients (median age 71 [interquartile range, 66-77] years, 68% men) were implanted between 2017 and 2021 according to guidelines, 12 with a CRT-D and 35 with a CRT-DX. Baseline clinical characteristics were similar between groups. At 1-month follow-up, there were no differences in all electrical parameters of the right and left ventricular leads, but also in the atrial sensing amplitude (CRT-D 2.7 (1.8-4.7)mV vs. CRT-DX 2.6 (1.3-3.6)mV, $p=0.42$). A high amount of delivered CRT was observed in both groups (99% [93%-100%] vs. 98% [87%-99%], $p=0.24$). CRT-D devices were programmed with a basic rate of 50 beats-per-minute showing a very low percentage of atrial pacing (0% [0%-10%]). No lead-related complications were observed in the CRT-DX group, whereas an atrial lead dislocation occurred in the CRT-D group.

CONCLUSION

The 2-lead CRT-DX technology may be considered as an effective treatment option in patients without the need for atrial pacing, allowing to avoid atrial lead-related complications.

Permanent His Bundle Pacing: Comparison of Four Implantation Techniques

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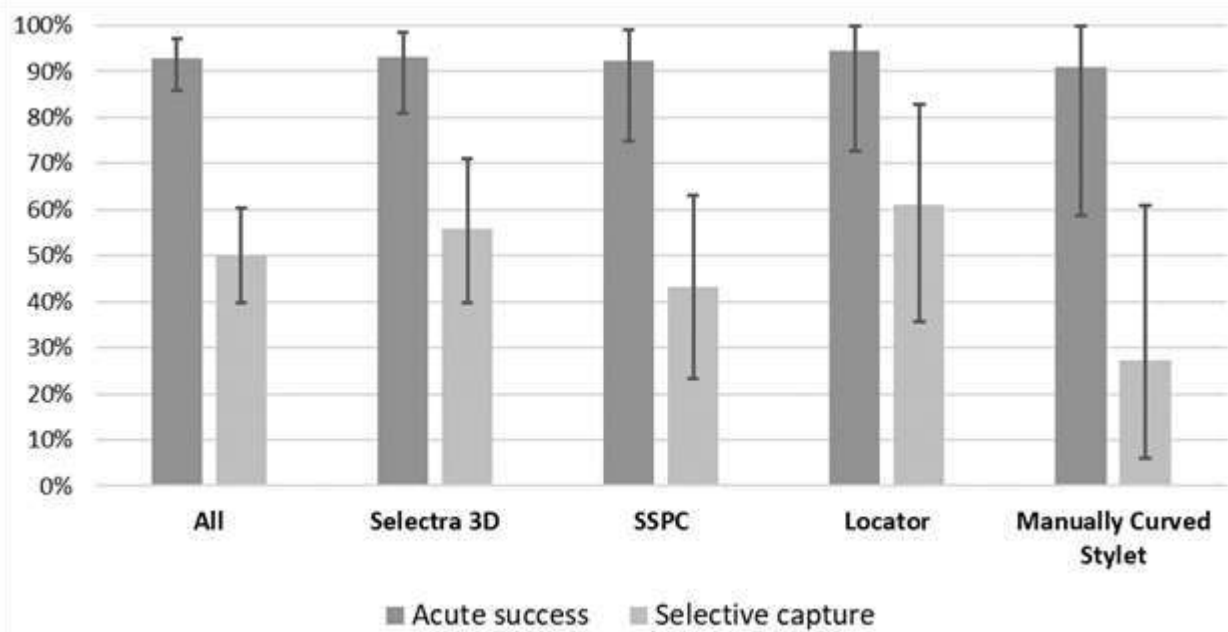
OBJECTIVE: The purpose of this study was to describe acute performance, safety, and effectiveness of His Bundle Pacing (HBP) implantations using four different systems: the Biotronik Selectra 3D sheath with Solia S60 lead (Selectra 3D), the Boston Scientific Site Selective Pacing Catheter with Ingevity lead (SSPC), the Abbott steerable stylet locator with Tendril lead (Locator), and the use of a standard stylet manually pre-shaped with conventional lead (Curved stylet).

MATERIALS AND METHODS: We included all consecutive patients who underwent permanent HBP attempt in our initial experience between June 2020 and May 2022. The procedure success, characteristics and complications were compared among the implantation techniques.

RESULTS: Ninety-eight pacemaker patients (median age 79 [interquartile range, 73-83] years, 83% men) were identified. The Selectra 3D technique was used in 43 procedures (44%), SSPC in 26 (27%), Locator in 18 (18%) and Curved stylet in 11 (11%). The groups had similar clinical characteristics. Overall, acute procedural success was achieved in 91 patients (93%) with similar proportions among groups ($p=0.986$). Fluoroscopy and procedural times were 6.0 (4.4-8.5) and 60 (45-75) minutes, respectively, without significant differences ($p=0.333$ and $p=0.790$). The rate of selective capture (50%), the pacing threshold (0.60 [0.50-0.75] V), and the paced QRS duration (112 [97-13] ms) were also comparable. There was one pre-discharge HBP lead dislodgment (1%) which required implant revision.

CONCLUSION: In our experience, four techniques for HBP achieved comparable results in terms of safety and effectiveness. The availability of different systems may lead to widespread use of physiological pacing.

SUPPORTING DOCUMENTS



Long-term Prognosis Following Transvenous Lead Extraction: Insights from a Single-center Registry

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OBJECTIVE: The purpose of this analysis was to investigate the long-term prognosis following transvenous lead extraction (TLE).

MATERIALS AND METHODS: We retrospectively studied all consecutive CIED patients who underwent TLE between January 2014 and January 2016 followed in our institution. The primary outcome was the composite endpoint of time to death or repeated TLE stratified by the presence of infection; secondary outcomes included individual components.

RESULTS: Of the 191 patients (85% male, median age 70 years) who underwent TLE, 96 (50%) had infection and 95 (50%) were extracted for a different reason. Complete procedural success was achieved in 189 patients (99%) with no major complications. During a follow-up of 6.5 (5.4 – 7.1) years, infectious indication was associated with a significantly lower event-free survival (67% vs 83%; adjusted hazard ratio [aHR] 1.97, 95% confidence interval [CI] 1.02–3.81, P=0.04). The difference was significant also considering the death component (30% vs 10%, log-rank P<0.01); while the rate of re-repeated TLE was similar (4% vs 7%, P=0.62). In the infectious group, the presence of vegetation (aHR 2.56; 95% CI 1.17–5.63, P=0.02) and positive blood cultures (aHR 2.64; 95% CI 1.04–6.70, P=0.04) were independently associated with the primary outcome.

CONCLUSION: Our long-term data showed a higher combined death or repeated TLE endpoint for patients who underwent TLE with infectious compared to those with a different indication. In the subgroup of infectious patients, the presence of vegetation and positive blood cultures were associated with poor prognosis despite an uncomplicated extraction and appropriate therapy.

Effects of Envelopes on CIED Pocket Healing: a Head-to-head Preclinical Evaluation

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Objectives: The body's immune response to cardiac implantable electronic device (CIED) implantation results in capsule formation with healthy surrounding tissue. Alternatively, chronic inflammation and infection can disrupt healing, cause pocket instability, and increase morbidity and cost, while complicating future interventions. This study compares the CIED pocket healing effects of the recently developed third-generation TYRX absorbable antibacterial envelope (T3) vs. the CanGaroo envelope derived from porcine extracellular matrix (ECM).

Materials/Methods: CIEDs were implanted in an ovine model with T3 or ECM per manufacturer's instructions or with no envelope (control). At least one control was implanted per animal. Across 21 sheep, 90 CIED pockets were evaluated (T3=32, ECM=20, control=38). Morphometric and histopathologic analyses were completed for pockets at 3 days, 7 days, 4 wks, 12 wks and 24 wks post-implant. An independent pathologist completed blinded histopathology assessment of tissue blocks using ISO 10993-6:2016 scoring standards.

Results: The healing process peaked early at 4 wks for T3 (lymphocytes=1.4, macrophages=2.4) compared to ECM (lymphocytes = 2.7 at 24 wks, macrophages = 3.0 at 12 wks). ECM had consistently elevated lymphocytes compared to T3 through 24 wks (T3=0.5, ECM=2.7, Control=0.5), suggesting ongoing inflammation. Capsule thickness decreased over time for all groups from 4 wks (T3= 1.44±0.16, ECM= 2.31±0.10, Control= 0.89±0.33 mm), and T3 resulted in the thinnest mature capsules at 24 wks (T3= 0.37±0.10, ECM= 0.80±0.14, Control= 0.56±0.17 mm).

Conclusion: The TYRX T3 absorbable antibacterial envelope was associated with a more rapid healing response with less inflammation and thinner capsule formation compared to ECM.

Pre-clinical Evaluation of a Third Generation Absorbable Antibacterial Envelope

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Objectives: The TYRX Absorbable Antibacterial Envelope has been shown to stabilize implantable cardiac devices and reduce infection. A third-generation envelope (T3) has been developed to reduce surface roughness with a redesigned multifilament mesh and enhanced form factor but identical polymer coating and antibiotic concentrations as the currently available second-generation envelope (T2). We compare drug elution, bacterial challenge efficacy, stabilization, and absorption of T3 vs. T2.

Materials/Methods: Antibiotic elution was assessed in vitro and in vivo. For efficacy against gram+/gram- bacteria, 40 rabbits underwent device insertions with and without T3 envelopes. For stabilization (migration, rotation), 5 sheep were implanted with 6 devices, each in T3 or T2 envelopes. Pre-specified acceptance criteria were ≤ 83 mm migration and ≤ 90 degrees rotation. Absorption was assessed via gross pathology.

Results: Elution curves were equivalent (similarity factors ≥ 50 per FDA guidance¹). T3 eluted antibiotics above minimal inhibitory concentration (MIC) in vivo at 2hr post-implant through 7d, consistent with T2. Bacterial challenge showed reductions ($p < 0.05$) in infection with T2 and T3. Device migration was 5.5 ± 3.5 (T3) vs. 9.9 ± 7.9 mm (T2) ($p < 0.05$). Device rotation was 18.9 ± 11.4 (T3) vs. 17.6 ± 15.1 degrees (T2) and did not differ statistically ($p = 0.79$). Gross pathology confirmed absence of luminal mesh remainders and no differences in peri-device fibrosis at 9 or 12wks.

Conclusion: The T3 absorbable antibacterial envelope demonstrated equivalent pre-clinical performance compared to T2 as antibiotic elution curves were similar, elution was above MIC for 7d, infections were reduced compared to no envelope, and acceptance criteria for migration, rotation, and absorption were met.

The Lower Complications Rate after Pacemaker Implantation - a Real-World Observation from a Low-Middle-Income Country

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OBJECTIVES: We aimed to study the pattern and frequency of complications of implants over a 10-year period at a tertiary care hospital in a low-middle-income country.

MATERIAL AND METHODS: A retrospective observational study was conducted at the Aga Khan University Hospital, Pakistan, after obtaining the institutional ethical review committee approval (5343-Med-ERC-18). All patients who underwent PPM implantation, from 2008 to 2018, were included. Statistical Package for Social Sciences (SPSS), version 23 was used for analysis.

RESULTS: Out of 795 patients, 424(53.3%) were males. The mean age at implantation was 70.8 ± 12.4 years. The third-degree atrioventricular block was the indication for PPM implantation in 265(40.3 %) patients, followed by 2:1 AV block in 83(12.6%), sinus node disease in 78(11.9%), high degree AV block in 75(11.4%) and tachy-brady syndrome in 62(9.4%) patients undergoing a new implant. There were a total of 138 generator changes for end-of-life or elective replacement indication. The overall complication rate was 4%. At a mean follow up of 82.6 weeks, complications were; lead dislodgement/displacement in 2.5% (n=20), wound infection in 1% (n=8), hematoma in 4(0.5%), pneumothorax in 2(0.2%) and access site venous thrombosis in 1(0.1%). There was no mortality due to procedure or procedure-related complications.

CONCLUSION: Our study showed that major complication rates from a tertiary care hospital in a low-middle-income country were comparable to developed global health care setups. This can be achieved if meticulous techniques and patient preparation protocols are followed.

Subcutaneous - Implantable Defibrillator (S-ICD) in the Prevention of Sudden Cardiac Death—A Single-Center Experience

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Objective:

Subcutaneous Implantable Defibrillator (S-ICD) differs from the transvenous ICD (TV-ICD) system in its extrathoracic and extravascular localization; eliminating the risks arising from vascular access, and leading to fewer complications. The objective was to describe the functionality and postoperative complications associated with S-ICD implants in patients with cardiac dysfunctions.

Methods: The study sample comprised six patients indicated for S-ICD due to either anterior wall myocardial infarction (MI) or left ventricular dysfunction who reported to a Tertiary Cardiac Care Center. Pre-procedural evaluation for various cardiac parameters was carried out. The procedure was performed under antibiotic prophylaxis. Two incision technique were used for the placement. The primary and secondary endpoints for the cases were set at evaluating the device-related complications and evaluating prognostic outcomes, respectively.

Results: Subcutaneous Implantable Defibrillator (S-ICD) was placed in six male patients with ages ranging from 36 to 51 years. The procedure demonstrated that it was effective, safe, and well tolerated in eliminating ventricular tachycardia/ventricular fibrillation and sudden cardiac death. Postoperative complications such as device infection, pocket hematoma, blood transfusion, prolonged hospitalization, cardiac perforation or tamponade, lead repositioning, or inappropriate shocks were not seen.

Conclusion: Subcutaneous Implantable Defibrillator (S-ICD) promises to be a suitable alternative to TV-ICD, especially in young patients. It circumvents the need to enter the heart and vasculature, resulting in fewer lead-related complications, better cosmetic appearance, and greater comfort as it permits free movement of the shoulder.

Worldwide Experience with Leadless Pacemaker Retrievals

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OBJECTIVES

Chronic retrievability is critical for long-term management of patients with Leadless cardiac pacemakers (LPs). Herein, we report worldwide chronic retrieval data of the Nanostim LP system out to nine years.

MATERIALS AND METHODS

Subjects enrolled in any of three Abbott-sponsored worldwide clinical trials (www.clinicaltrials.gov, NCT02051972, NCT02030418, and NCT01700244) that received a Nanostim right-ventricular LP and had an attempted retrieval were included in the analysis. Sites collected data for retrieval attempts and documented serious or unexpected adverse device effects (SADEs/UADEs) associated with the retrieval procedure. An independent clinical events committee (CEC) adjudicated all SADEs/UADEs.

RESULTS

A total of 1423 Nanostim LPs were successfully implanted across the three studies. There were 241 Nanostim retrievals attempted in 239 subjects between March 2014 and March 2022. The retrieval success rate was 88.0% (212/241) with 29 unsuccessful retrievals. The most common reason for unsuccessful retrieval was inability to access the LP docking button (75.9%, 22/29). Other unsuccessful retrievals were due to inability to deliver retrieval catheter (3), detached docking button (2), inability to remove retrieval snare (1), and inability to unscrew the LP from the ventricle wall (1). The mean time from implant to attempted retrieval was 3.09 ± 1.84 years (range 0 days - 8.98 years). There was no significant difference in time from implant to successful retrieval versus unsuccessful retrieval ($p = 0.71$). There were 10 SADEs and a UADE adjudicated in 9 subjects (3.8%, 9/239).

CONCLUSION

Worldwide experience with Nanostim LP retrieval attempts in 239 subjects demonstrate high success rate (88.0%).

Utility of Cardiac Implantable Electronic Device Algorithm in Sleep Apnoea Screening for Patients With Cardiomyopathy

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Objective

Half of patients with heart failure are estimated to have sleep apnoea. However, many are undiagnosed as they do not report typical symptoms. This study aims to validate the inbuilt ICD sleep apnoea algorithm in a cohort of multi-racial Asian patients for detecting severe sleep apnoea.

Materials and Methods

In this prospective pilot study, twenty-four participants who fulfill ACC indication for implantable cardiac defibrillator (ICD) of primary or secondary prevention of sudden cardiac death were recruited. Participants had no history of sleep apnoea. The Boston Scientific ICD has an inbuilt Apnoea Scan (AP Scan) algorithm that uses transthoracic impedance sensing to calculate a respiratory disturbance index (RDI). Using the AP Scan algorithm, we aim to validate its sensitivity and specificity against the gold standard polysomnography (PSG).

Results

Twenty-four patients were enrolled and underwent PSG exam for formal investigation for OSA, and eighteen participants completed the study as of 23/08/2022. Severe sleep apnoea (defined as PSG-AHI ≥ 30 episodes/h) was diagnosed by PSG in 66.7% of the patients. RDI was found to have a positive correlation with PSG-AHI ($r = 0.519$, $p < 0.05$). The optimal cut-off value for RDI for severe sleep apnoea is 41, with a sensitivity of 58% and specificity of 100%.

Conclusion

Transthoracic impedance sensing with an advanced inbuilt algorithm may be helpful in helping to detect severe sleep apnoea in patients with heart failure and cardiomyopathy. This is the first study known to validate the algorithm in an exclusively multi-ethnic Asian population with heart failure.

Long Term Follow-up After Left Bundle Branch Pacing

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Introduction:

Left bundle branch pacing has evolved recently as an alternative modality for cardiac resynchronization therapy though the long term follow-up data is largely unknown. The aim of our study is to assess the long-term follow-up of patients undergoing LBBP for the management of bradyarrhythmia and heart-failure.

Methods:

This was a prospective single center observational study involving consecutive patients who underwent successful left bundle branch pacing for bradyarrhythmia and as an alternative for cardiac resynchronization therapy since April 2019. LBBP was performed using C315 sheath and 3830 selectsecure lead in all patients and LBB-capture was confirmed as per standard criteria. Electrocardiographic, pacing and echocardiographic parameters were documented. In patients with heart failure, serial monitoring of left ventricular function, 6-minute walk test and NT-pro BNP were performed. Patients were followed up in device clinic at 15 days, one month and every 3 months thereafter.

Applications:

LBBP was successful in 405 out of 438 attempted patients (acute procedural success rate 92.4%). Reason for failure were inability to penetrate the septum and incomplete QRS correction requiring biventricular pacing in heart failure patients. Indications for pacing include AV block (n=174), CRT alternative (n=148), sinus node dysfunction (n=44), AV junction ablation (n=22) and pacing-induced cardiomyopathy (n=17). Procedural success rate was higher in patients with baseline narrow QRS duration (96.2%). Mean fluoroscopy duration was 15.1±8.7 minutes. Mean follow-up duration was 20.1±10.2 months. Operator learning curve for the procedure will be discussed. The procedural success rate, incidence of left bundle potential, non-selective to selective capture transition, and change in ECG and echo parameters for patients with baseline narrow QRS, LBBB and RBBB will be discussed. Pacing parameters remained stable during mean follow-up of 20.1±10.2 months. Complications noted include septal perforation during implantation, coronary artery injury, septal hematoma, pneumothorax and loss of LBB capture will be discussed. The predictors of septal perforation during implantation and loss of LBB capture during follow-up will be discussed. To the best of our knowledge this is the longest follow-up data after LBBP reported in the literature.

Next steps/Future:

LBBP is a safe, feasible and effective alternative modality to right ventricular pacing for bradyarrhythmia and biventricular pacing for cardiac resynchronization therapy. Long term follow-up data is encouraging. Pacing parameters remain stable as opposed to His-bundle pacing, hence reducing the need for re-do procedure. Future randomized trials are required to establish this cost effective therapy

SUPPORTING DOCUMENTS



The chance of redo CABG after CRT-D implantation response on Heart failure and LBBB

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-Objective:

Ischemic myocardial pathology is one of the cause of heart failure (HF) and LBBB under history of CABG and optimal medical treatment (OMT). The CRT response can improve the heart failure and the chance for redo CABG or PCI again.

-Material and Methods:

The reporting case 60-year-old male patient had history CABG and HF. He had some episodes of dyspnea and hospitalization and improved after OMT. This admission, he has had episode of dyspnea and leg edema, acute pulmonary edema, high NTproBNP and TnT-hs. The sinus rhythm with LBBB 180ms on ECG and the echocardiography showed poor LVEF 21%, severe mitral regurgitation.

The CAG showed only 1 graft support the LAD and total occlusion origin coronary artery. The strategy of RCA reopen was tried and failed.

The acute decompensated HF control with OMT under Dobutamin, CRRT was performed.

For 6 week, he still had dyspnea at rest, legs edema with Furosemide 40mg IV tid and Dobutamine.

The strategy of CRT-D implantation was performed as Class I.

After CRTD implantation, the optimized of CRT was performed with LV4 to LV2, LV-RV 20ms and SAV 100ms. The ECG showed sinus rhythm, QRS 131ms.

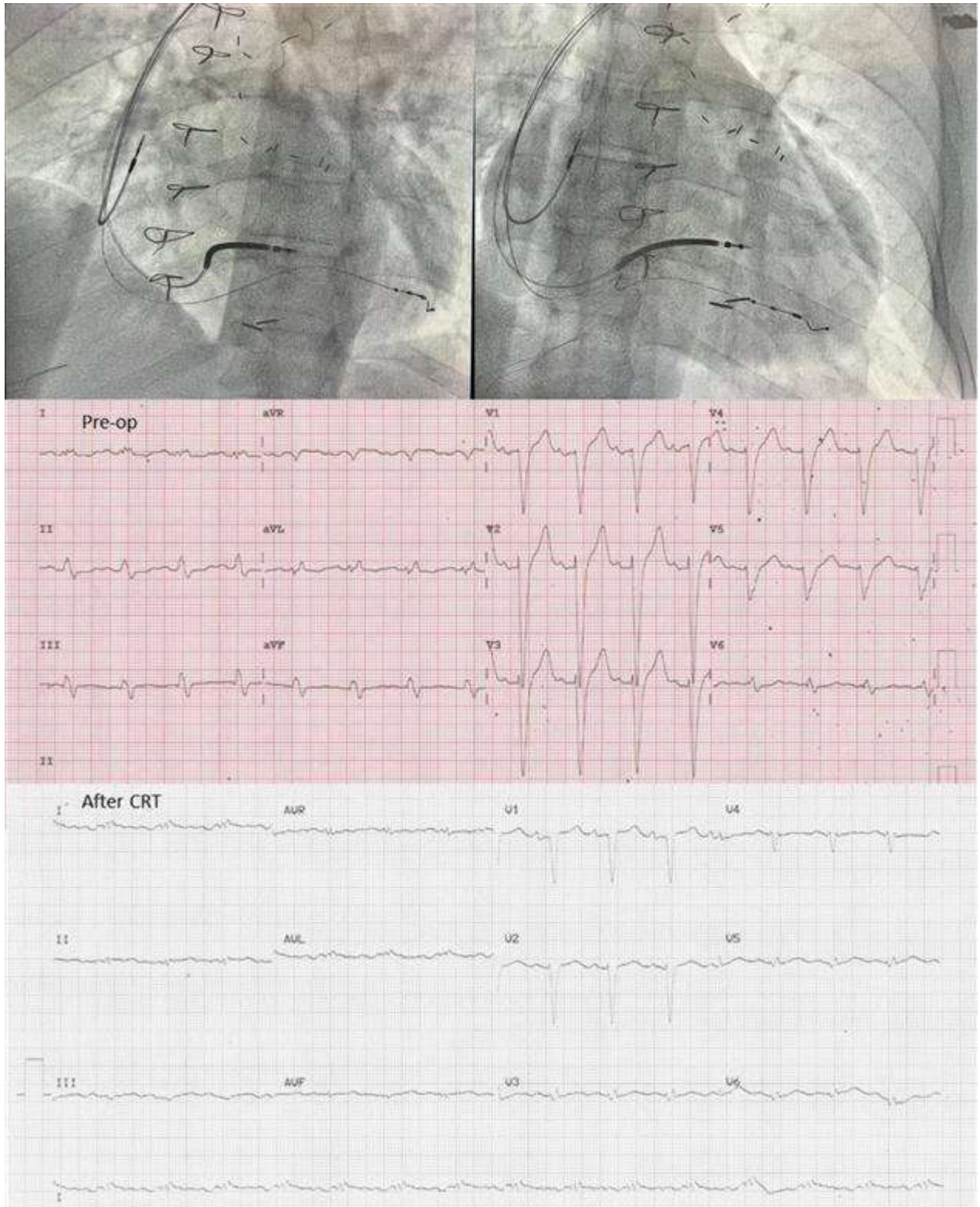
-Result:

The patient felt less dyspnea, stopped Dobutamin, transfer to the furosemide oral, controlled blood pressure, improved NYHA II, decreasingly NTproBNP, improved eGFR, add ARNI, Spironolactone. When he is better, plan trasfering to CABG once again.

-Conclusion:

The ischemic myocardial pathology was rather difficult due to akinesia of the left ventricle. So the CRT response will the chance to CABG

SUPPORTING DOCUMENTS



Permanent Reverse Remodeling After Cardiac Resynchronization Therapy In A Patient With Ischemic Heart Disease

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OBJECTIVE

To report a case of reverse left ventricular (LV) remodeling after cardiac resynchronization therapy (CRT) in a patient with ischemic heart disease.

MATERIALS AND METHODS

A 60-year-old male presented with acute decompensated heart failure and two-vessel coronary artery disease post percutaneous coronary angioplasty. Electrocardiogram (ECG) showed complete left bundle branch block with QRS duration of 160 milliseconds. (Figure 1). Pre-procedural echocardiogram showed an ejection fraction (EF) of 28%, end diastolic diameter (EDD) of 66 millimeters and end systolic diameter (ESD) of 57 millimeters. Due to recurrent episodes of acute heart failure despite optimal guideline directed medical therapy, we decided to do CRT-P implantation.

The multipolar LV lead was advanced to the posterolateral vein, with the other leads placed at the right ventricular (RV) apex and right atrial appendage with acceptable threshold. The CRT-P was programmed as DDD multipoint pacing, with LV2 to LV4 at 5 milliseconds and LV to RV at 60 milliseconds.

RESULT

Nine months after the procedure, the patient came for routine follow up without complaints of any symptoms. ECG showed narrow QRS complexes with rS pattern in V1 suggesting normal septal activation (Figure 2). After the mode was changed to ODO, the QRS complexes were persistently narrow with QRS duration of 80 milliseconds, indicating LV reverse remodeling. Echocardiographic assessment showed an improvement in EF to 43%, EDD of 45 millimeters and ESD of 36 millimeters.

CONCLUSION

The use of CRT can induce electrical and mechanical reverse remodeling permanently even if pacing ceases.

SUPPORTING DOCUMENTS

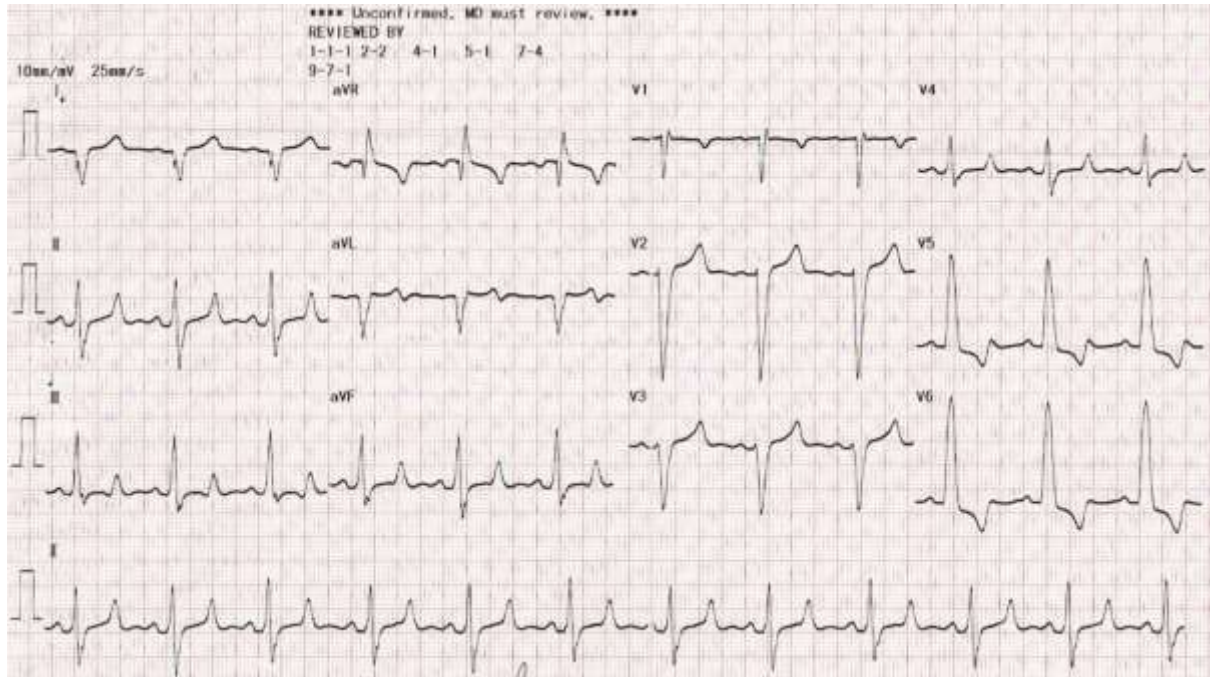


Figure 1. Baseline ECG

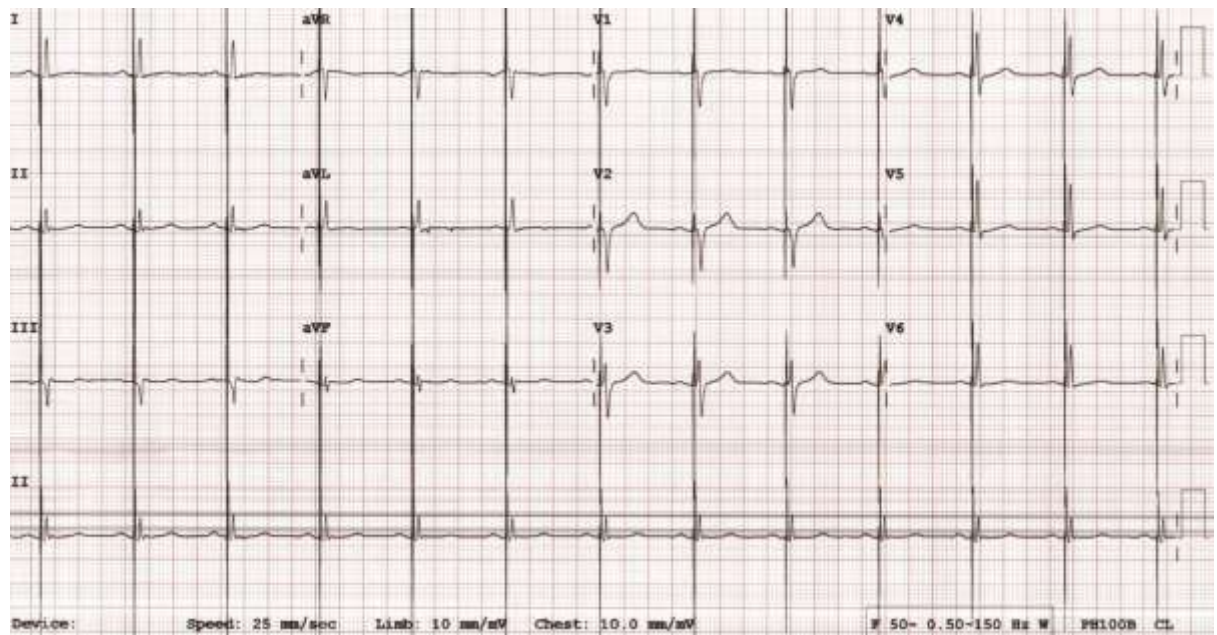


Figure 2. Follow up ECG

New Generation of Transfemoral Aortic Valve- New Risk of Late AV-block?

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Introduction: Over the years new trans-femoral aortic valves were established in market, and some of them self-expanding. In last month we are regarding more and more patients with late occurrence of AV-block 2nd or 3rd degree. Because of shorter stay in hospital we see a greater risk for those patients and we want to know, if there are the need of new strategies. In a retrospective study we tried to find special risk-factors for late AV-Block.

Methods: 60 consecutive patients receiving transfemoral aortic valve replacement between January and July 2022 with post-operative AV-block were compared with 60 consecutive patients also receiving transfemoral aortic valve replacement and post-operative av-block between January and July 2019. Patient characteristics, procedural time, type and size of valve and many other markers were recorded.

Results: The demographical and clinical patient characteristics were nearly identical in both groups. No procedure-associated complications have been noted. Only slight differences in procedural time and in X-ray exposure time were observed. Also we can't show a difference concerning balloon dilatation before implantation. A great difference was regarded in time of appearance from av-block. (2,7 days vs. 1,5 days). Patients with pre-existing RSB showing a higher risk, but this was identical in both groups.

Conclusion: With this study we can show, that new aortic valves had mild higher risk for late appearance from av-block 2nd oder 3rd degree. We can't show other reliable indicators. Therefore more studies had to be done, if a longer rhythm-monitoring is necessary and in which cases.

Left Bundle Branch Area Pacing (LBBAP) Simplified Using a Deflectable Sheath, Stylet-driven Screw-in Lead.

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Objectives: Left bundle area pacing (LBBAP) can be tedious. Clinical outcomes with non-selective vs selective LBBAP may be comparable. We analyzed the procedural success of LBBAP using a novel deflectable sheath (Agilis™, Abbott), a 58 cm stylet-driven screw-in lead and 12-lead ECG.

Materials and Methods: All 20 LBBAP procedures performed by a single operator at 7 different centers were included. Pacing indications were bradycardia (11) or heart failure (9). Briefly, LBBAP procedure involved: abutting the sheath to the RV septum → choosing the RV site based on 12-lead QRS pattern obtained following unipolar pacing by the extended screw → stepwise drilling the lead guided by fluoroscopy, 12-lead ECG, pacing parameters and sheath angiogram.

Results: All patients (63 ± 13.76 yrs, M/F: 13 /7), except 1, underwent the procedure under conscious sedation. LBBAP was successful in 19/20 (95%) procedures. Need to target >1 site (13) was common, requiring >1 sheath (3) or >1 lead (2) was uncommon. LBBAP parameters achieved were QRS width (103.63 ± 10.67) and LVAT (74.68 ± 6.55) msec. Unipolar pacing parameters at implant were R wave (7.21 ± 4.35 mV), threshold (0.71 ± 0.25 V) and impedance ($762 \pm 15.11 \Omega$).

Conclusions: LBBAP is simplified using deflectable sheath, stylet driven screw-in lead and 12-lead ECG and has a high implantation success

Pacing Mode Survival in Patients With Single Chamber Atrial Pacemaker for Sinus Node Dysfunction

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Objectives:

To study the rate of pacemaker mode change, AV block, pacemaker reoperation and death in patients with a single chamber atrial (AAI) pacemaker implanted for Sinus node dysfunction (SND).

Materials and methods:

This is a prospective-retrospective study. All patients above the age of 18yrs who underwent implantation of an AAI pacemaker for sinus node dysfunction between January 2014 and December 2020 were included. Patients were followed up annually, during which they were assessed for pacemaker mode change, new onset AV block, bundle branch block, atrial fibrillation (AF), lead complications, reoperation and death.

Results

A total of 101 patients underwent AAI pacemaker implantation for SND during the study period. The mean age was 55.3 ± 12.1 years. Three patients had paroxysmal AF and three had LV dysfunction at the time of implant. During a mean follow-up of 49.5 ± 22.6 months, none of the patients required a pacemaker mode change. Seven patients underwent reoperation, five for lead dislodgement, one for high threshold and one for pocket site erosion. None developed AV block or AF with slow ventricular rate. Only four patients developed AF (3 paroxysmal, 1 permanent). There were three deaths during follow-up and all were due to non-cardiac causes.

Conclusion:

Single chamber atrial pacing is an acceptable mode of pacing in patients with SND in developing countries. Development of AV conduction abnormalities is rare in this relatively younger population.

Does Cardiac Resynchronisation Using WiSE-CRT Leadless Pacing Result In Greater QRS Shortening Than Conventional Resynchronisation?

Dr Simon James¹

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OBJECTIVES

To assess if LV leadless pacing at a site of latest activation results in greater acute QRS shortening than conventional CRT

MATERIALS AND METHODS

WiSE-CRT is a leadless endocardial pacing system. It uses ultrasound technology to transfer energy to a receiver implanted on the Left Ventricle (LV) endocardial wall. This can be implanted at any site within the LV.

WiSE-CRT implants were compared with an equal number of consecutive conventional CRT cases. Leadless LV electrodes were implanted at the site of latest activation defined by strain echocardiography.

Conventional CRT were via standard coronary sinus route. Intrinsic QRS width was measured pre/post-implant. For pacing dependent cases the QRS width during RV pacing was measured.

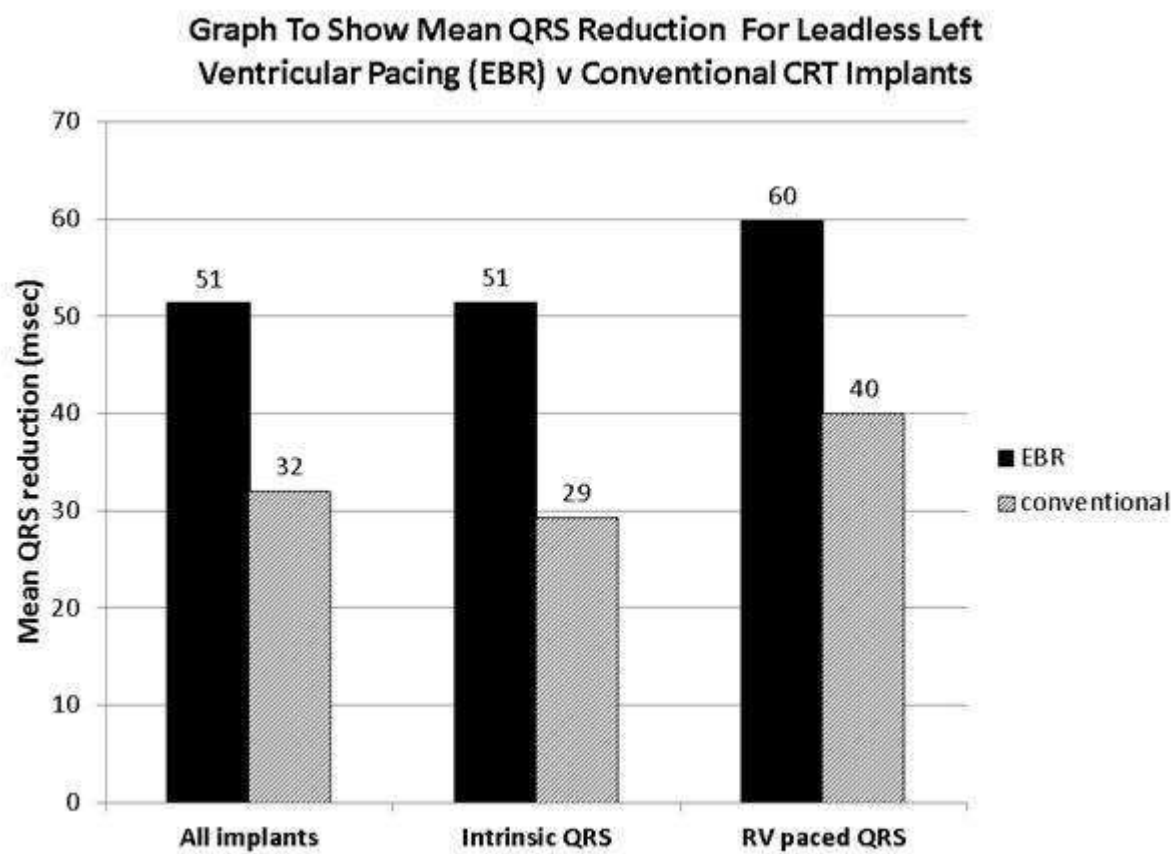
RESULTS

24 patients underwent WiSE-CRT implant. (6 pacing dependent, 18 intrinsic conduction) were compared with 24 consecutive conventional CRT (6 pacing dependent). Cases were well matched for baseline QRS duration. Underlying pathologies for WiSE-CRT & conventional CRT were ischaemic 11 v 14, dilated cardiomyopathy 4 v 6, pacing induced LV impairment 4 v 4 respectively.

WiSE-CRT resulted in greater QRS reduction for all cases (51msec v 32, $p=0.002$), intrinsic conduction (51 v 29, $p = 0.003$) and pacing dependent (60 v 40, $p= 0.15$)

CONCLUSION

WiSE-CRT implant demonstrate a greater acute QRS shortening than conventional CRT. This should confer improved mortality.. Further investigation is needed to ascertain whether this is due to targeting a specific site of latest activation or a specific property of endocardial pacing itself



A Novel Standardized Left Bundle Branch Pacing With Left Bundle Branch Block Model

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Objective: Left bundle branch pacing (LBBP) has been demonstrated in the treatment of dyssynchronous HF. The purpose of this study was to develop a novel standardized LBBP with left bundle branch block (LBBB) model.

Methods: A "triangle-zone" method by tricuspid valve annulus angiography for LBBP were performed in 6 canines. A catheter was then applied for retrograde His potential recording and LBB ablation. The electrocardiogram and pacing parameters were recorded. The hearts were isolated and stained by Lugol's iodine (5%) to assess the relative locations of the LBBP lead-tip, in relation to the left septal fascicular (LSF).

Results: The mean LBB potential to ventricular interval was 11.8 ± 1.2 ms. The mean interval between the pacing stimulus to retrograde His potential was 16.0 ± 1.7 ms. The Stimulus-peak left ventricular activation time of LBBP was 35.7 ± 3.1 ms. The average intrinsic QRS duration was 44.7 ± 4.7 ms. LBB ablation significantly prolonged the QRS duration (106.3 ± 8.3 ms, $P < 0.001$). However, LBBP significantly shortened the paced QRS duration to 62.5 ± 5.3 ms ($P < 0.001$). After 6 weeks follow-up, both paced QRS duration (63.0 ± 5.4 ; $P = 0.203$) and LBBB duration (107.3 ± 7.4 ; $P = 0.144$) were unchanged when comparing to acute phase, separately. Anatomical analysis showed that the lead-tip were all placed in LSF area. The average lead depth in the septum was 12.2 ± 1.3 mm.

Conclusion: The new LBBP with LBBB model was stable and feasible. It provided a useful tool to investigate the basic mechanism underlying the physiological pacing.

SUPPORTING DOCUMENTS



Ambulatory AV Synchronous Pacing Over Time Using a Leadless Ventricular Pacemaker: Regional Experience

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Objectives: Prior proof-of-concept studies demonstrated that accelerometer-based mechanically delivered AV synchronous (AVS) pacing is feasible using a leadless ventricular pacemaker; however, ambulatory performance and maintenance of AVS over time have not been studied.

Methods: AccelAV was a prospective single-arm study to characterize AVS in patients implanted with a Micra AV, which uses the device accelerometer to mechanically detect atrial contractions and promote VDD pacing. The primary objective was to characterize resting AVS at 1-month in patients with complete AV block (AVB) and normal sinus function.

Results: A total of 152 patients were enrolled and implanted with a leadless pacemaker, including 19 patients from Hong Kong. Among patients with normal sinus function and complete AVB (n=54), mean resting AVS was 85.4% at 1-month, while ambulatory AVS was 74.5%. Mean resting and ambulatory AVS were similar among Hong Kong patients (n=7; 85.6% resting, 72.7% ambulatory, P>0.8). Among patients (n=20) with programming optimization, mean ambulatory AVS was 82.6%, representing a 10.5% improvement (P<0.001). Quality of life as measured by the EQ-5D-3L improved significantly from pre-implant to 3 months (P=0.031). There were no upgrades to dual-chamber devices or CRT through 3 months.

Conclusion: Accelerometer-based mechanical atrial sensing significantly improves quality of in patients with AVB and normal sinus function and a leadless pacemaker implanted in the right ventricle. Mean resting and ambulatory AVS among Hong Kong patients were similar to the overall cohort with an increase in ambulatory AVS among patients with programming optimization. There were no upgrades to dual-chamber pacemakers.

Performance of Model 3830 Left Bundle Branch Area Pacing: Results from CareLink and Registration Data

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¹*Virginia Commonwealth University, Richmond, United States*, ²*Lancaster Heart and Vascular Institute, Lancaster, USA*, ³*St. Thomas Heart, Nashville, USA*, ⁴*St. Luke's University Health Network, Bethlehem, USA*, ⁵*Medtronic, Inc., Mounds View, USA*, ⁶*Geisinger Heart Institute, Wilkes-Barre, USA*

Objectives: Left Bundle Branch Area Pacing (LBBAP) with a Model 3830 lead is an alternative to right ventricular pacing (RVP) and his-bundle pacing (HBP). Literature suggests LBBAP may avoid detrimental effects of RVP. Using CareLink and registration data, lead inactivation rate, electrical performance and pacing output were determined.

Materials and Methods: Medtronic Model 3830 leads were included in the analysis if they were associated with a pacemaker implanted in 2020 or later and were assigned to a LBBAP, HBP, or apical/septal placement group. Pacing capture threshold (PCT) was determined based on ventricular capture management. Time-to-inactivation analysis used Kaplan-Meier survival estimates and comparisons were made using log-rank tests.

Results: Within the database and registry, 14,933 LBBAP leads were identified. The average age at implant was 75.1±11.1, 56.1% were male, and 51.7% had an indication for AV block. At 6 months, mean pacing output was 2.1±0.5V at 0.4±0.1ms, mean PCT was 0.88±0.32V, and mean sensed amplitude was 14.9±8.1mV. At 24 months, LBBAP leads were more likely to remain active (95.3%) than apical/septal leads (94.7%, p=0.026) or HBP leads (93.0%, p<0.001).

Conclusion: In this large cohort of Model 3830 leads, LBBAP leads had a low PCT and reasonable sensed amplitude at implant, and electrical performance remained stable over follow-up. LBBAP leads were also less likely to become inactive during the first 24 months of implant than apical/septal leads or HBP leads. These data suggest LBBAP with Model 3830 is a viable alternative to right ventricular pacing.

Real-World Evidence on Surgical Intervention Rates for Pacemaker Lead Dysfunction: Tendril STS vs Other Leads

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¹Cleveland Clinic, Cleveland, United States, ²Abbott, Sylmar, United States, ³University at Buffalo, Buffalo, United States

OBJECTIVES

While several studies have reported on the safety of cardiac leads, there are limited comparative data on lead performance. Our aim was to compare Abbott Tendril STS leads and other manufacturers' pacing leads using real-world evidence methodology.

METHODS

Medicare Fee-For-Service (FFS) claims and Abbott device registration databases were linked to identify patients implanted with single-chamber or dual-chamber pacemakers with the Abbott Tendril STS lead from 1/1/2014–12/31/2019. Medicare pacemaker patients who did not link to Abbott devices were assumed to have non-Abbott leads. Patients in both groups had to be enrolled in Medicare FFS at least 1 year prior to implant date and have an initial pacemaker and associated lead(s) implanted on the same date. Patients were followed through the end of 2021. Surgical intervention for lead dysfunction was defined as a diagnosis code for a mechanical lead complication and a procedure code for a lead-related surgery on the same claim. Kaplan-Meier curves for lead intervention-free survival rates were compared between groups at the device level using a log-rank test.

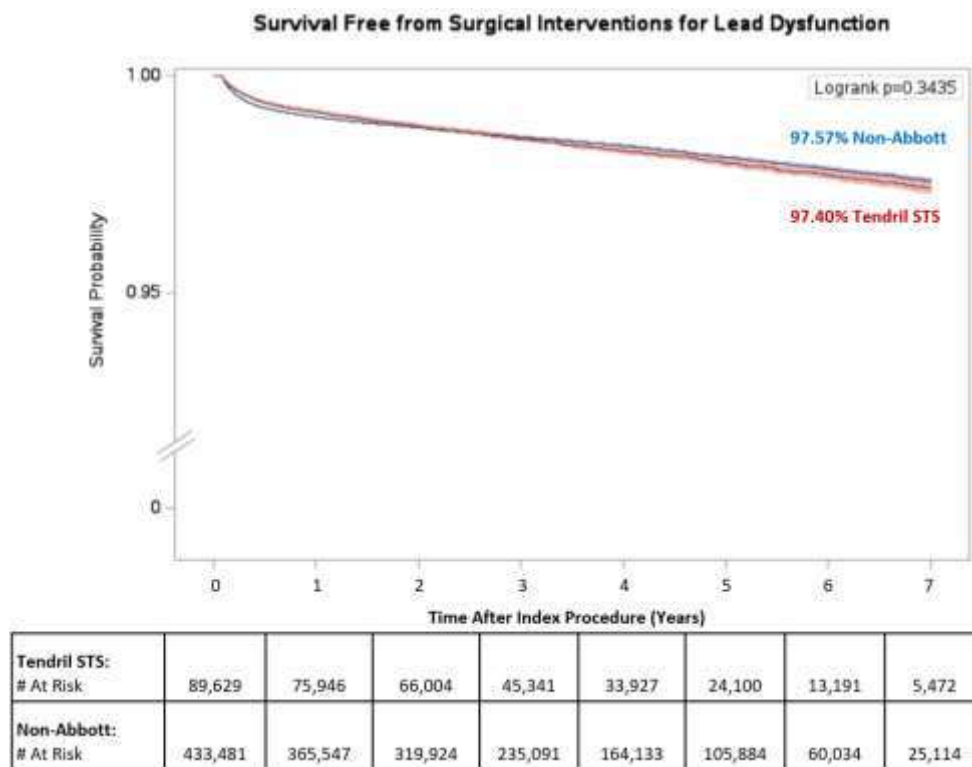
RESULTS

The study cohort had 89,629 Tendril STS and 433,481 non-Abbott patients. Groups were comparable in age (79.7±8.6 years), sex (52.2% male), race/ethnicity, and baseline comorbidities. At 7 years, there was no significant difference in intervention-free survival rates between groups (97.40% Tendril STS vs 97.57% non-Abbott, $p=0.3435$).

CONCLUSION

In this large Medicare population, there was no significant difference in surgical intervention-free survival rates for pacemaker lead dysfunction between Tendril STS and non-Abbott pacing leads over 7 years of follow-up.

FIGURE



Precordial QRS Voltage Predicts Response to Immunosuppression in Patients With Cardiac Sarcoidosis

Dr Swapna Nalla¹, Dr Muthiah Subramanian¹, Mrs Radhika Korabathina¹, Dr Sachin Yalagudri¹, Dr Daljeet Saggu¹, Dr C Narasimhan¹

¹*Aig Hospital, Hyderabad, India*

Objective: There is a paucity of clinical markers to assess the response to immunosuppression (IST) in patients with cardiac sarcoidosis. The aim of this study was to assess the utility of surface 12 lead ECG in assessment of response to cardiac sarcoidosis.

Materials and Methods: Clinical and electrocardiographic data of 41 patients with cardiac sarcoidosis from the Granulomatous Myocarditis Registry was analyzed. All patients underwent a 18Fluorodeoxy glucose positron emission tomography (18FDG PET-CT) prior to initiation of IST. Response was assessed after 4-6 months of therapy. Clinical response (CR) was defined as an improvement in functional class (NYHA Class >1), freedom from ventricular arrhythmias and heart failure hospitalizations. Complete responders had no residual myocardial FDG uptake and fulfilled the CR criteria.

Results: Among the 41 patients included in the final analysis, 29 (70.7%) had complete response to IST. Cox regression analysis identified that the summed QRS voltage in the precordial leads was higher in responders (5.1 ± 0.8 mV vs. 3.4 ± 0.7 mV, $p=0.031$) compared to non-responders. Compared to baseline, there was a significant improvement in QRS voltage among responders ($+1.2 \pm 0.2$ mV vs. $+0.2 \pm 0.1$ mV, $p=0.016$) compared to non-responders. There was no correlation between clinical response and summed QRS voltage in the limb leads. Summed precordial lead voltage was an independent predictor of response following immunosuppression (HR 1.13, 95% CI 1.03-1.22, $p=0.042$). Precordial lead voltage had a strong positive correlation with change in LVEF following immunosuppression. It had a good discriminative power (AUC=0.73) for predicting response to immunosuppression.

Conclusions : Summed precordial lead voltage can be used to assess clinical response to immunosuppression in patients with cardiac sarcoidosis.

Diagnostic Performance of Criteria in Predicting PVC RVOT Origin

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Abstract submitted under supporting document

OBJECTIVES

To compare nine diagnostic criteria for predicting RVOT origin of PVC

MATERIALS AND METHODS

Fifty patients with PVC morphology of LBBB pattern (predominantly negative in lead V1) and inferior axis (predominantly positive in lead II and III) underwent ablation between March 2018- November 2021. We calculate and compare criteria mentioned by Anderson et al., (1) by 6 diagnostic accuracy measures. RVOT criteria used were: 1) Earliest onset of QRS or peak in V₂, 2) V₁ R-wave duration index <0,5 ms and R/S-wave amplitude index <0,3 mV, 3) S-R amplitude difference in V₁ through V₂ >1,625 mV, while LVOT criteria used were: 4) V₃ R-wave deflection interval >80 ms and V₁ R-wave amplitude > 0,3 mV, 5) V₂ transition ratio >0,6 mV, 6) TZ Index <0, 7) V₂S/V₃R Index < 1,5 mV, 8) V₂QRS_{i40} >0,52 mV, 9) Combination Index: $Y = -1,15x(TZ) - 0,494x(V_2S/V_3R)$, $Y > -0,76$. Negative result on LVOT criteria was concluded as RVOT.

RESULTS

We found that highest sensitivity and NPV was criterion 9 (90% and 55,6%, respectively). The highest specificity and PPV was criterion 5 (87,5% and 96,6%, respectively). Criterion 7 has the highest accuracy (82,98%), while criterion 5 has the highest AUC (0,779)

CONCLUSION

Criteria originally used to predict LVOT origin can also give good performance in predicting RVOT origin when applied to those with LBBB pattern and inferior axis. In our dataset, the best criteria to rule in RVOT origin was criterion 5 (when negative).

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Table 1. Diagnostic Measures of nine criteria

	n	AUC	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy (%)
Criterion 1	49	0,566	75,6%	37,5%	86,1%	23,1%	69,39%
Criterion 2	47	0,647	79,5%	50%	88,6%	33,3%	74,47%
Criterion 3	48	0,625	62,5%	62,5%	89,3%	25%	62.5%
Criterion 4	47	0,500	-	-	-	-	-
Criterion 5	49	0,779	68,3%	87,5%	96,6%	35%	73,47%
Criterion 6	50	0,679	85,7%	50%	90%	40%	80%
Criterion 7	47	0,611	84,6%	37,5%	86,8%	33,3%	82,98%
Criterion 8	50	0,503	88,1%	12,5%	84,1%	16,7%	76%
Criterion 9	48	0,763	90%	62,5%	92,3%	55,6%	81,25%

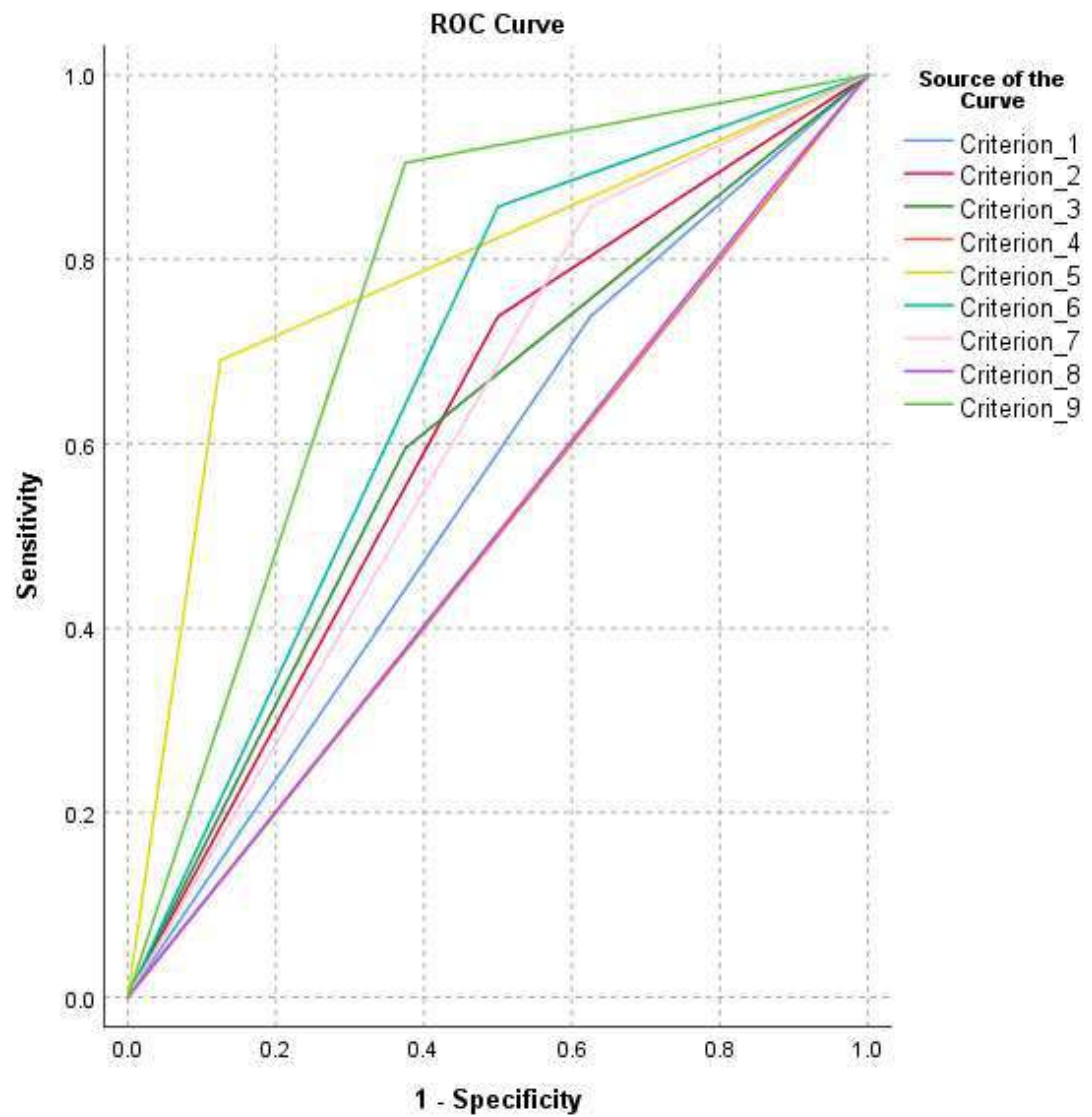


Figure 1. ROC Curve of Nine Criteria

Habitual Coffee Intake is Safe and Improves Survival in Prevalent Arrhythmia and/or Cardiovascular Disease

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OBJECTIVES

Physicians often recommend avoiding coffee in patients with pre-existing arrhythmia and cardiovascular disease (CVD). The objective of this study was to investigate the associations between coffee and mortality/arrhythmia outcomes in people with underlying cardiac conditions.

MATERIALS AND METHODS

The UK Biobank consists of 502543 people followed over > 10years with outcomes linked to ICD-10 codes. Self-reported coffee intake was divided into 0, <1, 1, 2-3, 4-5, >5 cups/day. CVD was defined as a composite of coronary heart disease, stroke and cardiac failure. Cox regression was used to assess associations with mortality/arrhythmia outcomes.

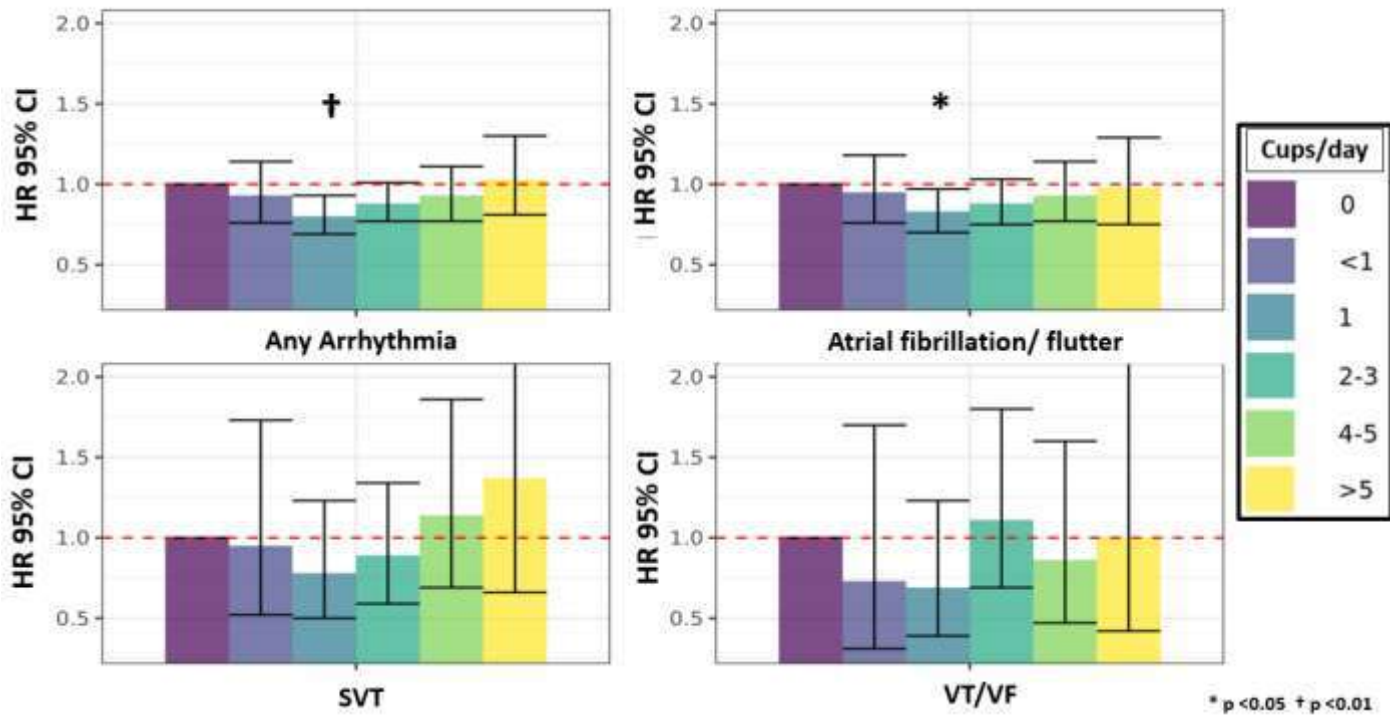
RESULTS

7706 participants had diagnosis of arrhythmia at enrolment, of which 1571(20.4%) died during follow up of 12.2 ±1.7 yrs. Coffee intake in those with arrhythmias was associated with reduced mortality (lowest risk 1 cup/day HR 0.80, CI 0.69-0.93, p<0.01). There was no increase in sudden cardiac death risk (p=0.59). 1 cup/day was associated with improved survival in AF/AFL (HR 0.83, CI 0.70-0.97, p=0.02). Mortality in those with SVT and VT/VF was unaffected by all levels of coffee intake. In participants diagnosed with CVD(17587), coffee consumption at all levels was not associated with increased risk of arrhythmia, including AF/flutter. Mortality risk was significantly reduced in participants with CVD who consumed 2-3 cups of coffee/day (HR0.88, CI 0.80-0.96, p<0.01).

CONCLUSIONS

Regular coffee intake is associated with improved survival in those with underlying arrhythmias. In prevalent CVD, coffee intake is safe with no increase in arrhythmias. Coffee should not be discouraged in patients with underlying arrhythmias and/or CVD.

Coffee intake and all cause mortality outcomes in prevalent arrhythmias and arrhythmia subtypes



Impact of Decaffeinated, Ground and Instant Coffee Subtypes on the Incidence of Arrhythmias

Dr David Chieng^{1,2,3}, Dr Rodrigo Canovas¹, Dr Hariharan Sugumar^{1,2,3}, Dr Louise Segan^{1,2,3}, A/Professor Liang-Han Ling^{1,2,3}, A/Professor Aleksandr Voskoboinik^{1,2,3}, Dr Joseph Morton^{3,4}, A/Professor Geoffrey Lee^{3,4}, A/Professor Sandeep Prabhu^{1,2,3}, Professor David Kaye^{1,2,5}, Professor Jonathan Kalman^{3,4,5}, Professor Peter Kistler^{1,2,3,5}

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OBJECTIVES

Observational studies report health benefits from coffee. Coffee is a complex beverage with up to 100 biologic compounds. Caffeine binds to adenosine receptors and is potentially anti-arrhythmic, although the impact of caffeine on arrhythmia outcomes is unclear. The objective of this study is to evaluate the associations between coffee subtypes and incident arrhythmias.

MATERIALS AND METHODS

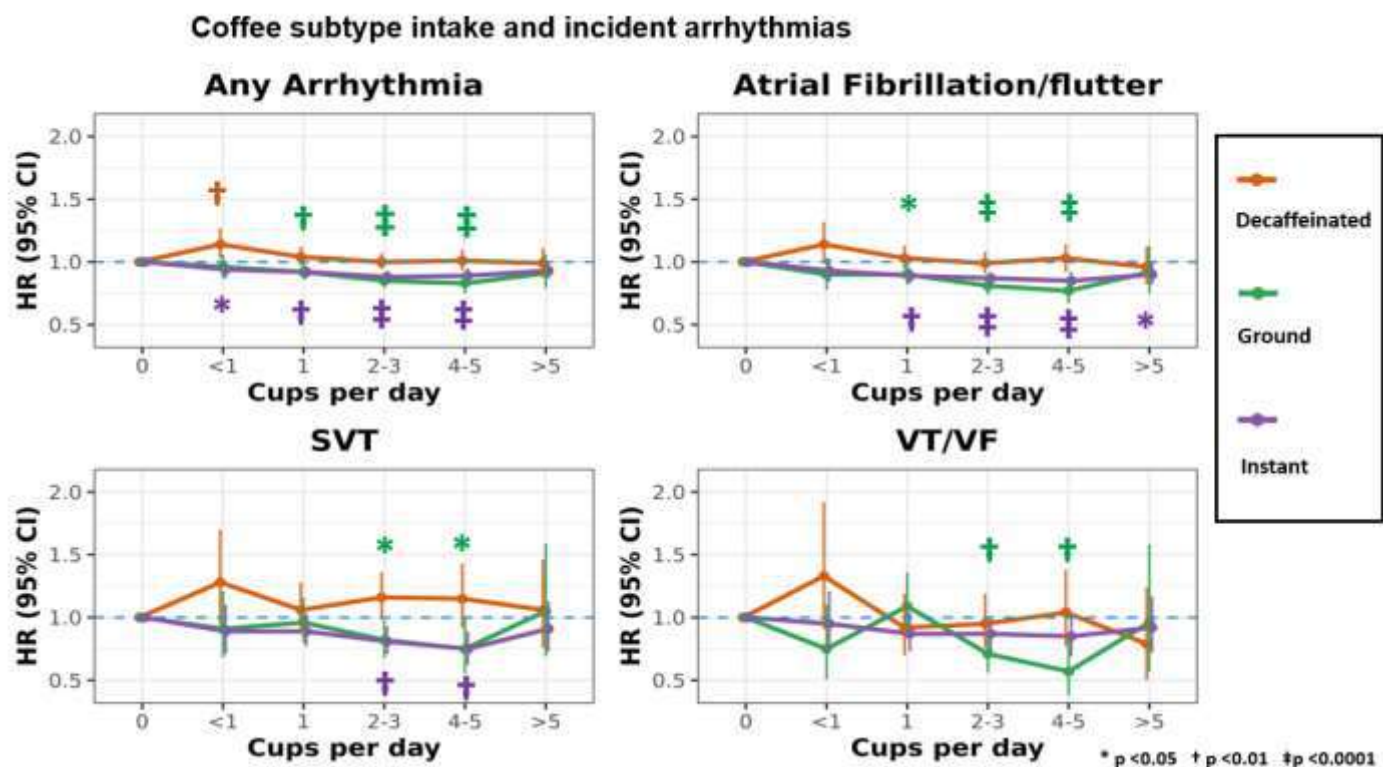
The UK Biobank is a large prospective cohort with follow up >10 years. Coffee amount and type (ground, instant, or decaffeinated) were self reported and divided into 0, <1, 1, 2-3, 4-5, >5 cups/day. Associations between coffee subtypes and arrhythmia endpoints were assessed using Cox regression modelling and hazard ratios (HR).

RESULTS

Of 449536 participants, there were 82575 ground, 198062 instant, 68416 decaf coffee drinkers. Ground coffee intake between 1-5 cups/day was associated with reduced risk of any arrhythmia and atrial fibrillation/flutter (AF/AFL), with the lowest risk seen at 4-5 cups/day (HR0.83, CI0.76-0.91, & HR0.77, CI0.68-0.87, respectively; $p<0.01$). Risk of SVT and VT/VF were reduced at between 2-5 cups/day ($p<0.05$). Instant coffee between 1-5 cups/day reduced the risk of any arrhythmia, and AF/AFL. The lowest risk was seen in 2-3 cups/day for any arrhythmia (HR0.88, CI0.85-0.94, $p<0.01$), and 4-5 cups/day for AF/AFL (HR0.85, CI0.79-0.91, $p<0.01$). SVT risk was lowest at 4-5 cups/day (HR0.75, CI0.63-0.88, $p<0.01$). Decaf coffee had a neutral effect against incident arrhythmia.

CONCLUSION

Regular ground or instant but not decaffeinated coffee was associated with a reduction in arrhythmia incidence. These findings support in part a proposed antiarrhythmic effect of caffeine.



Habitual Coffee Consumption is Associated With Reduced Incidence of Arrhythmias: a Large Population Study

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OBJECTIVES

There is a perception that arrhythmias are increased in coffee drinkers. Meta-analyses suggest beneficial effects of coffee on incident arrhythmias, although evidence is based on studies with small sample sizes. The objective of this study was to evaluate associations between coffee intake and incident arrhythmias utilising the UK Biobank.

MATERIALS AND METHODS

The UK Biobank is a large prospective cohort with outcomes measured >10 years. Coffee intake, obtained from questionnaires, was divided into 0, <1, 1, 2-3, 4-5, >5 cups/day. Cox regression modelling with hazard ratios (HR) determined associations with incident any arrhythmia, atrial fibrillation/flutter (AF/flutter), SVT, and ventricular tachycardia/ fibrillation (VT/ VF).

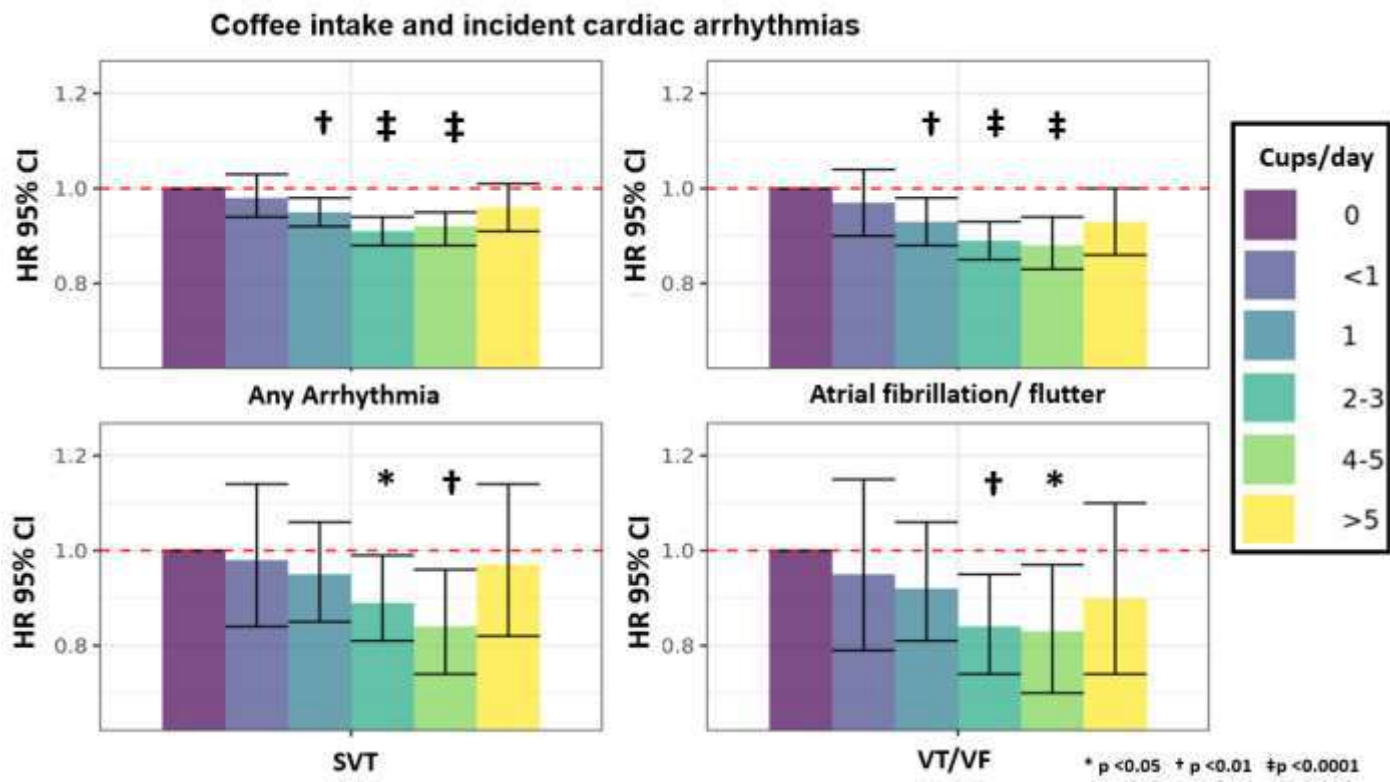
RESULTS

The cohort included 449,563 individuals (age 57 ± 13 yrs, 55.3% female, hypertension 28%). U shaped relationships exist between higher coffee intake and incident any arrhythmia, AF/flutter, and SVT. After adjustment for co-variables age, gender, alcohol intake, tea intake, obesity, diabetes mellitus, hypertension, physical activity, OSA, smoking status, the lowest risk for any arrhythmia was seen in those who consumed 2-3 coffee cups/day, with HR 0.91 (CI 0.88-0.94, $p < 0.01$). Risk of AF/flutter and SVT were lowest at 4-5 cups/day, with HR 0.88 (CI 0.83-0.94, $p < 0.01$), and HR 0.84 (CI 0.74-0.96, $p < 0.01$), respectively. Lowest VT/ VF risk was seen with 4-5 cups/day (HR 0.83, CI 0.70-0.97, $p = 0.02$).

CONCLUSIONS

Mild-moderate regular coffee intake was associated with significant reductions in the incidence of any arrhythmia, AF/flutter, SVT and VT/VF. Daily coffee intake should not be discouraged but rather considered part of a healthy diet.

SUPPORTING DOCUMENTS



Atrial Fibrillation Alarm System to Improve Correct Anticoagulation Prescription Rate

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OBJECTIVES

Anticoagulation therapy reduces the stroke risk from atrial fibrillation (AF). However, the mis-prescription rate of anticoagulation is high. An intervention to improve it should be undertaken.

MATERIALS AND METHODS

An alarm system which could screen all the electrocardiography of each admitted patients was developed. Once AF was detected, it would suggest appropriate anticoagulation agents with correct doses. An experienced cardiologist would confirm it and inform the particular in-charge care team.

The system was engaged into the clinical practice since 1st, November, 2021. All the enrolled patients would be followed at discharge, the first month, the third month and the sixth month after discharge. The correct prescription rates were analyzed. The data until 30th, June, 2022 was presented in this study.

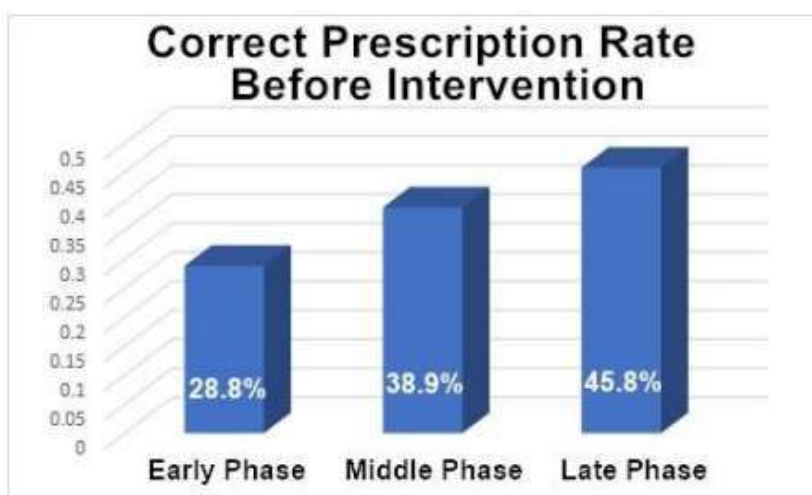
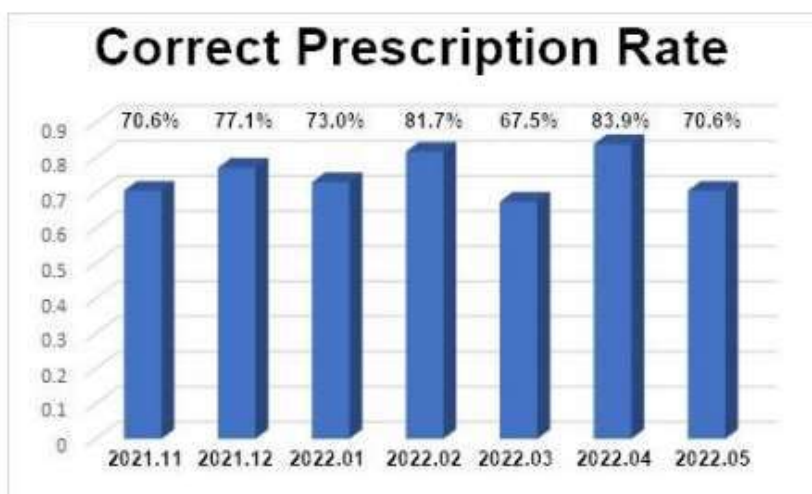
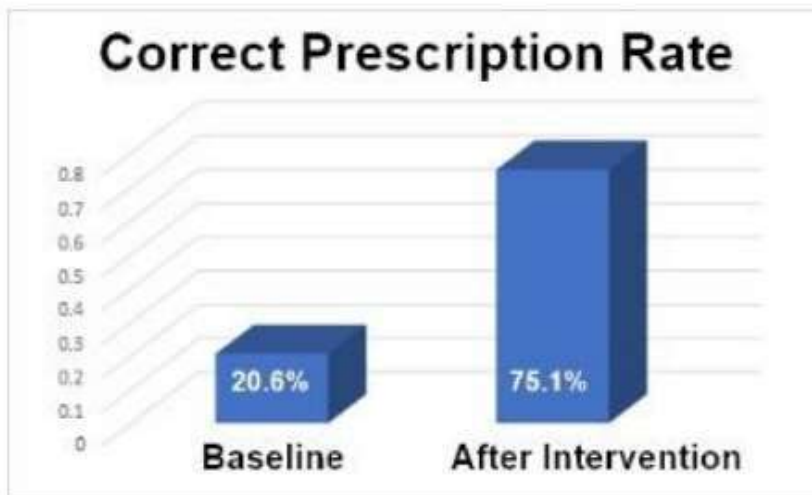
RESULTS

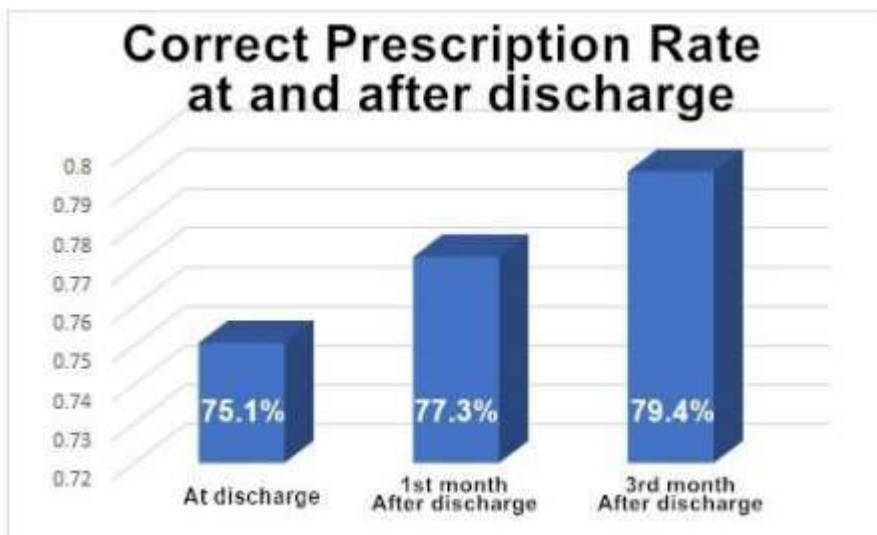
After the system engagement, the correct prescription rate was improved from 20.6% at baseline to 75.1% ($p < 0.00001$). In the first two months of the engagement, the correct prescription rate at admission was only 28.8%, leaving 71.2% AF patients needed our intervention to get correct prescriptions. However, the correct prescription rate at admission went up to 38.9% in the middle two months and 45.8% ($p = 0.024$) in the last two months. The correct prescription rate lasted even after discharge. (75.1% at baseline, 77.3% at 3rd month, 79.4% at 6th month, $p > 0.05$).

CONCLUSION

The AF alarm system could improve the correction prescription rate of anticoagulation therapy significantly. Due to the spread of knowledge, the correction prescription rate was even improved before the intervention and lasted after discharge.

SUPPORTING DOCUMENTS





Late ventricular potential for risk prediction of sudden cardiac death risk

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¹*Korea University Anam Hospital, South Korea*

Objectives

There is a paucity of data with signal-averaged electrocardiography (SA-ECG) on sudden cardiac death (SCD) survivors without structural heart disease, whereas majority of previous studies had been focused on post myocardial infarction survivors. This study assessed SA-ECG as a risk stratification modality for lethal arrhythmic event (LAE) in patients at risk of SCD without structural heart disease.

Materials and Methods

A total of 581 patient without significant structural heart disease were assessed with SA-ECG. SA-ECG was defined positive when fulfilling three or more criterion: (1) unfiltered QRS duration $\geq$ 114ms, (2) filtered QRS duration $\geq$ 114ms, (3) duration of terminal QRS $<$ 40uV exceeding 40ms, and (4) root mean square voltage in the terminal 40ms of $\leq$ 20ms.

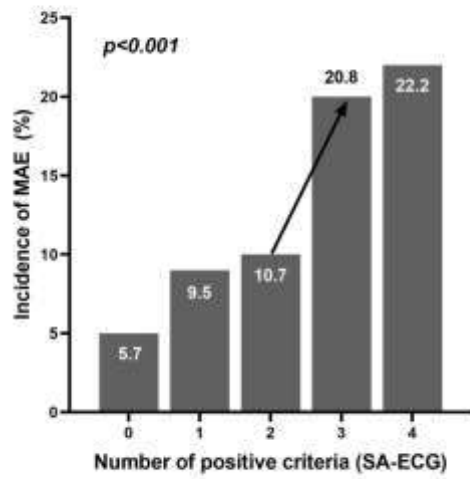
Results

Among 581 patients, 145 patients with positive late potential (LP) showed higher incidence of LAEs compared to patients with negative LP (21.4% vs. 6.7%, $p<0.001$, odds ratio 3.816 [95% confidence interval 2.208-6.597]). As the number of positive SA-ECG criteria increases, incidence of LAE tended to increase sequentially, which was markedly noted from 2 positive to 3 positive criteria (10.7% to 20.8%, $p<0.001$). Patient with inherited arrhythmia showed higher rate of positive LP compared to those with non-inherited arrhythmia (51.0% vs. 19.3%, $p<0.001$).

Conclusion

Positive LP resulted strong association with LAE, which enables SA-ECG as a non-invasive risk stratification tool for SCD in patients without structural heart disease. At least 3 out of 4 diagnostic criteria in SA-ECG can independently predict LAEs. Furthermore, our study suggests risk prediction for SCD using SA-ECG in patients with inherited arrhythmias.

SUPPORTING DOCUMENTS



	Number of positive criteria					Total
	0	1	2	3	4	
Total	298	95	56	96	36	581
Incidence of MAE	17 (5.7%)	9 (9.5%)	6 (10.7%)	20 (20.8%)	8 (22.2%)	60

Brugada Phenocopy in a Patient With Severe Hyperkalemia

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BACKGROUND

Brugada syndrome is an autosomal-dominant channelopathy that present with characteristic findings on electrocardiogram. Electrolyte abnormality such as hyperkalemia can also present with Brugada ECG.

CASE

A 51-year-old man with no known co-morbidities presented with lower urinary tract symptoms and enlarging hypogastric mass. He had no history of syncope and denied family history of sudden death. Workup revealed high-grade urothelial carcinoma of the bladder and acute kidney injury from obstructive uropathy. Hemodialysis was initiated and was weaned off after a urinary diversion was done. On follow up, he was anemic and not complaining of chest pain or its equivalent. His ECG showed a coved ST segment with T wave inversion typical of Brugada Type I.

He had elevated serum potassium (5.6 mmol/L) and creatinine (1173 umol/L). Patient received treatment for hyperkalemia and eventually underwent hemodialysis. There was resolution of the Brugada pattern as the potassium level normalized.

CONCLUSION

Severe hyperkalemia can present with Brugada pattern ECG. Recognition of Brugada phenocopy is essential in clinical decision-making to come up with appropriate management.

SUPPORTING DOCUMENTS



Figure 1. ECG on presentation showing sinus rhythm with normal axis and coved ST segment elevation with T wave inversion in V1-V2 and peaked T waves in other precordial leads.

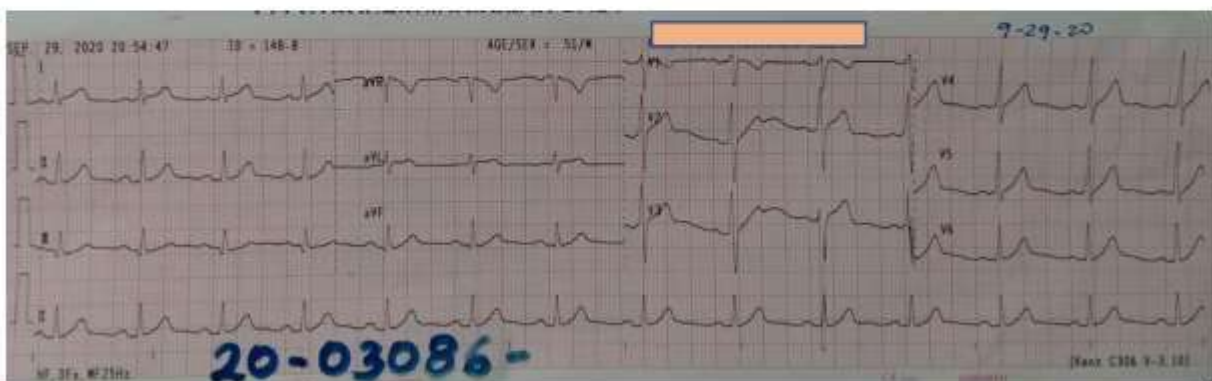


Figure 2. ECG upon treatment of hyperkalemia showing resolution of Brugada I pattern.

A Case of SCN5A Mutation-associated Left Atrial Standstill and Ischemic Stroke

Dr Dong-Seon Kang¹, **Dr Pichmanil Khmao**², Assistant Prof. Jaewon Oh¹, Prof. Hui-Nam Pak¹

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Objective: To screen genetic mutation of the proband with left atrial standstill and his first-degree relative. The disease progression on atrial mechanical contraction and the electrical involvement on AV conduction system was also observed.

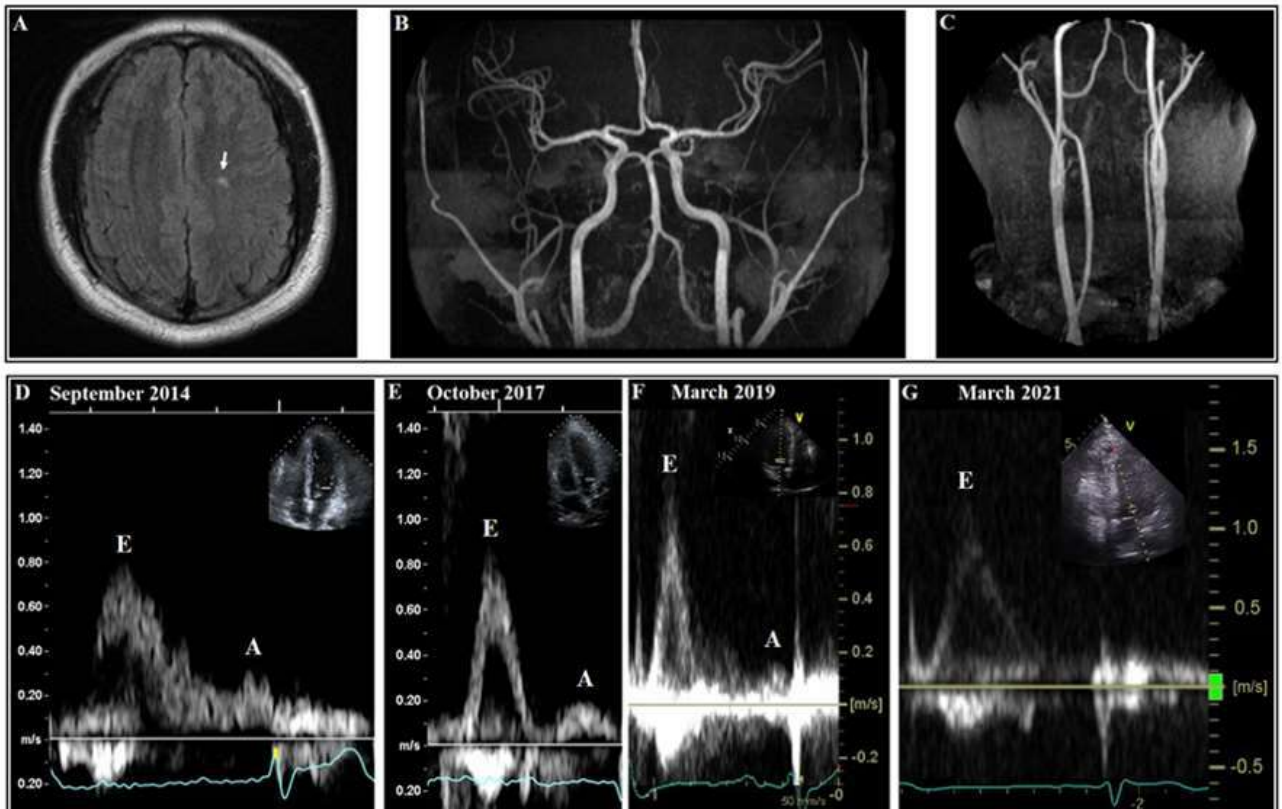
Materials and Methods: Informed consent was obtained from the patient and his first-degree relative including the mother and sister. Patient's father died due to traffic accident. Patient underwent AF ablation and EP study. Standard 12-lead ECG, echocardiography and peripheral blood sample for DNA extracted were obtained from the proband and his first-degree relative. Genetic screening using target gene sequencing for exome region of cardiovascular related 369 genes using NextSeq 550Dx System (Illumina) with 2 × 150 bp reads was performed.

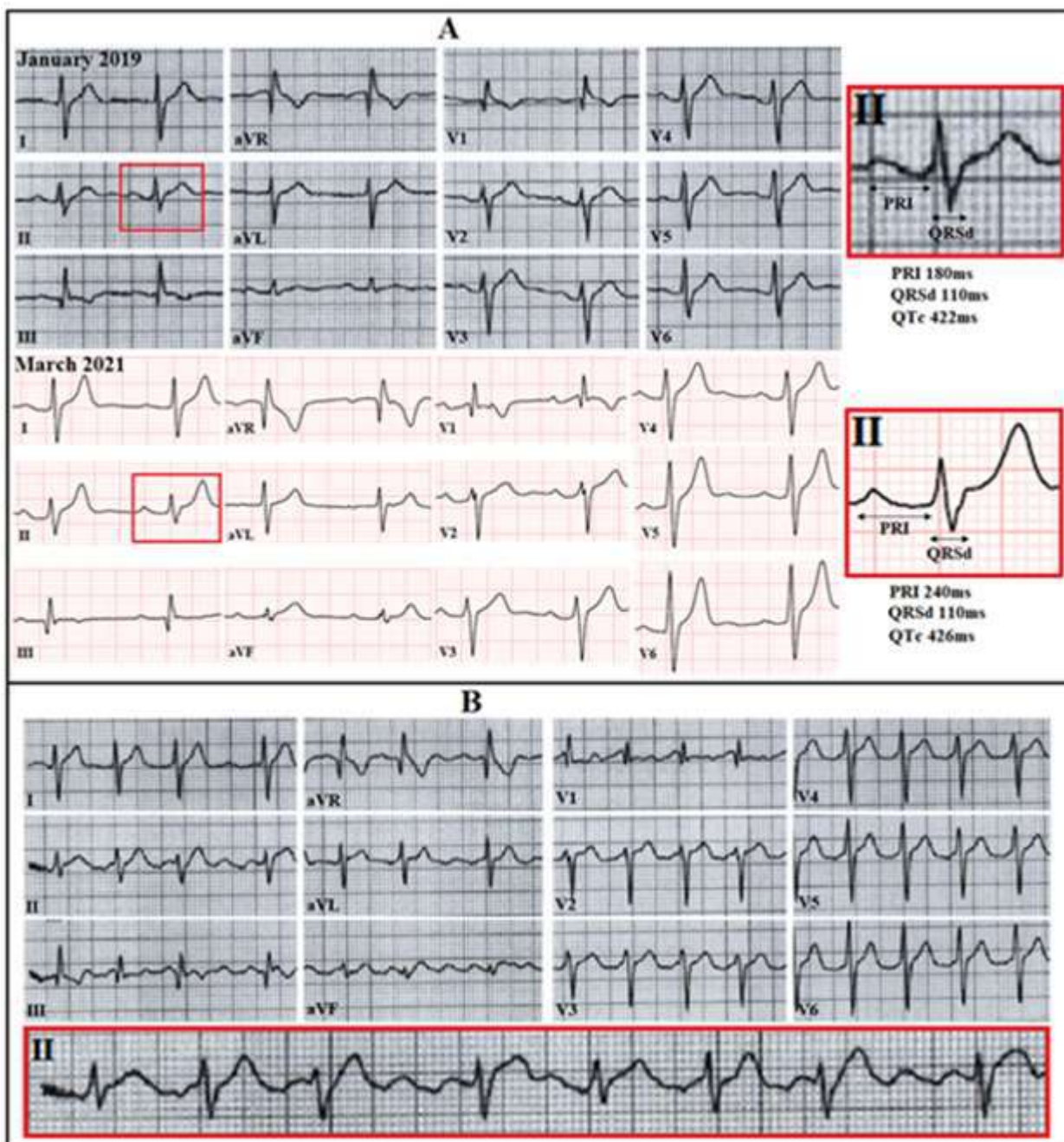
Results: Serial echocardiography from the patient showed gradual and loss of A wave. EP study of the patient showed electrical silent of LA and infra-nodal conduction delay. Two months after diagnosis of LA standstill, Holter EKG monitoring from the proband showed paroxysmal AV block which required permanent pacemaker implantation. ECG and echocardiography from first-degree

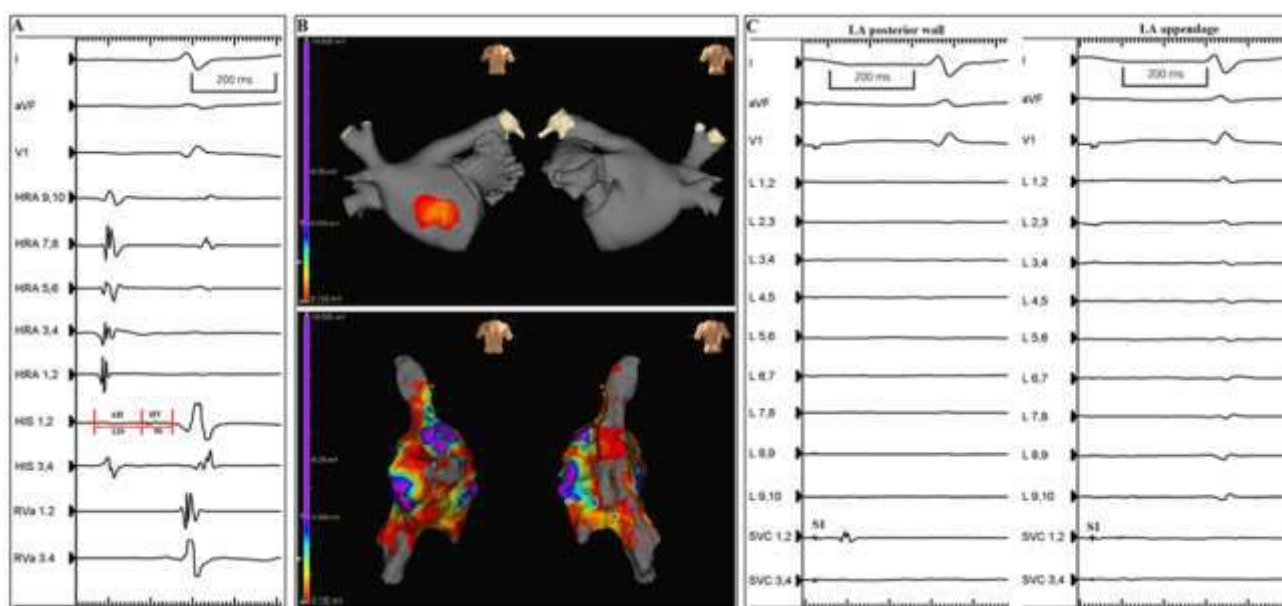
relative including mother and sister were within normal. An SCN5A heterozygous missense mutation (NM_198056.2: c.3823G>A, D1275N) was found in the proband, and his mother and sister.

Conclusion: SCN5A-D1275N mutation is one of the pathogenic factors associated LA standstill. This condition might require long term anticoagulation therapy and close follow up to evaluate the progression of disease. The difference manifestation of the disease can suggest modifier genes include polymorphism in gap junction proteins can implicate in this particular form.

SUPPORTING DOCUMENTS







Supplemental Table 1.

List of 369 genes included in the targeted gene panel for cardiovascular disorders.

A2ML1, AARS, ABCA1, ABCC9, ABCG5, ABCG8, ACAD9, ACADM, ACADS, ACADVL, ACTA1, ACTA2, ACTC1, ACTN2, ACVR1, ACVR2B, ACVR1L1, ADRB1, ADRB2, ADRB3, AGK, AGL, AGTR1, AKAP9, ALMS1, ALPK3, ANGPTL3, ANGPTL4, ANK2, ANKRD1, APOA1, APOA4, APOA5, APOB, APOC2, APOE, ATP5E, BAG3, BCAT1, BDKRB1, BMPR1B, BMPR2, BRAF, CACNA1A, CACNA1C, CACNA1D, CACNA1G, CACNA1H, CACNA2D1, CACNB2, CALM1, CALM2, CALM3, CALR3, CASQ2, CAV1, CAV3, CBL, CBS, CDH13, CELSR2, CETP, CFC1, CHD7, CHRM2, CHRNA3, CITED2, CLCNKA, COA5, COL3A1, COL5A1, COL5A2, CORIN, COX15, CPT1A, CPT2, CREB3L3, CRELD1, CRYAB, CSRP3, CTF1, CTNNA3, CXCL12, CYP1A2, CYP2C19, CYP2C9, CYP2D6, DEPD5, DES, DMD, DMPK, DNAJC19, DNM1L, DOLK, DPP6, DSC2, DSG2, DSP, DTNA, ECE1, EFEMP2, ELAC2, ELN, EMD, ENG, EYAA, F2, F5, FADS1, FBN1, FBN2, FHL1, FHL2, FKBP, FKTN, FLNA, FLNC, FOXC1, FOXD4, FOXH1, FOXRED1, FXN, GAA, GALNT2, GATA4, GATA6, GATAD1, GBE1, GCKR, GDF1, GFM1, GJA1, GJA5, GLA, GLB1, GNAI2, GPD1L, GPIHBP1, GRK5, GUSB, GYG1, HADHA, HBB, HCN1, HCN2, HCN4, HFE, HMGCR, HNF1A, HNF4A, HRAS, HSPB8, ILK, IIRX4, JAG1, JPH2, JUP, KCNA5, KCND3, KCNE1, KCNE2, KCNE3, KCNE4, KCNE5, KCNH2, KCNJ11, KCNJ2, KCNJ3, KCNJ5, KCNJ8, KCNK3, KCNQ1, KCNQ2, KCNQ3, KCTD10, KLF10, KLHL3, KRAS, LAMA2, LAMA4, LAMP2, LCAT, LDB3, LDLR, LDLRAP1, LEFTY2, LGALS2, LIPC, LIPG, LMF1, LMNA, LPIN1, LPL, LRP6, LTA, LTBP2, LY2, MAFB, MAP2K1, MAP2K2, MED12, MED13L, MIA3, MIAT, MIB1, MLXIPL, MRAS, MRPL3, MTHFD1L, MTHFR, MTO1, MURC, MYBPC3, MYH10, MYH11, MYH6, MYH7, MYL2, MYL3, MYL4, MYLK, MYLK2, MYO6, MYOCD, MYOM1, MYOT, MYOZ1, MYOZ2, MYPN, NCAN, NCOA6, NDUFAF1, NEBL, NEXN, NF1, NXX2-5, NXX2-6, NODAL, NOS1AP, NOTCH1, NOTCH2, NPPA, NRAS, NUP155, OBSCN, OR13G1, PCDH19, PCSK9, PDCD5, PDLIM3, PHACTR1, PHOX2A, PHOX2B, PITX2, PKP2, PLEC, PLN, PLOD1, PLOD3, PLTP, PPARGC1A, PPCS, PRDM16, PRKAG2, PRKARIA, PRKG1, PRMT1, PRR4, PRR72, PSEN1, PSEN2, PSMA6, PTPN11, RAF1, RANGRF, RASA1, RBM10, RBM20, RET, RIT1, RYR1, RYR2, SALL4, SCN10A, SCN1A, SCN1B, SCN2B, SCN3B, SCN4B, SCN5A, SCN8A, SCN9A, SCNN1B, SCNN1G, SCD2, SDHA, SELENON, SEMA3E, SEZ6L, SGCA, SGCB, SGCD, SGC6, SH2B3, SHOC2, SKI, SLC22A5, SLC25A20, SLC25A3, SLC25A4, SLC2A1, SLC2A10, SLC6A4, SLC8A1, SLC10B1, SLMAP, SMAD3, SMAD4, SMAD6, SMAD9, SNTA1, SOS1, SPRED1, SREBF2, SURF1, SYNE1, SYNE2, TAZ, TBX1, TBX20, TBX3, TBX5, TCAP, TDGF1, TFAP2B, TGF82, TGF83, TGFBR1, TGFBR2, TLL1, TMEM43, TMEM70, TMPO, TNNC1, TNNT3, TNNT3K, TNNT2, TP63, TPM1, TRDN, TRIB1, TRIM63, TRPM4, TSFM, TTC39B, TTN, TTR, TXNRD2, VCL, VKORC1, WDR12, XK, XKR6, ZBTB17, ZFPM2, ZHX3, ZIC3, ZPR1, TK2

Supplemental Table 2. List of variants of interest.

dbSNP, The single Nucleotide Polymorphism Database; VOUS, Variants of unknown significance; AD, autosomal dominant; AR, autosomal recessive; XR, x-linked recessive

ACMG Classification	Gene	Accession	Nucleotide	Amino acid	Zygosity	dbSNP	Inheritance
Likely pathogenic	SCN5A	NM_198056.2	c.3823G>A	p.Asp1275Asn	Hetero	rs137854618	AD, AR
VOUS	DSG2	NM_001943.4	c.1422A>T	p.Glu474Asp	Hetero		AD
VOUS	DSC2	NM_004949.3	c.2368_2370del	p.Gly790del	Hetero	rs377272752	AD, AR
VOUS	TTN	NM_001267550.1	c.45325A>G	p.Thr15109Ala	Hetero		AD, AR
VOUS	TNNT2	NM_001276345.1	c.68-3del		Hetero	rs200153031	AD
VOUS	TTN	NM_001267550.2	c.69193T>C	p.Leu23065=	Hetero	rs776735247	AD, AR
VOUS	LMNA	NM_005572.3	c.1714C>T	p.Arg572Cys	Hetero	s773169005	AD, AR
VOUS	EMD	NM_00117.2	c.129C>T	p.Thr43=	Hetero	Rs781938390	XR

Role of Tpeak-Tend Indices in Risk Stratification for Patients With ECG Pattern of Brugada Syndrome

Dr Long Vien-Hoang¹, Dr Linh Pham Tran¹, Dr Hieu Pham Trung¹, Dr Thuy Nguyen Thi Le¹, Dr Tuan Nguyen Duy¹, Dr Thanh Vu Huy¹

¹*Vietnam National Heart Institute - Bach Mai Hospital, Hanoi, Viet Nam*

OBJECTIVES

Brugada syndrome is an inherited arrhythmogenic syndrome, has the repolarization disorder proposed as one of underlying pathophysiological mechanisms. Tpeak-Tend interval and Tpeak-Tend/QT ratio are the parameters, which reflect transmural dispersion of repolarization. In this study, we investigate the association between Tpeak-Tend indices on the 12-lead electrocardiogram (ECG) and the results of electrophysiological study (EPS).

MATERIALS AND METHODS

A total of 41 patients with ECG pattern of Brugada syndrome (mean age 49±11, 39 males) were included. Tpeak-Tend interval and Tpeak-Tend/QT ratio were measured in each of the right precordial leads (V1-V3). EPS was performed in all participants, after the presence of structural heart disease was excluded.

RESULTS

EPS was positive in 24 patients (59%), which induced the ventricular tachycardia, ventricular fibrillation. The Tpeak-Tend interval were significantly longer in the positive EPS group than those

had negative EPS, as in lead V1 (79.83 ± 6.78 vs 73.29 ± 4.21 ms; $p=0.001$), in lead V2 (80.92 ± 8.91 vs 75.47 ± 3.41 ms; $P=0.022$), in lead V3 (80.63 ± 5.27 vs 74.18 ± 4.8 ms; $P<0.0001$). The similar result was also found with Tpeak-Tend/QT ratio when comparing the positive EPS group versus the negative EPS group, 0.212 ± 0.012 vs 0.190 ± 0.012 in lead V1 ($P<0.0001$), 0.213 ± 0.012 vs 0.191 ± 0.011 in lead V2 ($P<0.0001$) and 0.219 ± 0.009 vs 0.197 ± 0.014 in lead V3 ($P<0.0001$), respectively.

CONCLUSION

In patients with Brugada ECG pattern, Tpeak-Tend interval and Tpeak-Tend/QT ratio were significantly higher in leads V1-V3 in the positive EPS group. These Tpeak-Tend indices may be useful to predict the result of risk stratification using EPS for patients with Brugada ECG pattern.

Role of SV2/RV3 Ratio on Electrocardiogram in Differentiating the Origin Site of Outflow Tract PVBs

Dr Long Vien-Hoang¹, Dr Linh Pham Tran¹, Dr Anh Nguyen Thi Lan², Dr Thuy Nguyen Thi Le¹, Dr Tuan Nguyen Duy¹, Dr Thanh Vu Huy¹

¹*Vietnam National Heart Institute - Bach Mai Hospital, Hanoi, Viet Nam*, ²*Thanh Nhan Hospital, Hanoi, Viet Nam*

OBJECTIVES

This study aimed to investigate the surface electrocardiographic characteristics of outflow tract PVBs of left bundle branch block (LBBB) pattern; and develop the criteria for distinguishing LVOT from RVOT origin in patients with outflow tract PVBs using the SV2/RV3 index.

MATERIALS AND METHODS

We analyzed the characteristics of surface ECG in a cross-sectional study of 150 patients with PVBs of LBBB pattern without structural heart diseases. The wave amplitude were measured using electronic caliper. The SV2/RV3 index was calculated by dividing the S wave amplitude in lead V2 by the R wave amplitude in lead V3 of the same PVB.

RESULTS

Among 150 patients with outflow tract PVBs, 110 were confirmed with RVOT origin and 40 with LVOT. The SV2/RV3 index was significantly smaller in the LVOT than in the RVOT (1.23 ± 0.78 vs

6.07 ± 6.32 ; p < 0.001). The area under the curve (AUC) for the SV2/RV3 index was 0.934, with a critical value ≤ 1.6, yielding sensitivity of 90.9% and specificity of 80% for predicting PVBs originating from LVOT. Comparing this index with a number of other indices in both the study group and the subgroup of patients with transition at V3, we found that our index yields the highest result in terms of value under the ROC curve, sensitivity and specificity.

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CONCLUSION

The SV2/RV3 index is a simple measure that reliably distinguishes LVOT from RVOT origin in patients with outflow tract PVBs, which is useful in clinical practice.

Implementation of Computational ECG Mapping System Is Associated with Decreased Procedure Duration and Fluoroscopy Use

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¹University of California San Diego, San Diego, United States, ²VA San Diego Healthcare System, San Diego, United States, ³Mills Peninsula Medical Center, Burlingame, United States, ⁴Medical University of South Carolina, Charleston, United States

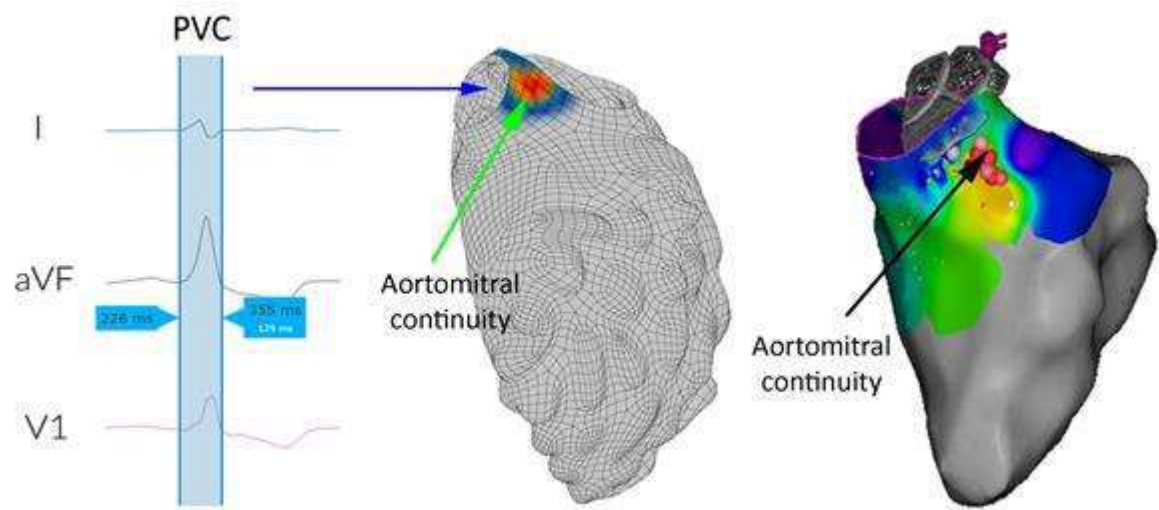
Background: Computational ECG mapping provides arrhythmia source information during electrophysiology ablation procedures, but whether this information would have an impact on procedural metrics was uncertain. We performed a retrospective, case-control study to evaluate the hypothesis that non-invasive ECG mapping may reduce overall procedural duration, fluoroscopy, and cost.

Materials and Methods: We retrospectively compared the first 30 clinical cases using a computational ECG mapping system with matched control cases performed prior to system availability at 2 tertiary medical centers. Cases were matched based upon attending physician, institution, and arrhythmia type, and case complexity. Procedural, fluoroscopy, and catheter data were obtained from anesthesia and nursing electronic records; total procedural time was defined from beginning intravascular access to beginning hemostasis.

Results: Of the first 30 cases, 2 (6.7%) were noninvasive programmed stimulation (NIPS) in preparation for stereotactic ablative radiotherapy which did not have comparable control cases and were excluded. Use of the system was associated with a reduction in procedure duration (68 minutes; 227 ± 54 vs 295 ± 77 minutes, $p < 0.001$), fluoroscopy time (16.3 minutes; 18.4 ± 13.9 vs 34.7 ± 16.6 minutes, $p < 0.001$), and EP lab costs (\$2267). Fewer 64-electrode basket catheters were used in AF ablation cases ($p = 0.025$).

Conclusion: Clinical use of noninvasive computational ECG mapping is associated with a significant reduction in procedural duration, fluoroscopy use, and cost. The system also permitted a novel case type to be performed (NIPS in preparation for stereotactic radiotherapy). Prospective studies are planned to further quantify these results.

SUPPORTING DOCUMENTS



Change in Left Ventricular Ejection Fraction 3 Months Post-acute Myocardial Infarction

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OBJECTIVE: Patients with lower left ventricular ejection fraction (LVEF) post-myocardial infarction (MI) are at higher risk of sudden cardiac death (SCD).

MATERIALS/METHODS: The Improve SCA Bridge study included patients ≥ 18 years old, with acute MI ≤ 30 days and LVEF $< 50\% \leq 14$ days post-MI.

Patients were followed for 12 months in a total of 6 protocol-defined regions: China, India Subcontinent (ISC), Korea, Middle East/Africa/Central Asia/Turkey (MEACAT), Southeast Asia (SEA), and Taiwan. At any follow-up visit, patients could be referred for SCD risk stratification and management if they had a LVEF $\leq 40\%$. This prespecified sub-analysis included patients with LVEF measurements at both baseline and 3 months post-MI.

RESULTS: Of the 1491 patients enrolled (age=60.2 $\pm$ 12.0 years, 82.4% male) 1046 (70.2%) had both LVEF measurements. Mean LVEF change was 6.25% (SD = 8.95%). Patients with higher baseline LVEF (61.3% $\geq 40\%$) were likely to also have higher 3-month LVEF (91.9% $\geq 40\%$). Decreased LVEF at 3 months post-MI was comparable among patients with baseline LVEF above and below 40%: 20.7%

and 19.7%, respectively. Of the patients with reduced LVEF at 3 months, 46% were referred for SCD risk stratification and management.

CONCLUSION: Despite average LVEF showing an increase, ~20% of patients showed reduction. Furthermore, 29.8% of patients' LVEF was unmeasured contrary to ESC guidelines. These results highlight a need for continued education to increase adherence to guideline recommendations for post-MI care.

Abnormal Heart Rate Variability in Patients With Acute Stroke

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¹*Aga Khan University, Karachi, Pakistan*

Objective: Reduced heart rate variability is a marker of autonomic dysfunction following stroke and carries prognostic value. We aimed to evaluate heart rate variability in our patients with acute stroke using Holter monitoring.

Methods: All patients admitted with acute ischemic stroke, undergoing Holter monitoring for stroke workup were enrolled in the study. The study duration was from 2013-2019. The cut-offs for heart rate variability were extracted from studies of Holter monitoring in normal individuals.

Results: A total of 268 patients with acute ischemic stroke were enrolled. The mean age was 62 ± 14 years. 73% were males. The majority were diabetic (53%) and hypertensive (73). 15% had a prior history of stroke. The most involved stroke territories were left MCA (30%), right MCA (21%), and right ACA (5%). Most strokes were left-sided (55%). The mean EF was 51%. The mean LVID was 40 mm, and the mean LAVI was 29. Overall, abnormal heart rate variability was found in 41% of patients. Abnormal ASDNN5 was found in 35% of patients. The majority had compromised SDNN (51%), and 12% had unhealthy SDNN. The majority had RMSSD < 30 ms (55%).

Conclusion: Heart rate variability is altered in patients with acute stroke. This can be assessed to predict cardiac autonomic dysregulation in these patients. Future studies are needed for establishing the correlation between HRV and cardiovascular outcomes.

Patient Comfort in Using Chest Strap and Dry Electrode System for Longer Term Arrhythmia Monitoring

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⁵*Medtronic Inc, Minnesota, United States*

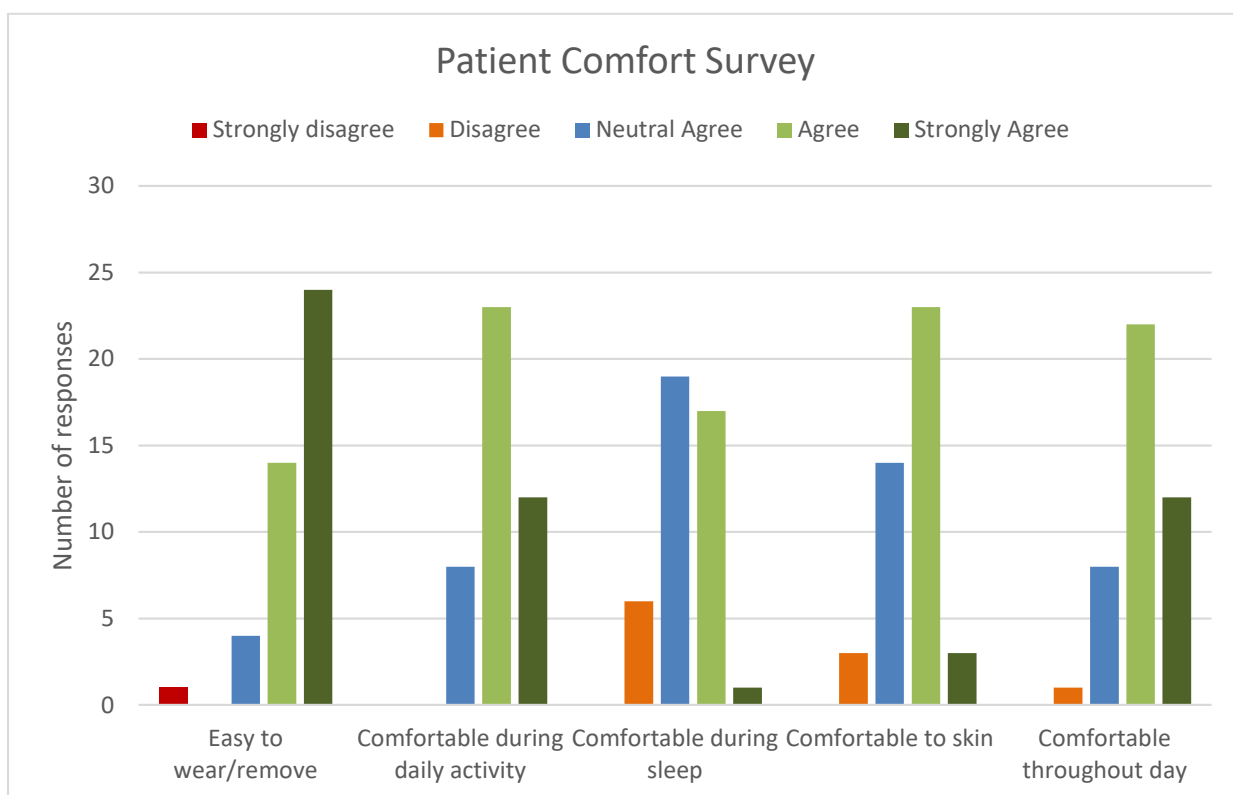
Objective: To investigate the patient comfort level of wearing a chest strap based dry electrode system for continuous monitoring for a period of 3-months in an ambulatory setting.

Materials & Methods: The prospective observational Cardling external cardiac monitor (ECM) feasibility study enrolled patients with history of cardiovascular disease or increased risk of cardiac arrhythmia. Patients wore the ECM prototype at home continuously except when bathing or having discomfort. The ECM investigational prototype was designed using a chest strap with dry electrodes connected to a coin cell battery powered implantable cardiac monitor electronics capable of patient-initiated loop recording and automatic cardiac arrhythmia detection. Patient filled out a survey at 2-, 4-, 8-, and 12-week follow-ups which answered 5 questions related to their comfort level. Patients also maintained a diary noting down number of times and reason for temporarily removal of device.

Results: The study enrolled 14 patients for ambulatory monitoring (21% females, average age 49.7 years, average BMI 26.1 kg/m²). Total 43 patient comfort survey responses were completed and are summarized in figure. Only 5.1% of the responses indicated that patients disagreed that ECM was comfortable to wear (2.8% uncomfortable during sleep, 1.4% uncomfortable for the skin). The patient diary reported a total of 726 days with temporary removal of device. The total duration of temporary removal was ≤2-hour in 93%. The major reason (93%) for removal was during bathing, and 1.5% removals due to skin irritation.

Conclusion: The ECM was mostly comfortable to wear over a 3-month period.

SUPPORTING DOCUMENTS



Bizarre ECG Patterns in Intensive Care Units

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Abstract

Bizarre ECG patterns in intensive care units

Dr Pratik Giri[1] Dr Pratap Nathani[1] Dr Milind Phadke[1] Dr Sriram Esawaran[1] Dr Sainath Hiwarale[1]

1-LTMMC & Sion Hospital, Sion Mumbai

Background: The ECG is the go-to decision making test for acute ischemia, arrhythmias and hyperkalaemia, depending on recognition of specific patterns. However, myocarditis, metabolic derangements and toxicities can produce myriad abnormalities which do not fit into set patterns.

Objective: To study and identify bizarre ECG patterns in critically ill patients to guide appropriate therapeutic intervention.

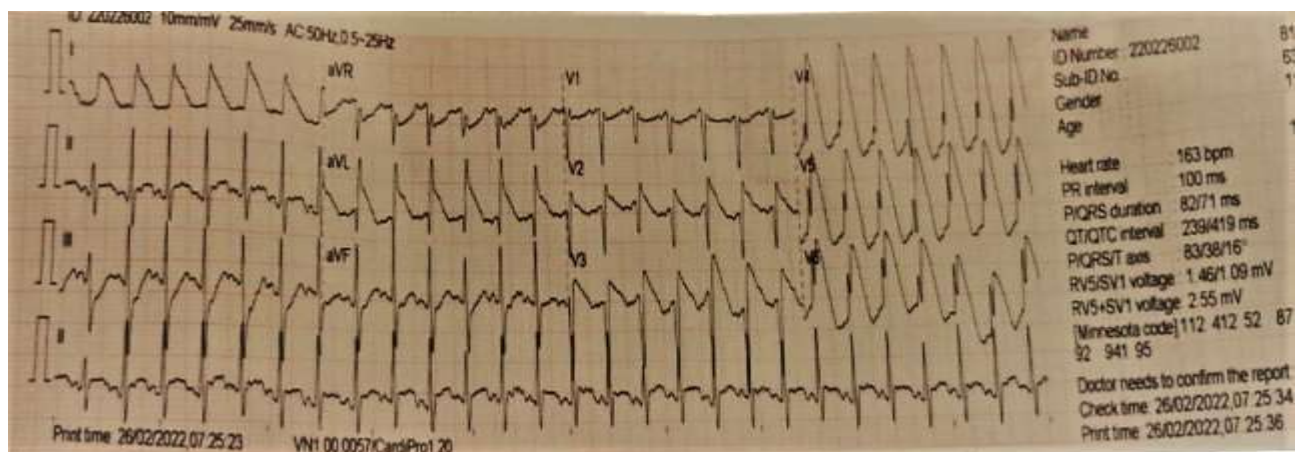
Material and methods. Grossly abnormal ECGs which showed unclassifiable changes were prospectively sought from the cardiac, medical, surgical and paediatric ICU of a university hospital from 2020 to 2022. The clinical features, echocardiogram, metabolic parameters and outcome were recorded.

Results. We encountered 15 bizarre ECG changes, These were detected in the scenarios of intrathoracic pleural or pericardial abnormalities (n=3), extreme metabolic derangements (n=5) & intense psychological/physical stress in post-operative critically ill patients developing secondary acute cardiomyopathies (n=3), Poisoning and drug intoxication(n=2), structural heart disease(n=2). These ECGs were initially misdiagnosed as ischemia(n=2), infarction(n=4) & ventricular tachycardia (n=5). So 11/15(73%) ECGs were misdiagnosed, this could lead to unnecessary and harmful interventions.

As an example, a 4year child with medulloblastoma with raised intracranial tension, in hypotension and metabolic shock, had an ECG showed bizarre ST elevations in leads I, aVL, V3-V6. The ECG normalised after correcting the milieu interior.

Conclusion: Bizarre ECG patterns are uncommon and often multifactorial. They could be misdiagnosed easily, leading to unnecessary and harmful interventions.

SUPPORTING DOCUMENTS



Predicting Cardiac Arrhythmia Risk With Lifestyle Behaviors: a Population-based Machine-learning Approach

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Introduction:

Physical inactivity, obstructive sleep apnea (OSA), and other modifiable lifestyle-related factors are associated with atrial fibrillation (AF), ectopics and other arrhythmias. The increasing use of wearables can monitor changes in these risk factors. We aimed to develop a machine learning (ML)-based model for real-time prediction of cardiac arrhythmia risk using wearables via the tracking of unhealthy lifestyle risk factors.

Methods:

In this prospective study, we applied Linear Regression (LR), Light Gradient Boosting Machine (LGBM), and Synthetic Minority Oversampling Technique (SMOTE) to develop ML approaches to predict the cardiac arrhythmia risks through tracking lifestyle behaviors change between August 1, 2020, to August 1, 2021, across China. The dataset of 2,676 subjects (mean age $\pm$ SD, 46 $\pm$ 16 years, 75% male) were randomly divided (7:3) into a training cohort and a testing cohort, with a total of 13,230 signals available for the optimization of the model. We validated the model in an independent cohort of 1,973 subjects. Furthermore, we assessed the consistence of subject-reported outcome and cardiac arrhythmias risk predicted by ML models involving in 470 subjects.

Application:

The 28 features of sleep quality, 16 features of physical activity, 12 features of OSA, and 18 features of prior monitored cardiac arrhythmia, were available for developing the model. For the testing cohort, the accuracy (% standard deviation, SD) of ML approaches for cardiac arrhythmia risk were 86.9% $\pm$ 0.8 with LR, 89.8% $\pm$ 0.6 with LGBM, and 88.2% $\pm$ 0.8 with SMOTE + LGBM, while F1-scores (SD) were 70.8 $\pm$ 1.4, 73.9 $\pm$ 1.3, and 73.1 $\pm$ 1.6, respectively. The goodness-of-fit of sleep quality, physical activity, OSA, and others (stress, etc.) of the ML models to the real-world setting, in relation to risk strata of cardiac arrhythmia, ranged from 0.95-0.99. The area under the curve (AUCs, 95% confidence interval, CI) of LR and LGBM for high-risk cardiac arrhythmia were 0.97 (0.85-0.98) and 0.96 (0.095-0.98), respectively (DeLong test, $p=0.334$).

For the external validated cohort, the accuracy and F1-score of ML approach for cardiac arrhythmia risk were 90.8 % and 75.5% with LGBM, respectively, while 88.5% and 75.1% with LR, respectively. A comprehensive score of subject-reported outcome questionnaire was 82.9, which was highly consistence with the cardiac arrhythmias predicted by ML models.

Future A wearable-based ML approaches demonstrated good ability for predicting cardiac arrhythmia risk. ML models offer a solution to operationalize the proactive management of lifestyle behaviors and risk factors modification in the general population to reduce the burden of AF and other common arrhythmias.

SUPPORTING DOCUMENTS

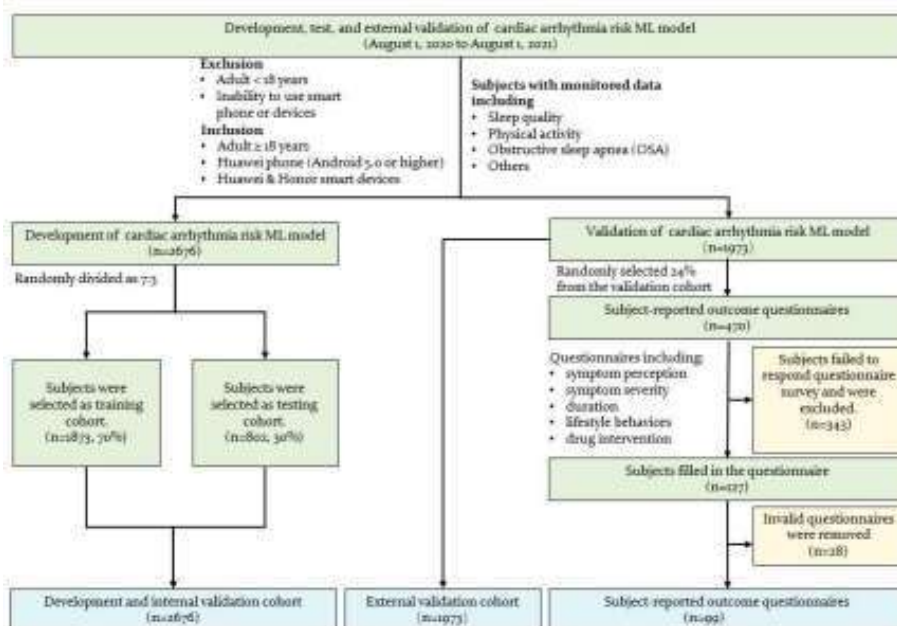


Figure 1. The flowchart of the study

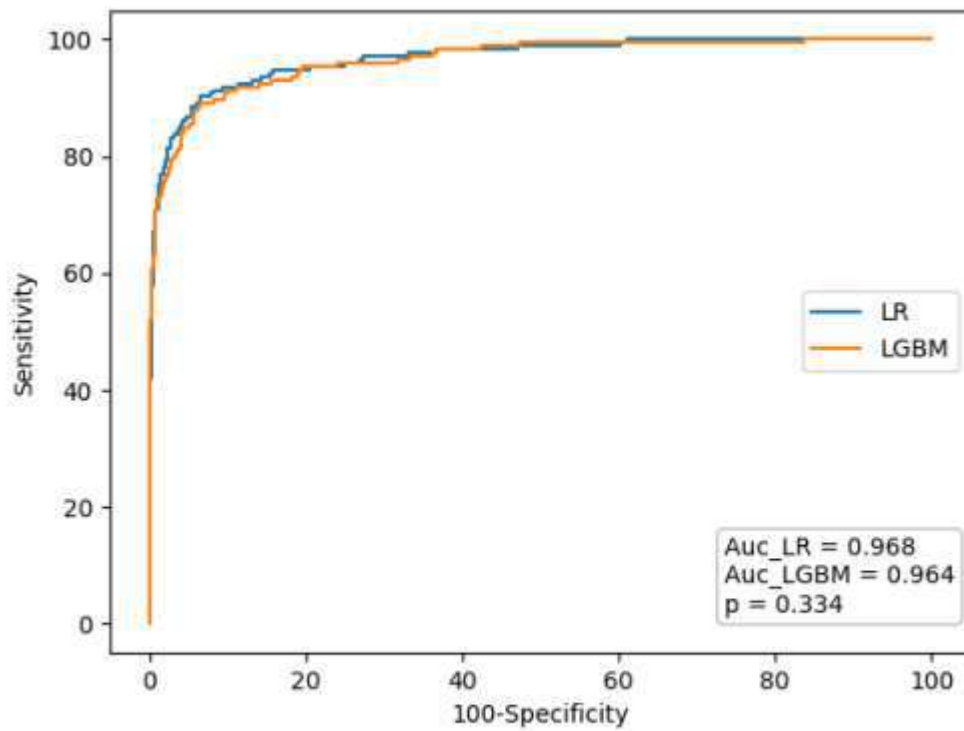


Figure 2 Receiver operating characteristic curve of LR and LGBM for high-risk cardiac arrhythmia.
* Delong test, $p=0.334$

The Arrhythmic Events and Short-term Cardiovascular Outcomes in Patients Hospitalized with COVID-19 Infection in Taiwan

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¹*Department of Internal Medicine, Taipei Medical University, Taipei, Taiwan,* ²*Division of Cardiology, Department of Internal Medicine, Wan Fang Hospital, Taipei Medical University, Taipei, Taiwan,* ³*Division of Infectious Disease, Department of Internal Medicine, Wan Fang Hospital, Taipei Medical University, Taipei, Taiwan*

Objective:

The aim of this study is to investigate the arrhythmic events and short-term cardiovascular (CV) outcomes in patients hospitalized with COVID-19 infection in single Taiwan tertiary center.

Methods:

A retrospective study was carried out on 186 confirmed COVID-19 infection patients admitted to our hospital between May, 2021 and September, 2021. We investigate their CV symptoms, vital signs, laboratory examinations, arrhythmic events and major adverse cardiovascular events (MACE), including ischemic stroke or systemic embolism, myocardial infarction, CV death, and heart failure (HF) during hospitalization.

Results:

During the hospitalization, 29.6% of patients had elevation of cardiac enzymes, 67.2% had elevation of d-dimer level, and 7.5% had abnormal NT-pro BNP level. The most common recorded arrhythmia is sinus tachycardia (22%), followed by atrial arrhythmia (12.4 %, including atrial fibrillation 7.0%), sinus bradycardia (3.2%), ventricular arrhythmia (1.6%), and paroxysmal supraventricular tachycardia (1.1%). Total 68 patients (36.6%) had arrhythmic events during hospitalization. During the mean follow-up of 2.8 months, 17 patients (9.1%) developed MACE, including 6 ischemic stroke, one pulmonary embolism, one peripheral artery occlusive disease, 3 HF and 7 CV death. The total mortality rate is 19.9%. The hospitalized patients with arrhythmic events were associated with a higher incidence of intubation (32% vs 15%, $p=0.0062$), MACE (22% vs 2%, $p<0.001$) and mortality (37% vs 10%, $p<0.001$) than those without arrhythmic events.

Conclusion:

The patients hospitalized with COVID-19 infection were associated with higher CV manifestations and arrhythmic events in Taiwan. Those patients with arrhythmic events were associated with higher morbidity and mortality.

Radiofrequency Ablation Lesion Size: Magnetic Resonance Imaging versus Gross Pathology

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¹Mayo Clinic, United States, ²UCLA, Los Angeles, United States, ³Medtronic, Minneapolis, United States

Objective: Compare radiofrequency ablation (RFA) lesion size on magnetic resonance Imaging (MRI) compared to gross pathology.

Materials and Methods: In-Vivo prospective experiments were conducted in canine animal model after approval by the Institutional Animal Care and Use Committee. RFA of left and right ventricles was followed by intravenous gadolinium and 8-10% triphenyl tetrazolium chloride administration. Post-mortem delayed contrast enhancement MRI on a 3 Tesla scanner (Signa HDxt, GE Healthcare) was performed followed by pathology examination after fixation in 10% formalin solution. Lesion volume calculation assumed an oblate ellipsoid shape. Mean differences and limits of agreement (LoA) were calculated using Bland-Altman plots.

Results: Data from 4 animals were included (38 total ablations: 20 LV & 18 RV). Each animal had 5 LV and 6 RV ablations (1 animal did not have RV RFA). Average lesion depth, maximum width and volume were $9 \pm 2.7\text{mm}$, $3 \pm 1.4\text{mm}$, and $326 \pm 327.0 \text{ [mm]}^3$ on MRI and $7 \pm 2.5\text{mm}$, $8 \pm 2.9\text{mm}$, $188 \pm 237.7 \text{ [mm]}^3$ on pathology. Wall thickness at site of ablation measured similar on MRI and gross pathology (average difference: $0.3 \pm 1.63\text{mm}$; LoA -2.9, 3.5mm). Lesion depth and volume were larger on MRI (average difference: $1.2 \pm 0.89\text{mm}$; LoA -0.58, 2.91mm & $138 \pm 116.80 \text{ [mm]}^3$; LoA = -90.6, 367 [mm]^3 respectively). Lesion max width was larger on pathology (average difference: $5.2 \pm 2.39\text{mm}$; LoA 0.5, 9.8mm). Lesion depth, measured as a percentage of overall wall thickness, was $5.8 \pm 12\%$ deeper on MRI compared to pathology (LoA = -17%, 29%).

Conclusion: RF ablation lesion volume measured larger on post-mortem MRI compared to gross pathology. This could be a result myocardial contraction as heart is placed in formalin.

Association of Interatrial Block and Left Atrial Fibrosis in Patients Without History of Atrial Fibrillation

Asst Prof Natnicha Pongbangli¹, Associate professor Arintaya Phrommintikul¹, Assistant professor Narawudt Prasertwitayakij¹, Assistant professor Teerapat Nantsupawat¹, Associate professor Wanwarang Wongcharoen¹

¹*Division of Cardiology, Thailand*

OBJECTIVES

Presence of left atrial (LA) fibrosis reflects underlying atrial cardiomyopathy. Interatrial block (IAB) is associated with LA scar in patients with atrial fibrillation (AF). The association of IAB and LA scar in the patients without history of AF is unknown. We aimed to assess the association of IAB and LA scar in the patients without history of AF.

MATERIALS AND METHODS

This is a retrospective analysis of 229 patients undergoing cardiac magnetic resonance imaging (CMR). LA scar was reported from the spatial extent of delayed enhancement of CMR. IAB was measured from 12-lead electrocardiography using digital caliper.

RESULTS

Of 229 patients undergoing CMR, the prevalence of IAB was 50.2%. Patients with IAB were older (56.9 ± 13.9 vs 45.9 ± 19.2 years, $P < 0.001$) and had higher prevalence of comorbidities. Left ventricular ejection fraction was lower in IAB group. LA volume index (LAVI) was greater in IAB group (54.6 ± 24.9 vs 43.0 ± 21.1 ml/m², $p < 0.001$). Patients with IAB had higher prevalence of LA scar than those without IAB (82.6% vs 35.1%, $p < 0.001$). After multivariable analysis, only IAB and LAVI were the independent factors that predict atrial scar.

CONCLUSION

Prevalence of IAB in the patients undergoing CMR was high. IAB was highly associated with presence of LA scar and larger LA size in patients without history of AF.

SUPPORTING DOCUMENTS

Table 3. Univariable and multivariable analyses of factors associated with left atrial fibrosis

	Univariate		Multivariate	
	Risk ratio (95%CI)	P value	Risk ratio (95%CI)	P value
Age	1.02(1.01-1.04)	0.002	0.99(0.95-1.02)	0.358
Diabetic mellitus	2.22(1.14-4.31)	0.019	0.73(0.20-2.66)	0.634
Hypertension	2.09(1.19-3.68)	0.012	2.35(0.80-6.90)	0.119
Coronary artery disease	2.78(1.56-4.97)	0.001	1.05(0.31-3.54)	0.932
Spironolactone	2.58(1.31-5.07)	0.006	0.81(0.21-3.16)	0.759
LVEF	0.97(0.95-0.98)	<0.001	0.98(0.95-1.01)	0.211
LA volume index (ml/m ²)	1.08(1.05-1.11)	<0.001	1.07(1.03-1.11)	<0.001
IAB	8.79(4.74-16.28)	<0.001	5.98(2.43-12.70)	<0.001

LVEF: left ventricular ejection function; LAVI: left atrial volume index; IAB: interatrial block

Changes in the Heart Rate Variability After Coronary Artery Bypass Grafting Surgery

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¹108 Military Central Hospital, Hanoi, Vietnam, ²Hanoi Heart Hospital, Hanoi, Vietnam

OBJECTIVES

To determine the pattern of changes in heart rate variability (HRV) of patients undergoing coronary artery bypass grafting surgery (CABG).

MATERIALS AND METHODS

A prospective study in 119 consecutive patients with chronic coronary syndrome underwent CABG at Hanoi Heart Hospital from June 2016 to August 2018. 24-hour Holter was evaluated in all patients on: 2 days before CABG and 7 days, 3 months, and 6 months after the surgery.

RESULTS

All the time-domain (ASDNN, SDNN, rMSSD, pNN 50) and frequency-domain (VLF, LF, HF) parameters of HRV decreased precipitately after CABG and were mostly recovered 3 months postoperatively. The percentage of decreased HRV before surgery was 28.6% and 51.8% after 7 days, 19.6% after 3 months, and 12.7% after 6 months. ASDNN and SDNN before and after surgery had the highest rates of change with the ratio of decreased indices before surgery (19,3%, 8,4%), after 7 days (45,9%, 21,1%), after 3 months (13,7%, 2%), and after 6 months (5,9%, 1%), respectively.

CONCLUSION

Our study shows that frequency and time domain indices changed over time following CABG. HRV reduced remarkably after 7 days, stabilized after 3 months, and increased 6 months after surgery. The ratio of decreased HRV was the highest 7 days after surgery, in which the ratio of decreased ASDNN and SDNN showed the most change, then lowered after 3 months and minimized after 6 months with significant reduction compared to pre-operation.

SUPPORTING DOCUMENTS

Introduction: Coronary artery bypass grafting (CABG) with extracorporeal circulation is a key therapy for coronary artery disease (CAD). However, cardiovascular events and cardiac arrhythmias may still occur in these patients following surgery. Many studies have demonstrated a correlation between cardiac arrhythmias and heart rate variability (HRV). This study aimed to establish the temporal change pattern of HRV observed following CABG. Methods: A prospective method was used to study 119 consecutive patients with stable CAD who were assessed using 24-hour Holter recordings 2 days before CABG and 1 week, 3 months, and 6 months after the surgery at Hanoi Heart Hospital from June 2016 to August 2018. Main results: All the time-domain and frequency-domain parameters of HRV decreased precipitately after CABG and were mostly recovered 3 months postoperatively. The percentage of decreased HRV before surgery was 28.6% and 51.8% after 7 days, 19.6% after 3 months, and 12.7% after 6 months. ASDNN and SDNN before and after surgery had the highest rates of change. Conclusion: The early decrease in HRV observed 7 days after CABG may be related to the acute effects of the surgery. The recovery of HRV at 3 months after surgery, regardless of the preoperative state of the patients, implies that autonomic nervous system (ANS) disorder may be improved at this time. At 6 months after surgery, the autonomic nervous injury was recovered in combination with improvement of reperfusion, resulting in improvement in almost all HRV indices compared with those indices pre-operatively.

Keywords: Coronary artery disease, heart rate variability, coronary artery bypass graft surgery

1. Introduction

Coronary artery disease (CAD) is a common disease and the leading cause of death worldwide [1,2]. Currently, *coronary artery bypass grafting* (CABG) with extracorporeal circulation is a key therapy for CAD, however, cardiovascular events and cardiac arrhythmias still occur in these patients after surgery [3-6]. Cardiac arrhythmias commonly occurring after surgery include atrial fibrillation (5-40%), ventricular tachycardia (26.6%), and ventricular fibrillation (2.7%) [7-9]. Cardiac arrhythmias account for 30-50% of all post-operative deaths [10]. Among the cardiac arrhythmias mentioned above, only 5-10% can be detected by a *12-lead electrocardiogram* (12-lead ECG); this can be increased to up to 40-60% by using 24-hour Holter monitoring (or 24-hour Holter ECG) detection [11]. The autonomic nervous system (ANS) is a risk factor for the development of arrhythmias [12].

Holter ECG plays a direct role in assessing arrhythmias and an indirect role in assessing ANS activity through HRV, which is considered to be a predictor of arrhythmia and cardiovascular events [12,13].

Several studies have evaluated HRV pre- and post-operatively. However, in these studies, HRV after CABG was only monitored at one time [14] or was assessed by sequential changes with a limited number of cases [15,16,17]. In this study, we assessed HRV in time domain and frequency domain by 24-hour Holter ECG in patients before and after CABG at 1 week, 3 months, and 6 months. The assessment of HRV at 3 times post- surgery will help to predict ventricular arrhythmias, especially new-onset atrial fibrillation for acute post-surgery and stable stage after surgery, which may provide better prognosis and treatment in different postoperative periods.

Materials and methods

Selection criteria: A total of 119 patients with stable CAD in sinus rhythm undergoing isolated CABG surgery at Hanoi Heart Hospital between June 2016 and August 2018.

Exclusion criteria: Patients with an acute coronary syndrome, acute heart failure, or other acute diseases; patients with medical conditions where HRV could not be assessed before surgery, such as atrial fibrillation, frequent premature ventricular complex, sinus node dysfunction, and second and third-degree atrioventricular block; patients with pacemakers; patients with congenital heart disease or combined cardiac surgeries; and patients who did not consent to participate in the study were excluded.

2. Methods and research

Study Design. This study was conducted by prospective, descriptive methods and approved by the Hospital Ethics Committee. Patients were advised of the protocol for the study and written informed consent was obtained.

Research Tools: Holter 24-hour recordings were made by 3-channel SEER LIGHTS Digital Holter recorders; an MSC 8800 Holter Monitoring system with Medical System International software version 5.02 was used.

Research Steps: Perioperative management: No patients took amiodarone preoperatively. Most patients were extubated on the day of surgery and oral medication was initiated on postoperative day 1, no inotropes were used at 3 days postoperatively. We tried to avoid prescribing drugs that affect HRV (calcium channel blockers, beta-blockers, antiarrhythmic drugs,

etc.). If drugs affecting HRV were prescribed for preoperative treatment, we overcame this influencing factor by continuing its use after surgery.

Holter ECG recordings and HRV analysis: The first recording was made 2 days before surgery, the second was made 7 days after surgery, the third was made 3 months after surgery, and the 4th was made 6 months after surgery. HRV was analyzed using the Holter Monitoring system and then over-read manually. It was analyzed in Holter ECG recordings only in patients with sinus rhythm. Holter ECG results were reviewed by a single cardiologist and only recordings with less than 15% of ectopic beats were used. All artifacts were cleaned and beats were modified as needed.

Evaluation Criteria: Most of the variables were calculated as recommended by the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology [18]. For frequency domain analysis, the indices measured included VLF (the magnitude of the HRV in the VLF range, 0.0033 to 0.04Hz), LF (the magnitude of the HRV in the LF range, 0.04 to 0.15Hz), and HF (the magnitude of the HRV in the HF range, 0.15 to 0.04Hz). HRV in the time domain covered ASDNN (the mean of the standard deviations of all normal to normal intervals for 5 minutes of recording), rMSSD (the square root of the mean of the sum of the squares of differences between adjacent normal to normal intervals), pNN50 (percentage of normal to normal intervals > 50 ms), SDNN (standard deviation of all normal to normal intervals), and SDANN (standard deviation of averages of normal to normal intervals in all 5-minute segments of recordings). Decreased HRV was defined according to Crawford et al. (1999), i.e. when there was at least one index of expression upper to the limit level [19]. Atrial fibrillation was defined as at least 6 minutes of an irregularly-irregular pattern of QRS-waves recorded [19].

Statistical Analysis

The corrected data were processed, and HRV was computed. The results are expressed by mean value $\pm$ standard deviation with minimum and maximum value. Normality of distribution of the variables was checked using a Kolmogorov Smirnov test. Variables that are normally distributed have a histogram (or "density function") that are bell-shaped, with only one peak, and are symmetric around the mean. Comparisons in parameters between two groups were performed using Pearson's X² test for categorical variables, unpaired t test for normally distributed variables, and Mann-Whitney's U test for skewed variables. Continuous variables underwent Student's unequal variance

unpaired t-tests or nonparametric tests, as appropriate. All analyses were performed with the SPSS statistical package, version 11.0.

3. Results and discussion

3.1. General characteristics of the patients

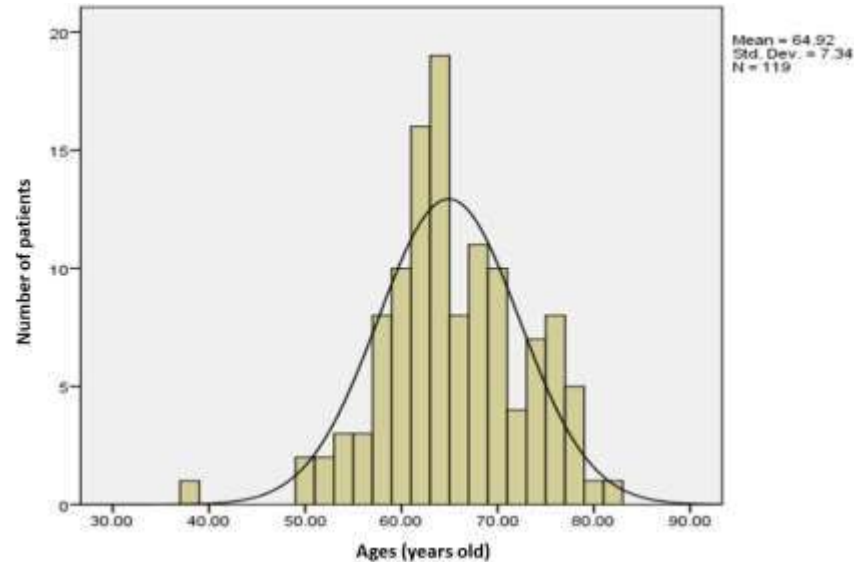


Figure 1. Age distribution

A total of 119 patients were recruited for this study. The general characteristics of the studied patients are shown in Table 1 and Figure 1. The average age of these patients was 64.92 ± 7.34 years old, with the common age ranging between 60 and 70 years old. The youngest patient was 38 years old and the oldest was 81 years old. The age of patients in this study is similar to that in published studies [20]

Table 1. General characteristics, risk factors, and comorbidities

Parameters \ Value	Patients (n=119)	
	Values (n)	Ratio (%)
Male	99	83.2
Smoking	55	46.2
BMI $\geq$ 23	61	51.2
History of myocardial infarction	10	8.4
Hypertension	103	86.6
Dyslipidemia	62	52.1

Value Parameters	Patients (n=119)	
	Values (n)	Ratio (%)
Chronic obstructive pulmonary disease (COPD)	4	3.4
Type 2 diabetes	40	33.6
peripheral arterial disease	15	12.6
Renal failure $\geq$ IIIa	56	47.1
Age (years)	64.92 $\pm$ 7.34 (39 – 81)	
BMI (kg/m ²)	22.99 $\pm$ 2.85 (15.99 – 30.8)	
EuroSCORE II (%)	1.31 $\pm$ 0.82 (0.6 – 4.9)	

Males accounted for 83.2% of the patients (99 patients) and females accounted for 16.8% (20 patients). The proportion of men was more than four times that of women. This rate is similar to that of several published studies [21-23]. Generally, men are three to four times more likely to develop coronary heart disease than women. The mean BMI of the patients was 22.99 $\pm$ 2.85 (ranging between 15.99 and 30.8). Being under/overweight or obese increases the frequency of pneumonia and it can be difficult to wean such patients off mechanical ventilation in the early stages of surgery [24]. Hypertension-related diseases were prevalent in 103 of the patients. These characteristics reflect the common risk factors of CAD such as advanced age, multiple risk factors, and comorbidities.

3.2. HRV in the frequency domain

Table 2. Heart rate variability by frequency domain before and after surgery

Timing Frequency Domain		Before surgery ⁽¹⁾ (n = 119)	After 7 days ⁽²⁾ (n =109)	After 3 months ⁽³⁾ (n =102)	After 6 months ⁽⁴⁾ (n = 102)
VLF (ms ²)	($\bar{X} \pm SD$)	25.19 $\pm$ 12.28	18.32 $\pm$ 11.86	25.74 $\pm$ 9.18	29.75 $\pm$ 11.33
	p		p ₍₁₋₂₎ <0.001	p ₍₁₋₃₎ >0.05	p ₍₁₋₄₎ <0.05
LF (ms ²)	($\bar{X} \pm SD$)	16.26 $\pm$ 12.33	12.95 $\pm$ 11.93	17.06 $\pm$ 9.09	20.25 $\pm$ 9.91
	p		p ₍₁₋₂₎ <0.05	p ₍₁₋₃₎ >0.05	p ₍₁₋₄₎ <0.05

Timing Frequency Domain		Before surgery ⁽¹⁾ (n = 119)	After 7 days ⁽²⁾ (n =109)	After 3 months ⁽³⁾ (n =102)	After 6 months ⁽⁴⁾ (n = 102)
HF (ms ²)	($\bar{X} \pm SD$)	11.35±7.21	8.74±6.19	12.00±6.26	12.91±5.40
	p		p ₍₁₋₂₎ <0.001	p ₍₁₋₃₎ > 0.05	p ₍₁₋₄₎ > 0.05
LF/HF	($\bar{X} \pm SD$)	1.43 ± 0.40	1.48± 0.64	1.48± 0.42	1.59± 0.43
	p		p ₍₁₋₂₎ > 0.05	p ₍₁₋₃₎ > 0.05	p ₍₁₋₄₎ <0.05

All 119 patients had sinus rhythm Holter ECG results before surgery. At 7 days after CABG surgery, there were two cases of death and eight cases of persistent atrial fibrillation. At 3 months and 6 months postoperatively, there were 14 cases of atrial fibrillation and one more death, respectively. HRV is the oscillation of the heart rate interval that reflects the interaction of factors regulating heart rate. Age, race, sex, physical status, and concomitant diseases influence HRV. However, HRV in 24 hours is stable on a day-to-day, day-to-week basis in the absence of therapeutic intervention or major events and regulated by the ANS [25]. Imbalances in the ANS have been shown to increase the risk of arrhythmia in CAD patients. Increments in sympathetic nervous system (SNS) activity in CAD patients may lead to greater myocardial ischemia which, in turn, increases SNS activity while decreasing parasympathetic nervous system (PSNS) activity [25,26].

Table 2 shows that the measured value of HRV according to the frequency domain changed over the study period. At 7 days after CABG surgery, the values of the frequency spectrum indices (VLF, LF, HF) were lower than before surgery; however, the LF/HF ratio remained unchanged. This is likely explained by acute post-operative injuries affecting the ANS, which decreased both the SNS (decreased VLF and LF) and PSNS (decreased HF) and continued the imbalance between the SNS and PSNS (LF/HF remained unchanged). Cheng-Deng Kuo [15] tested 14 patients, the result showed that total power and only low-frequency power (SNS activity) decreased significantly 1 month after CABG and returned to preoperative levels from the second month. There were no significant differences in high-frequency power (PSNS activity) and low-/high-frequency power ratio (SNS activity) before and after CABG. The author suggested that CABG affected on SNS and its improvement after 2 months of operation was attributed to the recovery from direct injury to the vagus nerve or sinus node. In their study with 22 patients, C. Ann Brown et al [16] found that overtime between six and

12 weeks postoperatively the indices of PSNS (HF/ total power) improved significantly, whereas no change was seen in the LF/HF ratio. Both authors above found that either SNS or PSNS was affected by CABG. In our study, both SNS and PSNS were reduced at one week postoperatively and changed during the follow- up period. The difference maybe explained that in these previous studies, a limited cases recruited can cause bias in statistical analysis and the difference on baseline characteristics maybe the reason.

At 3 months after surgery (table 2), all values of the frequency domain indices had risen again and were not significantly different from the preoperative values ($p_{(1-3)} > 0.05$), indicating the improved recovery of the ANS compared to 7 days after surgery due to the improvement of acute injury 3 months post-operatively. However, the LF/HF index was not improved, which implied a remaining SNS/PSNS imbalance. After 6 months of surgery, a significant increase was seen in LF but not in HF, which resulted in significantly increased LF/HF and the improvement of SNS/PSNS balance. Probably, before surgery LF was markedly reduced and only mild reduction was seen in HF, therefore, postoperative LF increased remarkably and an increase was also found in postoperative HF but without significance. This may explain the results of previous studies where cardiovascular events and cardiac arrhythmias at 6 months after surgery continued to improve compared to those 3 months postoperatively [28,29]. In other study [15], HRV did not exceed the preoperative level over 6 months after CABG, the author suggested that there was incomplete recovery from direct injury to the vagal nerve or sinus node, or that revascularization due to CABG cannot improve the autonomic nervous activity of the heart in 6 months. This present study was carried out recently with good condition and facilities, which may partly explain the better revascularization with the improvement of HRV as compared to the previous study.

3.3. HRV in the time domain

Table 3. Heart rate variability (HRV) in time domain before and after surgery

Timing Time Domain		Before surgery (1) (n = 119)	After 7 days ⁽²⁾ (n =109)	After 3 months ⁽³⁾ (n =102)	After 6 months ⁽⁴⁾ (n = 102)
ASDNN (ms)	($\bar{X} \pm SD$)	44.84±20.14	34.54±21.24	46.13±16.53	52.23±16.56
	p		$p_{(1-2)} < 0.001$	$p_{(1-3)} > 0.05$	$p_{(1-4)} < 0.05$

Timing Time Domain		Before surgery (1) (n = 119)	After 7 days (2) (n = 109)	After 3 months (3) (n = 102)	After 6 months (4) (n = 102)
rMSSD (ms ²)	($\bar{X} \pm SD$)	26.73±12.15	22.14±12.82	27.83±12.18	29.14±10.01
	p		p ₍₁₋₂₎ = 0.001	p ₍₁₋₃₎ > 0.05	p ₍₁₋₄₎ > 0.05
pNN 50 (%)	($\bar{X} \pm SD$)	6.84±7.24	4.94±8.78	7.69±7.74	8.40±6.72
	p		p ₍₁₋₂₎ <0.05	p ₍₁₋₃₎ > 0.05	p ₍₁₋₄₎ > 0.05
SDNN (ms)	($\bar{X} \pm SD$)	101.18±34.28	76.65±35.04	107.5±27.27	121.5±25.98
	p		p ₍₁₋₂₎ <0.001	p ₍₁₋₃₎ > 0.05	p ₍₁₋₄₎ <0.001

In this study, the time domain indices of HRV also changed over time. At 7 days after surgery, all of the time domain indexes (ASDNN, rMSSD, pNN50, SDNN, SDANN, and Mean NN) were lower than before surgery (Table 3). This shows that the acute effect of CABG surgery reduces the time domain indices, which is similar to the results of the frequency domain indices analysis above. Acute injuries caused by surgery include myocardium damage, autonomic nerve fibers (caused by cutting, burning, contusion, etc.), neurohumoral dilution due to cardiopulmonary system filling, bleeding, and fluid infusion [30,31]. The HRV indexes reflect the ANS, in which the SDNN index is governed by the SNS (like the LF index). The pNN50 and rMSSD indices are governed by the PSNS (like the HF index). In the first week after surgery, other authors have found that arrhythmias increase significantly compared to before surgery [32]. The decrease in the time domain indices during this time might indirectly reflect postoperative damage, which may help predict postoperative arrhythmias. At 3 months after surgery, all HRV indexes in the time domain had increased and were equal to those before surgery ($p_{(1-3)} > 0.05$, Table 3). HRV recovery at 3 months after surgery was consistent in both the frequency and time domains. This result further demonstrates that ANS damage (including the SNS and PSNS) caused by acute effects of CABG was generally healed 3 months after surgery. This results reach agreement with the other studies, Pedro Paulo S Soares [17] also noted that all the time-domain indexes of HRV decreased at 3 days, 6 days and 15 days after CABG, which gradually increased at 30 days postoperatively. At 60 days and 90 days after surgery, all time-domain indexes returned to pre-surgery values with no significant difference.

In this study, at 6 months after surgery, the ASDNN, SDNN, and SDANN indexes were higher than before surgery (Table 3), which is similar to the VLF and LF indices in the results of the analysis of the frequency domain indices, indicating an increased function of the SNS on the heart. Where as, at 6 months, the rMSSD and HF indices changed insignificantly compared to those before and 3 months after surgery. Both indexes were controlled by the PSNS and depended on concomitant diseases such as hypertension, kidney failure, diabetes, and CAD. Despite reperfusion after surgery, the underlying disease still existed and a proportion of patients had not been completely reperfused, which may explain the incomplete recovery of the PSNS indicators with no significantly different values compared to those before surgery.

3.4. Decreased HRV

Table 4. The ratio of decreased heart rate variability before and after surgery

Timing Time Domain		Before surgery (⁽¹⁾ (n = 119)	After 7 days (⁽²⁾ (n =109)	After 3 months (⁽³⁾ (n =102)	After 6 months (⁽⁴⁾ (n = 102)
Decreased heart rate variability (n, %)	Yes	34 (28.6)	57 (52.3)	20 (19.6)	13 (12.7)
	No	85 (71.4)	52 (47,7)	82 (80,4)	89 (87.3)
			p_(1,2) <0,001	p_(1,3) <0.05	p_(1,4) < 0.05
ASDNN (ms)	<30	23 (19.3)	50 (45.9)	14 (13.7)	6 (5.9)
	≥ 30	96 (80.7)	59 (54.1)	88 (86.3)	96 (94.1)
	p		p_(1,2) < 0.05	p _(1,3) > 0.05	p_(1,4) < 0.05
rMSSD (ms ²)	<15	18 (15.1)	28 (25.7)	10 (9.8)	7 (6.9)
	≥15	101 (84.9)	81 (74.3)	92 (90.2)	95 (93.1)
	p		p _(1,2) > 0.05	p _(1,3) > 0.05	p_(1,4) < 0.05
pNN 50 (%)	<0,75	26 (21.8)	34 (31.2)	13 (12.7)	11 (10.8)
		93 (78.2)	75 (68.8)	89 (87.3)	91 (89.2)
	p		p _(1,2) > 0.05	p _(1,3) > 0.05	p_(1,4) < 0.05
SDNN (ms)	<50	10 (8.4)	23 (21,1)	2 (2.0)	1 (1.0)
		109 (91.6)	86 (78.9)	100 (98.0)	101 (99.0)

Timing		Before surgery	After 7 days ⁽²⁾	After 3 months	After 6 months
Time	Domain	⁽¹⁾ (n = 119)	(n =109)	⁽³⁾ (n =102)	⁽⁴⁾ (n = 102)
	p		p_(1,2) < 0.05	p_(1,3) < 0.05	p_(1,4) < 0.05
SDANN (ms)	<40	6 (5.0)	22 (20.2)	2 (2.0)	1 (1.0)
		113 (95.0)	87 (79.8)	100 (98.0)	101 (99.0)
	p		p_(1,2) < 0.05	p _(1,3) > 0.05	p _(1,4) > 0.05

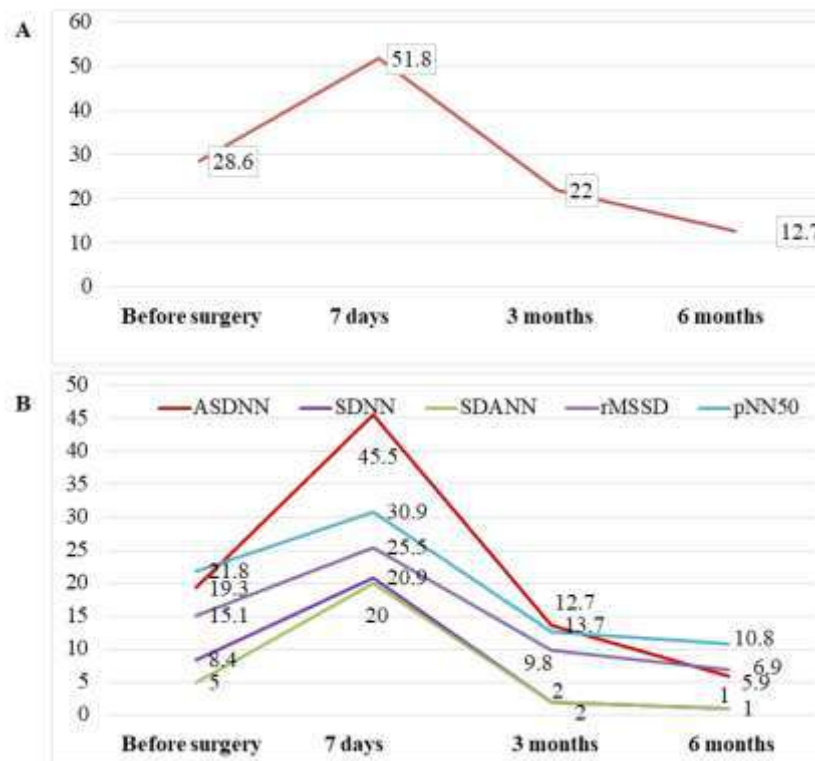


Figure 2. Heart rate variability. (A) The ratio of decreased heart rate variability before and after surgery; (B) The ratio of decreased heart rate variability by each indices

In our study, there was a change in the percentage of decreased HRV at the following time points: before surgery (28.6%), 7 days after surgery (51.8%), 3 months after surgery (19.6%), and 6 months after surgery (12.7%). There was a sharply increased ratio of decreased HRV at 7 days post-operatively. Among these indices, the ratios of decreased ASDNN, SDNN, and SDANN were found to be significantly higher; this reflects the reduction of SNS function (Table 4, Figure 2). No significant changes in the ratio of decreased rMSSD or pNN 50 was observed, indicating that PSNS activity was not greatly affected.

The high proportion of patients with decreased HRV immediately after surgery was possibly due to the acute impact of the surgery, which reduced the HRV indices governed by the SNS, while the HRV indices reflecting the PSNS were not affected. Previous studies have shown that only a reduction in PSNS function is valuable in predicting cardiovascular events [33]. This may be the reason why a decreased HRV at 7 days after surgery has little value in predicting cardiovascular events. Likewise, regarding the consequences of decreased HRV in CABG patients with stable CAD, most authors have the same opinions. Milicevic et al., studying 175 CAD patients (124 with acute myocardial infarctions (MI) and 51 undergoing CABG surgery), showed that a decreased HRV in the CABG surgery group had less predictive value for mortality than in the MI group [29]. Lakusic (2015) also suggested that, unlike a reduction of AMI in patients with MI, a reduction in HRV after CABG was not associated with major cardiovascular events [30]. Park et al. stated that a decreased HRV pre-operatively has a predictive value in the occurrence of new atrial fibrillation and stroke following CABG [31].

In this study, decreased HRV was gradually recovered by the third month, in conjunction with significantly lower ratios of decreased HRV by each time domain index. However, no significantly different value was observed compared to the pre-operative values. By the sixth month, the ratios of decreased HRV by each index continued to decrease compared to the third month and a significant difference was observed compared to the pre-operative values, except for that of SDANN. By the sixth month, the HRV indices reflecting the PSNS and the indices reflecting the SNS and PSNS were significantly improved. The post-operative ANS injury which occurred during the first week lasted up to 3 months after surgery. By the sixth month, these damages had recovered in combination with the recovery of reperfusion, which resulted in an improvement in almost all HRV indices compared with the pre-operative indices [32]. Despite an significant improvement of HRV comparing to pre-operation, a number of patients still have a decreased HRV, HRV had not totally normalized. This likely explains why cardiac arrhythmia often occurred in the first week and then decreased gradually after 1, 3, and 6 months in most of the patients [33-36].

4. Conclusion

Our study shows that frequency and time domain indices changed over time following CABG. HRV in both SNS and PSNS indices reduced remarkably after 7 days, stabilized after 3 months, and increased 6 months after surgery. The ratio of decreased HRV was the highest 7 days after surgery,

in which the ratio of decreased ASDNN and SDNN showed the most change, then lowered after 3 months and minimized after 6 months with significant reduction compared to pre-operation.

Limitation

In this study, HRV was not assessed monthly during the follow-up, the pattern of change was only evaluated at 7 days, 3 months and 6 months postoperatively. Cardiac events and death had not been followed up to find the relation with HRV change, which cannot help to provide prognosis. Due to lack of a large number of patients, HRV had not been analyzed in terms of baseline characteristic and surgery related factors.

Data availability

Data can be made available on request through email to the corresponding author.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this article.

Author contribution

P.T.S conceptualized the study, searched the literature, and wrote the manuscript, and supervised the work, N.V.T and N.S.H collected and processed the data, and P.N.S analyzed and interpreted the data.

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A Comparison Between Accuracy of Apple Watch 4 and Fitbit Versa to Measure Heart Rate

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Objective

To compare two commonly used newer generation wearables, the Apple Watch 4 (AW) and Fitbit Versa (FB) to accurately detect HR during various arrhythmias in patients undergoing EPS.

Materials and Methods

Patients underwent a clinically indicated EPS along with AW on one wrist and FB on other. The device measured HR was obtained by using the highest measured HR. The corresponding true HR was derived from the ECG. Accurate measurement was defined as HR within $\pm 10\%$ of true HR. The rhythms were divided into five categories i.e., regular, the onset and termination of tachycardia, irregular, and sinus pause more than 3 seconds (or CHB).

Results

Thirty-two patients with n=322 simplified rhythms were analysed. Both devices failed to capture HR of more than 180 bpm. The accuracy within 10% of true HR for regular rhythms for AW and FB was 86.9 % and 100 % for SR, 86.3 % and 88.6% for SVT, and 58 % and 40.5% for VT. AW had accuracy of 85.7% to detect the onset of SVT and of 60% to detect VT. FB had accuracy of 39.2% and 16.2% for SVT and VT onset. Both devices had poor accuracy (<70%) during termination of SVT and VT, AF, NSVT, and PVC. No episodes of VF, sinus pause or CHB were picked.

Conclusion

The overall accuracy of AW was better than FB. Both can accurately detect HR during tachyarrhythmias and an unexpected increase in HR detected by the AW is likely a true tachyarrhythmia

SUPPORTING DOCUMENTS

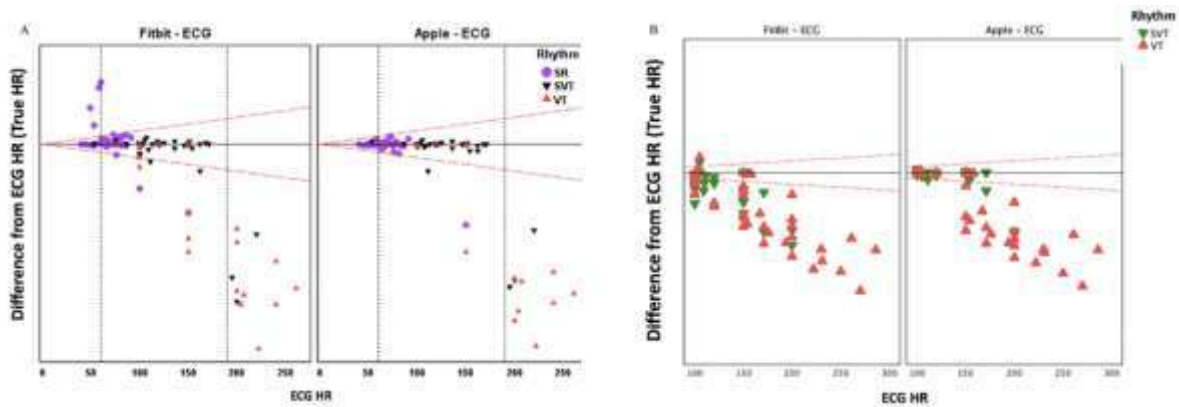
Table 1: Accuracy of Fitbit and Apple watch for the various rhythms.

	Number of rhythms	Accuracy ratio (≥ 10%) Fitbit	Delta (FB HR – True HR)	Accuracy ratio (≥ 10%) Apple	Delta (AW HR – True HR)
Regular	121 (37.5%)				
Sinus Rhythm (HR 40-150)	46 (38.0%)	40 (86.9%)	2.83 ± 11.83	46 (100 %)	0.7 ± 2.2
	44 (36.3%)	38 (86.3%)	- 8.75 ± 25.52	39 (88.6%)	- 8.32 ± 24.86
SVT (HR 100 – 200)	31 (25.6%)	18 (58.0%)	- 38.19 ± 49.14	21 (67.7%)	- 35.97 ± 53.85
	22	18	-11.05 ± 23.52	21 (95.4%)	-3.82 ± 17.02
VT (HR 100 – 261)	(18.8%)	(81.8%)			
VT HR < 180					
Onset	65 (20.1 %)				
SVT (HR 100 – 200)	28 (43.0%)	11 (39.2 %)	- 29.18 ± 34.61	24 (85.7%)	- 9.79 ± 26.88
	37 (56.9%)	6 (16.2 %)	- 71.51 ± 57.5	15 (40.5%)	- 63.57 ± 63.23
VT (HR 100 – 286)	25	6 (24 %)	- 34.0 ± 39.96	15 (60 %)	- 1.50 ± 43.11
VT HR < 180	(38.46%)				
Termination	66 (20.5 %)				
SVT (HR 41 – 140)	37	15 (39.4 %)	18.5 ± 20.32	23 (60.5%)	5.43 ± 8.06
VT (HR 27 – 169)	(56.1%)	9 (31%)	14.34 ± 36.71	12 (41.3%)	7.28 ± 32.48
	29				
	(43.9%)				
Irregular rhythms	66 (20.5%)				
AF (HR 56 -194)	28	10 (39.4%)	-19.92 ± 28.27	11 (60.5%)	-17.96 ± 31.76
VF (HR 171 – 430)	(42.4%)	0	-110.2 ± 60.37	0	-91.8 ± 61.91
VPC (HR 50 – 112)	10	6 (54.5%)	- 58.5 ± 41.85	6 (54.5%)	-65.5 ± 43.15
	(15.1%)	3. (17.6%)	- 7.36 ± 19.28	2 (11.7%)	-7.5 ± 16.09

NSVT (HR 102 – 197)	11 (16.6%) 17 (25.7%)				
Pause > 3 seconds and CHB	4 (0.01 %)	0	17.12 ± 19.32	0	-13.8 ± 24.48

Data is represented as n (%), mean ± SD

Figure 1 Scatter plot depicting accuracy of wearables for stable regular rhythm (Panel A) and (Panel B) onset of SVT. Red dashed lines are +/-10% ECG heart rate limits. Black line is zero difference from ECG HR.



Optimal Anticoagulation Intensity of Warfarin in Korean Patients With Atrial Fibrillation: Multi-center, Prospective, Randomized Controlled Trials

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Objectives: In this randomized, open-label trial, we compared low intensity anticoagulation (international normalized ratio, INR 1.6 to 2.6) with standard intensity anticoagulation (INR 2.0 to 3.0) with warfarin in 616 patients with atrial fibrillation (AF) and at least 1 risk factor for stroke.

Material and Methods: The per-protocol, intension-to-treatment analysis was designed to determine whether low-intensity anticoagulation (n=308) was non-inferior to standard-intensity anticoagulation (n=308) with warfarin for the primary end point of net clinical outcomes defined as the sum of stroke, systemic embolism, major bleeding and death.

Results: Median value of INR was significantly higher in standard-intensity group than low-intensity group (2.19 vs. 2.07, p=0.002), whereas that of time in the therapeutic range was comparable between the 2 groups. The rate of primary outcome was 1.55% per year in low-intensity anticoagulation, as compared with 2.46% per year in standard-intensity anticoagulation (hazard ratio [HR] 0.62, 95% confidence interval [CI] 0.22 to 1.74, p for non-inferiority <0.001). New-onset stroke occurred in 2 patients (0.52% per year) in low-intensity group and in 5 patients (1.23% per year) in standard-intensity group (HR 0.42, 95% CI 0.08 to 2.17, p for non-inferiority <0.001). Major bleeding occurred in 4 patients (0.88% per year) in low-intensity group and 5 patients (1.23% per year) in standard-intensity group (HR 0.84, 95% CI 0.22 to 3.17, p for non-inferiority <0.001).

Conclusion: In Korean patients with AF, low-intensity anticoagulation with warfarin as INR 1.6 to 2.6 was non-inferior to standard-intensity anticoagulation with warfarin as INR 2.0 to 3.0.

Baseline Electrocardiogram Changes Could Predict Clinical Outcomes Among Hospitalized Chronic Kidney Disease Patients

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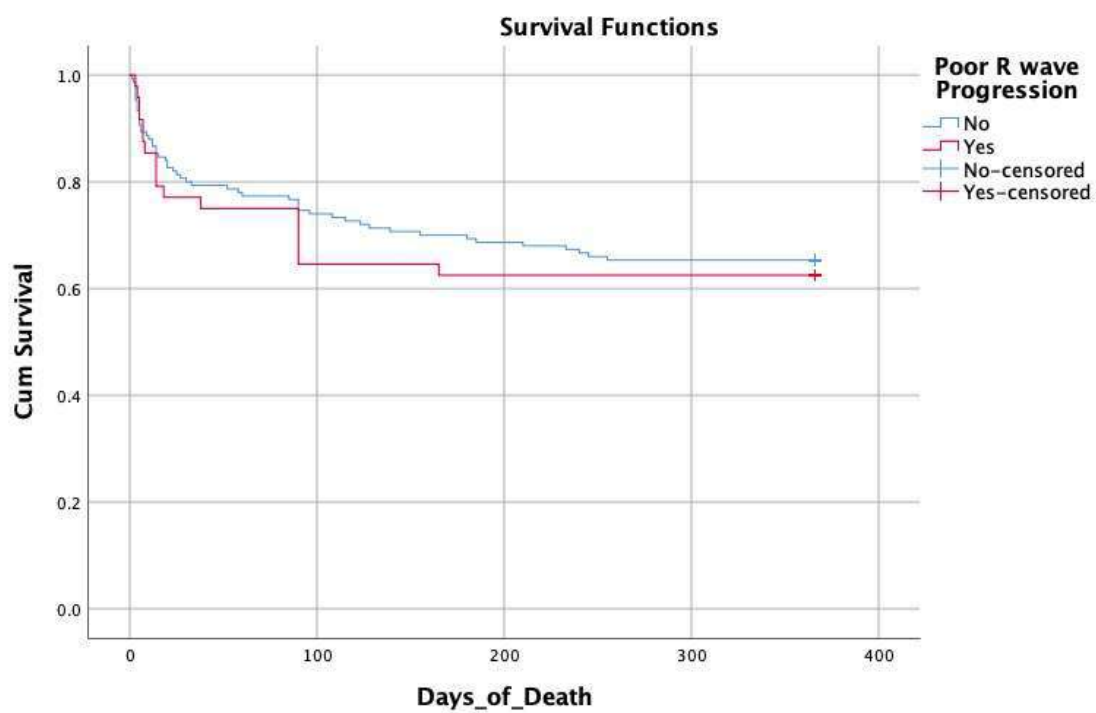
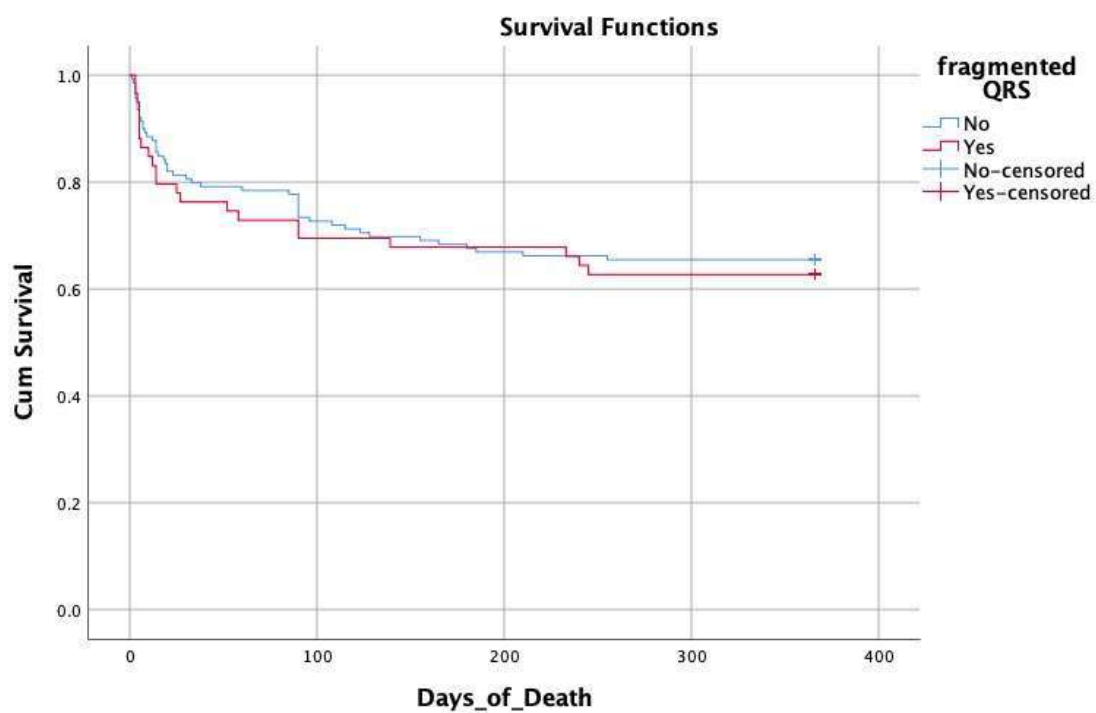
Objectives: As data on cardiovascular complication among chronic kidney disease patients has been limited, the present study aimed to understanding the association between electrocardiogram changes with clinical outcomes among hospitalized patients with chronic kidney disease.

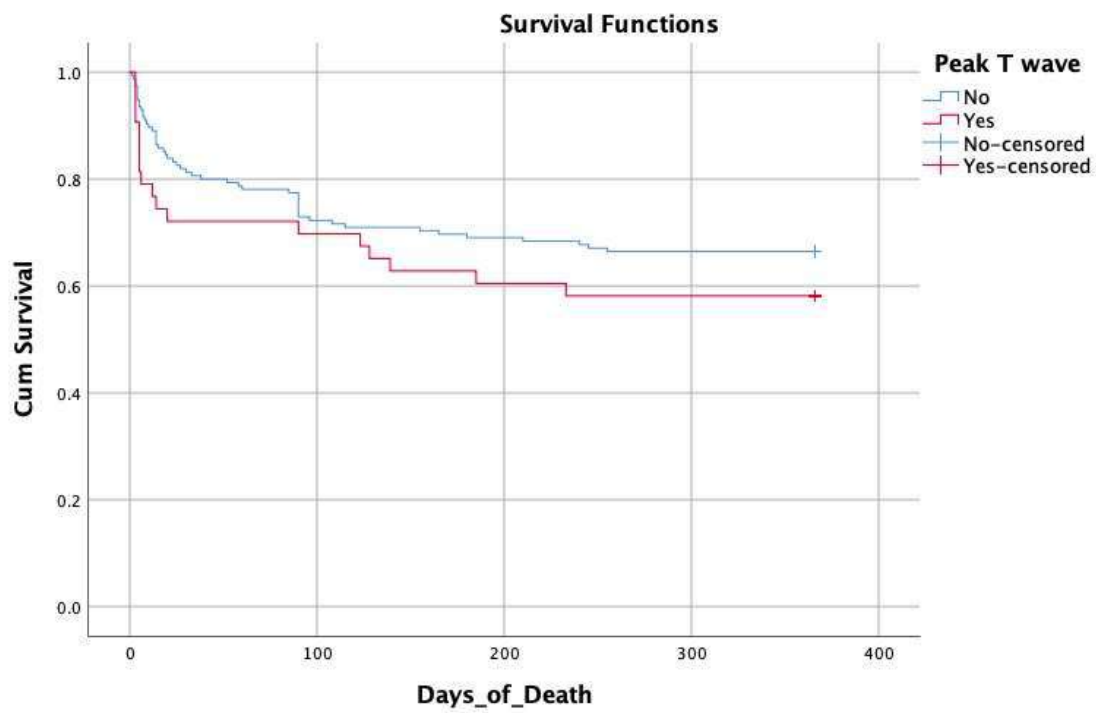
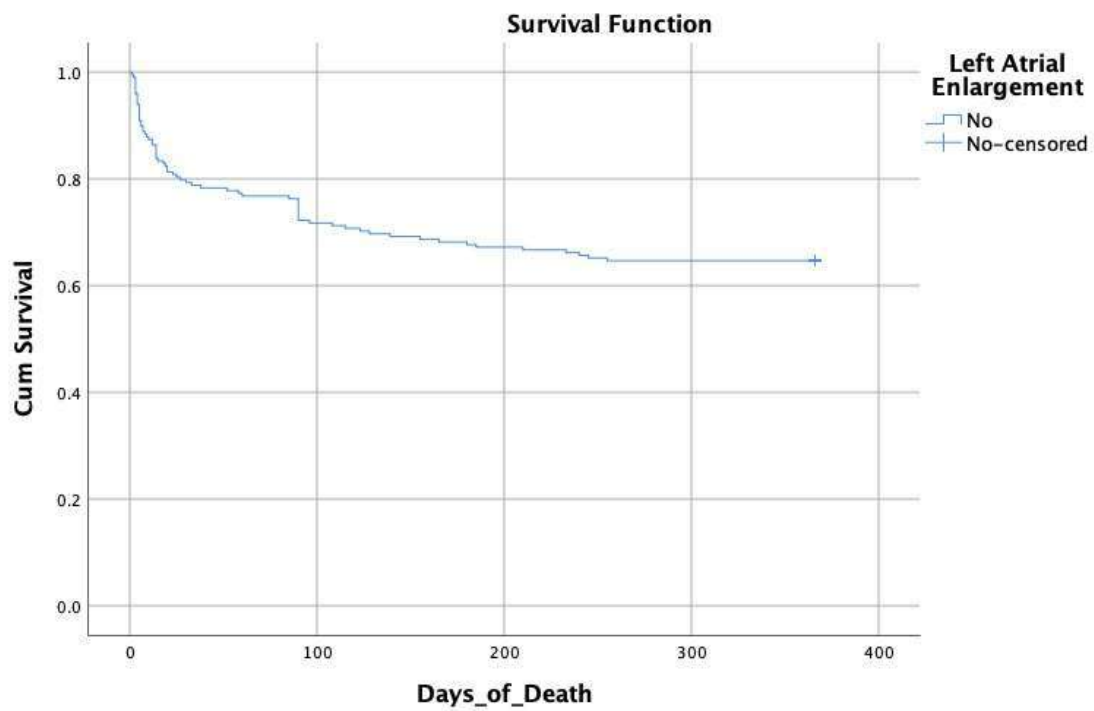
Methods: We performed a single-centre, observational prospective cohort study among stage V CKD patients who haven't experienced haemodialysis. CKD was diagnosed based on the KDIGO 2012 criteria. The cumulative all-cause mortality and cardiovascular death, MACE and non-fatal MI were analysed using Kaplan-Meier.

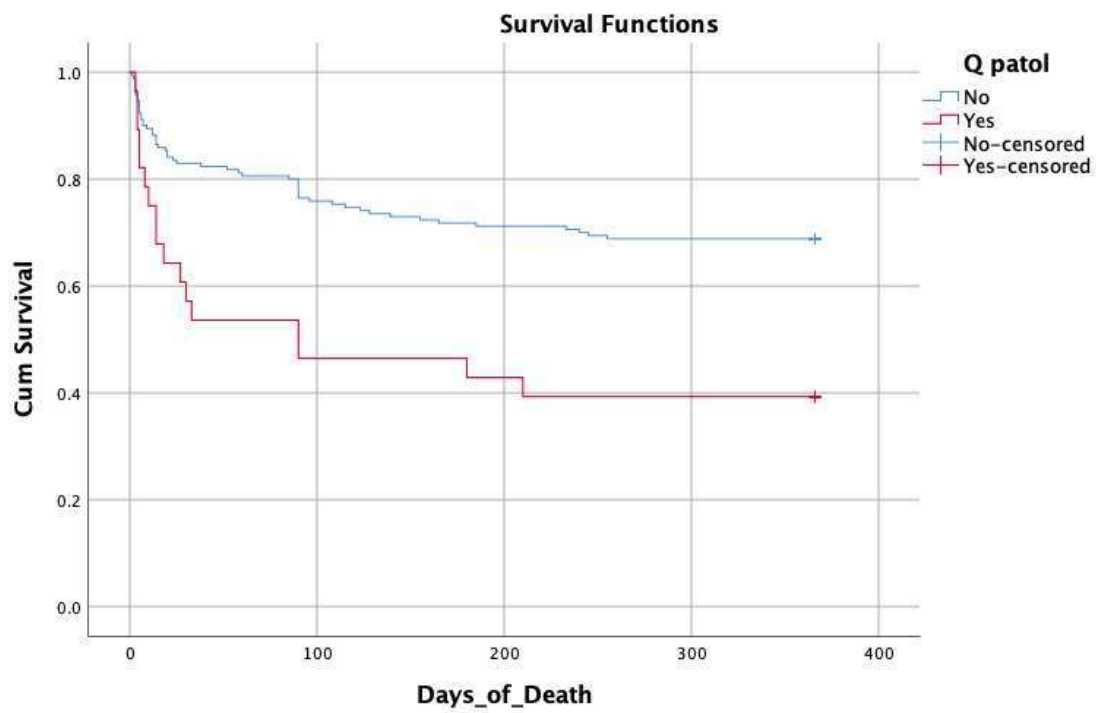
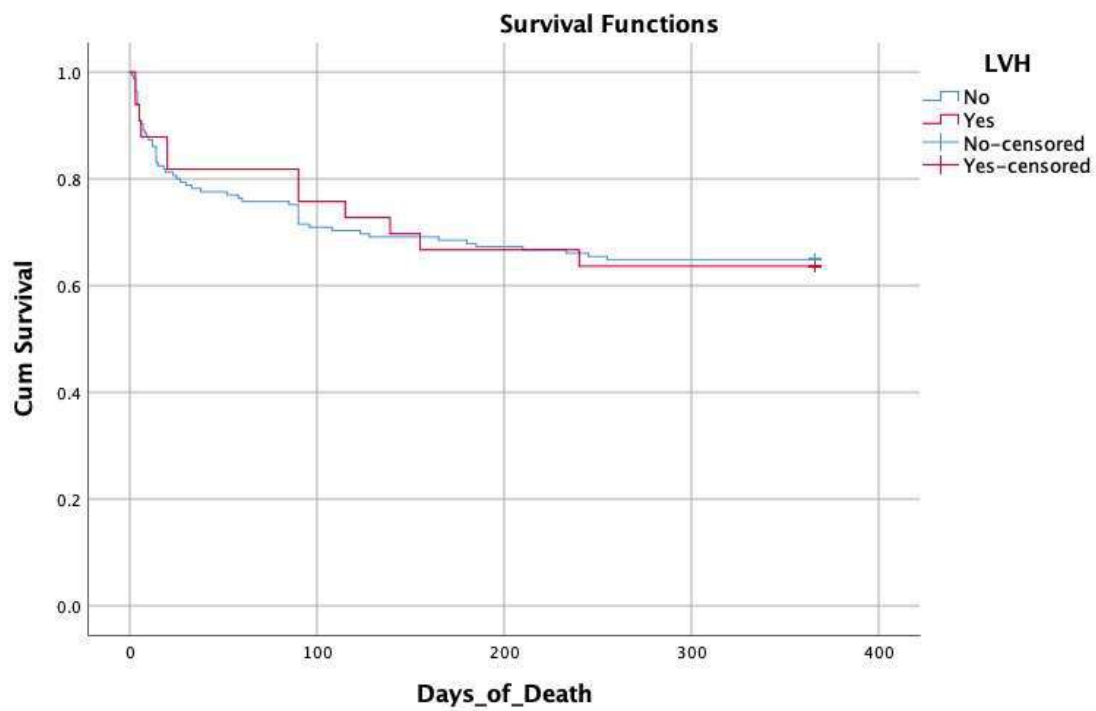
Results: Total of 350 patients were enrolled, 96 patients were excluded due to previous history of haemodialysis and 56 patients were excluded due to incomplete data. The rest of 198 patients were analysed. Their mean age was 39.87 years and 41.52% were women. They were followed up for 12 months on average, with 129 incident cases (65.15%) being identified during 1-years at risk. Pathologic Q wave at baseline (HR 3.15, 95% CI [1.81-5.37]; P<0.01), peak T wave (HR 1.93, 95% CI [1.07-2.84]; P=0.04), left axis deviation (HR 2.14, 95% CI [1.03-4.47]; P=0.04), and non-specific ST/T changes (HR 2.70, 95% CI [1.65-3.78]; P=0.01) were all independently associated with all-cause mortality, cardiovascular death, and MACE. On the contrary, left ventricular hypertrophy and fragmented QRS weren't associated with clinical outcomes.

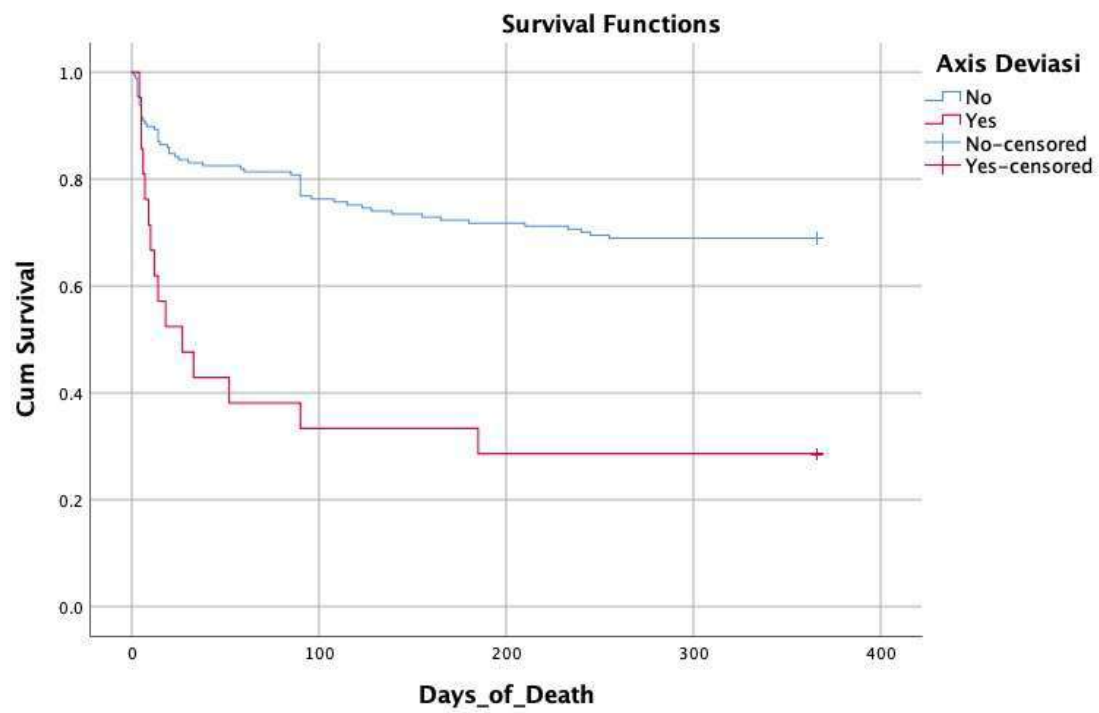
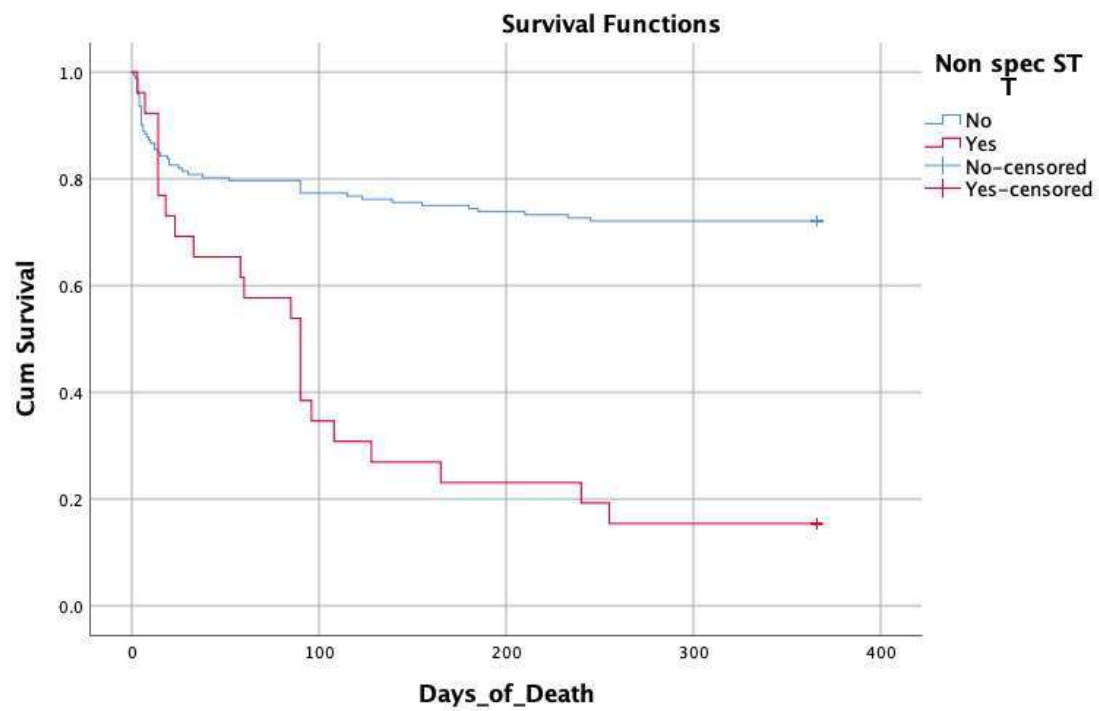
Conclusion: Several changes of electrocardiogram were significantly associated with the incidence of all-cause mortality, cardiovascular mortality, MACE, and rehospitalization independently of level and change in cardiovascular disease risk factors, and may have clinical utility for prognostication among hospitalized CKD patients.

SUPPORTING DOCUMENTS









Association Between Diastolic Dysfunction With Coronary Artery Calcium Score in Stable Coronary Artery Disease Patients

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OBJECTIVES

Diastolic dysfunction is a common problem in patients with obesity, hypertension, diabetes, or coronary artery disease (CAD) including stable CAD. The coronary artery calcium score (CACS) is used to non-invasively evaluate cardiovascular risk in asymptomatic patients with a low to intermediate pre-test probability for CAD. The purpose of this study was to evaluate the association of diastolic dysfunction with an abnormal CAC score.

MATERIALS AND METHODS

This study considered a cohort of patients > 18 years of age with normal ejection fraction who were admitted to the hospital with chest pain but low risk presentation for acute myocardial infarction. Patients then underwent cardiac CT for measurement of CAC score. Patients were excluded if they had prior history of CAD, ECG findings diagnostic of an acute coronary syndrome, an elevated troponin level, or hemodynamic instability.

RESULTS

A total of 200 patients were included and 96 (48%) patients had echocardiographic evidence of diastolic dysfunction. Patients with diastolic dysfunction were more likely to have a higher mean calcium score (12,154.68 ± 17,588.30 vs 2,666.38 ± 9,725.82; $p < 0.001$). Receiver operating characteristics (ROC) analysis showed the area under the curve was 86.3% and cut off was 129.5 with sensitivity 85% and specificity 74%.

CONCLUSIONS

Our study demonstrates that left ventricular diastolic dysfunction is associated with an abnormal CAC score. Patients without known CAD that present with chest pain with evidence of abnormal diastolic function on echocardiogram may warrant more thorough evaluation for coronary atherosclerotic disease with CAC score assessment.

Association of Electrocardiographic Abnormalities with In-Hospital Mortality in Adult Patients with COVID-19 infection

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OBJECTIVES

The study aims to determine the association of electrocardiographic abnormalities and in-hospital mortality of patients with Coronavirus Disease 2019 (COVID-19) infection admitted in a tertiary hospital in the Philippines.

MATERIALS AND METHODS

We conducted a retrospective study of confirmed COVID-19 infected patients. Demographic, clinical characteristics, and clinical outcomes were extracted from the medical records. Electrocardiographic analysis was derived from the 12-lead electrocardiogram (ECG) recorded upon admission. The frequencies and distributions of various clinical characteristics were described, and the ECG abnormalities associated with in-hospital mortality were investigated.

RESULTS

A total of 163 patients were included in the study, most were female (52.7%) with a median age of 55 years old. Sinus rhythm (40%), nonspecific ST and T wave changes (35%), and sinus tachycardia (22%) were the frequently reported ECG findings. The presence of any ECG abnormality was detected in 78.5% of patients and it was significantly associated with in-hospital mortality ($p = 0.038$). The analysis revealed a statistically significant association between in-hospital mortality and having atrial fibrillation or flutter ($p = 0.002$), supraventricular tachycardia (SVT) ($p = 0.011$), ventricular tachycardia ($p = 0.011$), third degree atrioventricular block (AVB) ($p = 0.011$), T wave inversion ($p = 0.005$) and right ventricular hypertrophy (RVH) ($p = 0.011$).

CONCLUSION

The presence of any ECG abnormality in patients with COVID-19 infection was associated with in-hospital mortality. ECG abnormalities that were associated with mortality were atrial fibrillation or flutter, SVT, ventricular tachycardia, third degree AVB, T wave inversion, and RVH.

Association of Electrocardiographic Abnormalities with In-hospital Mortality in Adult Patients with COVID-19 Infection

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Key words: Electrocardiography, COVID-19, mortality, Philippines

TABLES

Table 1: Demographic and Clinical Profiles of COVID-19 Patients (*n* =163) with ECG Abnormalities.

Variable	Group	Total (<i>n</i> =163)	Any ECG Abnormality	No ECG Abnormality	<i>p</i> -value
Age (Mean $\pm$ SD)			57.13 $\pm$ 17.20	45.63 $\pm$ 18.62	0.001*
Gender	Male	77	65	12	0.083
	Female	86	63	23	
Obesity	Not	84	63	21	0.258
	Obese	79	65	14	
Smoking	Never	110	83	27	0.383
	Active	12	10	2	
	Smoker				
	Former	41	35	6	
	Smoker				
Comorbidities					
Hypertension	No	70	46	24	0.001*
	Yes	93	82	11	
Diabetes Mellitus	No	116	90	26	0.646
	Yes	47	38	9	
Coronary Artery Disease	No	150	116	34	0.207
	Yes	13	12	1	
Chronic Heart Failure	No	154	119	35	0.107
	Yes	9	9	0	
COPD	No	159	124	35	0.290
	Yes	4	4	0	
Prior Stroke	No	146	113	33	0.303
	Yes	17	15	2	
Active Cancer	No	154	121	33	0.955

	Yes	9	7	2	
Permanent Pacing	No	160	125	35	0.361
	Yes	3	3	0	
Dyslipidemia	No	151	117	34	0.249
	Yes	12	11	1	
Heart rate			91.04 $\pm$ 14.57	87.80 $\pm$ 13.35	0.237
Laboratory Findings					
Hemoglobin (g/L) (Mean $\pm$ SD)			133.98 $\pm$ 17.99	132.83 $\pm$ 16.81	0.733
HsTrop I (ng/L) (Mean $\pm$ SD)			1.21 $\pm$ 13.08	0.02 $\pm$ 0.09	0.591
D-dimer, ng/mL (Mean $\pm$ SD)			3.0 $\pm$ 13.36	0.70 $\pm$ 1.30	0.313
Ferritin, ug/L (Mean $\pm$ SD)			1323.93 $\pm$ 1767.37	1436.35 $\pm$ 4121.85	0.811
eGFR (Mean $\pm$ SD)			82.65 $\pm$ 31.89	89.78 $\pm$ 38.43	0.203

*Significant at 0.05 level

Table 2: Clinical Profile of COVID-19 Patients (n = 163) based on their Survival Status.

Variable	Group	Total (n=163)	Survivors	Non-Survivors	p-value
Age (Mean $\pm$ SD)			52.13 $\pm$ 17.82	70.82 $\pm$ 9.53	0.000*
Gender	Male	77	64	13	0.231
	Female	86	77	9	
Obesity	Not Obese	84	69	15	0.093
	Obese	79	72	7	
Smoking	Never	110	100	10	0.002*
	Active Smoker	12	12	0	
	Former Smoker	41	29	12	
<i>Comorbidities</i>					
Hypertension	No	70	68	2	0.001*
	Yes	93	73	20	
Diabetes Mellitus	No	116	103	13	0.179
	Yes	47	38	9	
Dyslipidemia	No	151	133	18	0.037*
	Yes	12	8	4	
Coronary Artery Disease	No	150	133	17	0.006*
	Yes	13	8	5	
Chronic Heart Failure	No	154	136	18	0.005*
	Yes	9	5	4	
COPD	No	159	137	22	0.424

	Yes	4	4	0	
Prior Stroke	No	146	128	18	0.201
	Yes	17	13	4	
Active Cancer	No	154	134	20	0.431
	Yes	9	7	2	
					0.116
Heart rate			89.65 $\pm$ 13.65	94.82 $\pm$ 17.89	
Laboratory Findings					
Hemoglobin (g/L) (Mean $\pm$ SD)			134.98 $\pm$ 17.54	125.77 $\pm$ 17.00	0.026*
HsTrop I (ng/L) (Mean $\pm$ SD)			1.07 $\pm$ 12.46	0.22 $\pm$ 0.64	0.752
D-dimer, ng/mL (Mean $\pm$ SD)			0.87 $\pm$ 1.39	12.99 $\pm$ 30.70	0.078
Ferritin, ug/L (Mean $\pm$ SD)			989.43 $\pm$ 1230.87	3691.63 $\pm$ 5448.66	0.031*
eGFR (Mean $\pm$ SD)			87.34 $\pm$ 31.96	58.16 $\pm$ 32.34	0.000*

**Significant at 0.05 level*

Table 3: ECG Abnormalities of COVID-19 Patients ($n = 163$) based on their Survival Status.

Variable	Group	Any ECG Abnormality	No ECG Abnormality	Test Statistic (df)	<i>p</i> -value
Survival Status	Survivor	107	34	4.322	0.038*
	Non-Survivor	21	1		

**Significant at 0.05 level*

Table 4: ECG Parameters of COVID-19 Patients ($n = 163$) based on their Survival Status.

Variable	Survivors (Mean $\pm$ SD)	Non- Survivors (Mean $\pm$ SD)	Test Statistic <i>t</i>	<i>p</i> -value
Atrial rate	85.52 $\pm$ 20.65	101.68 $\pm$ 63.08	1.193	0.246
Ventricular Rate	87.09 $\pm$ 16.54	112.55 $\pm$ 39.26	3.000	0.007
PR-interval, ms	0.17 $\pm$ 0.04	0.11 $\pm$ 0.08	-3.322	0.003*
QRS Complex	0.08 $\pm$ 0.19	0.09 $\pm$ 0.03	1.299	0.207
QTc-interval, ms	0.36 $\pm$ 0.04	0.30 $\pm$ 0.11	-2.208	0.038*
QTc-Bazette	0.42 $\pm$ 0.04	0.39 $\pm$ 0.13	-1.225	0.234
QTc- Fridericia	0.40 $\pm$ 0.03	0.37 $\pm$ 0.13	-1.190	0.247

**Significant at 0.05 level*

Table 5: ECG Abnormalities of COVID-19 Patients ($n = 163$) based on their Survival Status.

Variable	Group	Survivors	Non-Survivors	Test Statistic (df)	p-value
Sinus rhythm (with other ECG abnormalities)	No	44	14	8.732	0.003*
	Yes	97	8		
Sinus bradycardia	No	137	22	0.640	0.424
	Yes	4	0		
Sinus Tachycardia	No	113	15	1.614	0.204
	Yes	28	7		
Sinus arrhythmia	No	135	21	0.004	0.950
	Yes	6	1		
Ectopic atrial rhythm	No	139	22	0.316	0.574
	Yes	2	0		
Atrial fibrillation or flutter	No	137	18	9.601	0.002*
	Yes	4	4		
SVT	No	141	21	6.449	0.011*
	Yes	0	1		
Ventricular tachycardia	No	141	21	6.449	0.011*
	Yes	0	1		
APCs or atrial premature complexes	No	134	21	0.007	0.933
	Yes	7	1		
VPCs or ventricular premature complexes	No	136	21	0.054	0.817
	Yes	5	1		
First degree AV block	No	137	21	0.187	0.666
	Yes	4	1		
Third Degree AV block	No	141	21	6.449	0.011*
	Yes	0	1		
Fragmented QRS	No	136	22	0.805	0.370
	Yes	5	0		
Right bundle branch blocks (RBBB)	No	137	20	2.099	0.147
	Yes	4	2		
Left bundle branch block (LBBB)	No	141	22	NA	NA
	Yes	0	0		
Left anterior fascicular block	No	140	22	0.157	0.692
	Yes	1	0		
Abnormal precordial R wave progression	No	131	20	0.111	0.738
	Yes	10	2		
Brugada pattern	No	138	22	0.477	0.490
	Yes	3	0		
Acute ST elevation	No	140	22	0.157	0.692
	Yes	1	0		
T wave inversion	No	136	18	7.814	0.005*
	Yes	5	4		
Old infarction	No	134	19	2.485	0.115

	Yes	7	3		
Nonspecific ST and T wave changes	No	89	17	1.676	0.195
	Yes	52	5		
Right ventricular hypertrophy (RVH)	No	141	21	6.449	0.011*
	Yes	0	1		
Left ventricular hypertrophy (LVH)	No	129	20	0.008	0.928
	Yes	12	2		
Left atrial abnormality	No	138	22	0.477	0.490
	Yes	3	0		
Early repolarization pattern	No	139	22	0.316	0.574
	Yes	2	0		
Presence of U waves	No	137	22	0.640	0.424
	Yes	4	0		
Prolonged QTc	No	134	19	2.485	0.115
	Yes	7	3		
Low voltage limb leads	No	137	22	0.640	0.424
	Yes	4	0		

**Significant at 0.05 level*

Study of Conduction System Disturbances in Patients Undergoing Aortic Valve Surgeries

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OBJECTIVES

To determine the Electrocardiographic and Electrophysiological changes in patients undergoing Isolated Aortic valve surgeries.

MATERIALS AND METHODS

This is a single-center open-labeled observational study that included 38 patients aged >45 years, with isolated degenerative severe aortic stenosis posted for coronary workup prior to valve replacement surgery. Enrolled patients at the time of coronary angiogram undergo one catheter EP study via 6F right femoral venous sheaths to assess the AH, and HV intervals. The same study shall be repeated in the post-operative period prior to discharge.

RESULTS

In this study of 38 patient, there was no difference between AH and HV intervals pre and post Procedure. AH interval difference in median pre and post-procedure is 5msec (74msec vs 79msec), weak association ($p=0.012$). HV interval difference in Median pre and post procedure 0.5msec (47.5msec vs 48msec), no association ($p=0.542$). One patient with basal RBB with normal HV interval developed a prolonged HV interval of 75msec and required a pacemaker at follow-up. The same patient had calcification of the aortic valve extending to the septum. There are no electrocardiographic changes post-procedure.

CONCLUSION

In this first study comparing the findings of the electrophysiologic study (EPS) and electrocardiography (ECG), the impact of the Aortic valve replacement on the AV conduction system showed not much perturbation of the conduction system by surgical aortic valve replacement.

Usefulness of T-wave Alternans as an Arrhythmic Risk Stratifier prior to use of the AAD

Dr Hyeonjeong Oh¹, Dr. Myung Jin Cha, Dr. Min Su Cho¹, Dr. Jun Kim¹, Dr. Kee-Joon Choi¹, Dr. Gi-Byoung Nam¹

¹*Asan Medical Center, Seoul, South Korea*

Microvolt level T-wave alternans (MTWA), a phenomenon of beat-to-beat variability in the repolarization phase of the ventricles, has been closely associated with an increased risk of ventricular tachyarrhythmic events (VTE) and sudden cardiac death (SCD). Analysis of ambulatory Holter monitors from patients with various forms of heart disease has demonstrated a sharp upsurge in repolarization alternans within the minutes prior to spontaneous VTE. Also, commonly used cardiac medications have been shown to alter susceptibility to TWA. We sought to pre-screen the patient who were vulnerable to arrhythmia by examining the TWA before the use of antiarrhythmic drugs. We retrospectively reviewed the medical records and 24Hr holter monitoring of 20 healthy patients, 22 patients with congenital LQT and 6 patients with acquired LQT and TdP. Exclusion criteria were the presence of AF or high grade AV block and valvular heart disease. Peak TWA was determined by the Modified Moving Average method. The sum of peak TWA values of three leads in healthy subjects were significantly lower than those in LQTS patients. [84.250 μ V versus 146.955 μ V, P<0.001]. The sum of peak TWA values of the patients with TdP history after acquired long QT due to AAD use had the highest value among all the patients. [176.3 μ V, P<0.001]. The patient with acquired LQT and TdP examined the 24Hr holter after wash out of AAD. The ability to detect or make prediction of the arrhythmic Risk by using TWA was useful and feasible under the clinical setting prior to use of the AAD.

A Study of Clinical and Electrophysiological Characteristics of Infrasisian Wenckebach

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OBJECTIVES

To study clinico-electrophysiological profile of patients with Infrasisian Wenckebach (IHW) conduction.

MATERIALS AND METHODS

Patients with a clinical diagnosis of atrioventricular (AV) block who underwent permanent pacemaker implantation(PPI) based on standard indications from July 2021-June 2022 at The Madras Medical Mission were subjected to pre- implant Electrophysiology study to document conduction pathology

RESULTS

A total of 94 patients underwent PPI for AV block during study period. EPS was performed in all but one patient (COVID pneumonia). Incidence of IHW was 9/93(9.6%) of patients with AV block. There is no gender predisposition (M-4,F-5) and their mean age was 71.4±11.7 years. As many as half of the patients (5/9) had an underlying narrow QRS. The mean QRS duration was 130±19.3. Ischemic heart disease affected half of the patients and cardiomyopathy in 4/9 patients (mean EF 45.1±13.7%). Presentation was syncope in all, mean NYHA class was 2.1. Presentation ranged from isolated 1st degree AV block(1/9) to tri-fascicular block(3/9). At EP study, mean basal HV interval was 94.7±27.1ms. IHW was noted spontaneously in 4 patients and on atrial pacing in the remaining. In literature, a total of 11 documented cases have been reported (8 case reports). Unlike typical wenckebach, the increment in PRI is minimal in the 2nd beat of the train.

CONCLUSION

Wenckebach periodicity is classically considered an AV nodal phenomenon. IHW scarcely reported in literature. Distinction becomes critical as IHW is harbinger of complete AV block. This is the largest series and first clinic-etiological profile of IHW patients published till date.

SUPPORTING DOCUMENTS

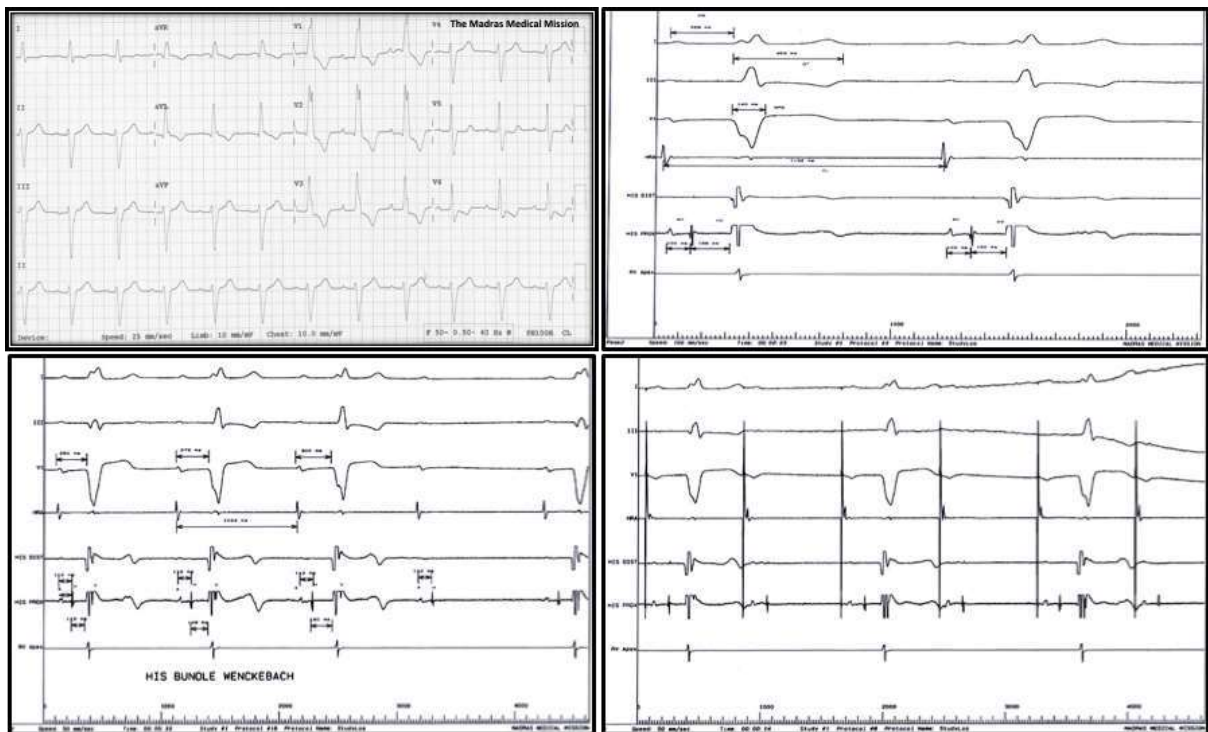
Table 1- Demographic and Electrophysiological Characteristics of patients with InfraHisian Wenckebach

Case	Age	Gender	IHD	EF	Clinical Presentation	ECG (Rhythm/ QRSd/ Frontal QRS axis)	Underlying conduction system disease	EPS findings
1	60	M	No	60%	Syncope	SR/ 160 ms/ -45degrees	First degree AV block, RBBB, LAFB	Baseline HV- 150 ms, Infra Hisian Wenckebach with 2:1 AVB on incremental Atrial pacing
2	73	F	No	33%	Syncope	SR/ 130 ms/ -45 degrees	First degree AV block, RBBB, LAFB	Baseline HV- 131 ms, Hisian automatic escape with Infrahisian Wenckebach (3:2 and 4:3) and intermittent HA dissociation with functional suprahisian block
3	74	F	Yes	59%	Syncope	SR/ 120ms/ -150 degrees	Mobitz type 1 (2:1, 3:2, 5:4), RBBB, LAFB	Baseline HV- 85 ms, Infrahisian Wenckebach With 2:1 AVB with atrial pacing at 120bpm
4	85	M	Yes	32%	Syncope	SR/ 110 ms/ -10 degrees	First degree AV block	Baseline HV- 70 ms, Infrahisian Wenckebach on incremental atrial pacing
5	84	M	No	51%	Syncope	SR/ 140 ms/ -45 degrees	First degree AV block, LBBB, Intermittent CHB with RBBB escape	Baseline HV- 90 ms, Infrahisian Wenckebach
6	73	M	Yes	35%	Syncope	SR/ 120 ms/ -45 degree	Mobitz type 2 AV block, RBBB, LAFB	Baseline HV- 76 ms, Infrahisian Wenckebach with intermittent 2:1 infrahisian AVB
7	79	F	No	53%	Syncope	SR/ 110 ms/ -45 degrees	Mobitz type 1 (3:2, 5:4) AV block, LBBB	Baseline HV- 90 ms, Intrahisian Wenckebach (3:2)
8	67	F	Yes	58%	Syncope	SR/120 ms/ -45 degrees	2:1 AV block, LBBB	Baseline HV- 80 ms, Infrahisian wenckebach (3:2)
9	48	F	No	25%	Dyspnea	SR/180 ms/-30 degrees	First degree AV block, LBBB	Baseline HV- 80-120 ms, InfraHisian Wenckebach spontaneously and on incremental atrial pacing (3:2)
IHD- Ischemic heart disease, EF- Ejection fraction, EPS- Electrophysiology study, RBBB- Right Bundle branch block, LAFB- Left Bundle branch block, LBBB- Left Bundle branch Block								

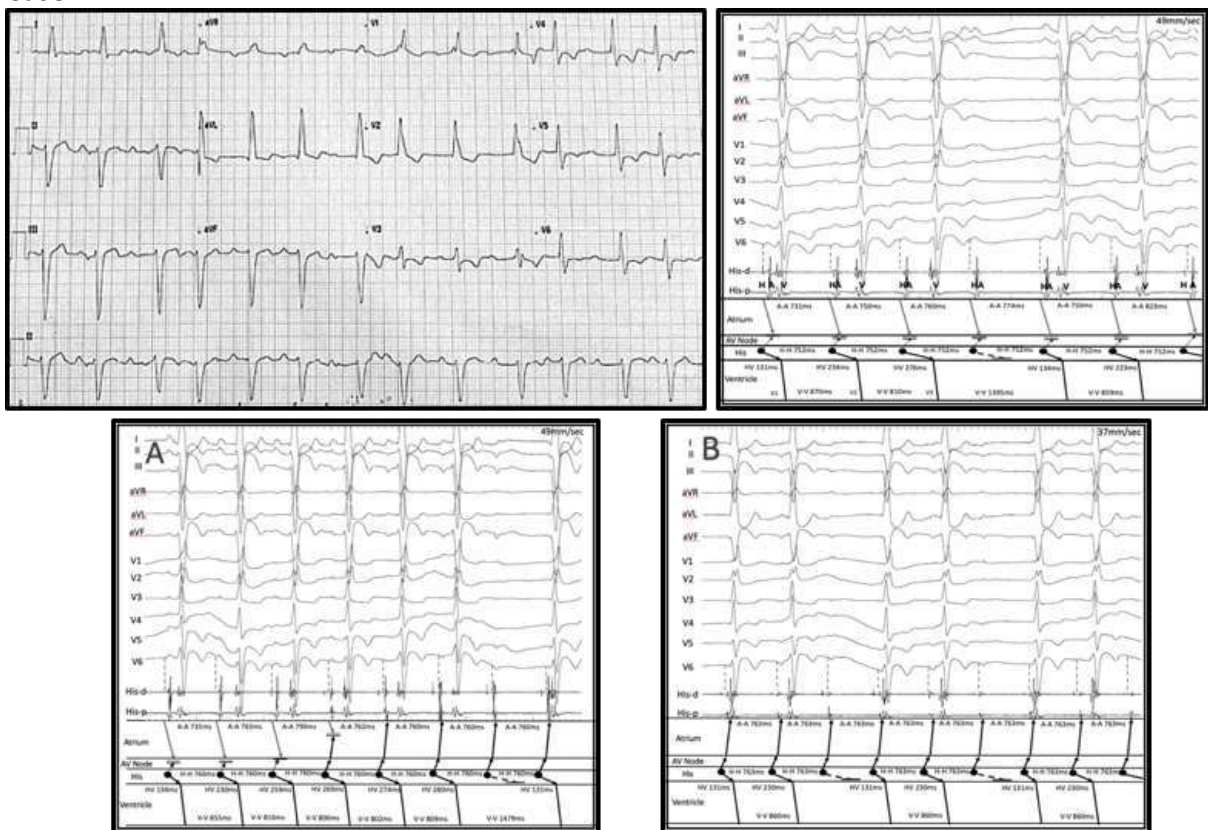
Table 2 Review of published literature

No	Author	Year	No of cases	Age/ Gender	IHD	EF	Clinical Presentation	ECG (Rhythm +QRSd + Frontal plane QRS axis)	Underlying conduction system disease	EPS findings
1	Richard Gray et al	1976	1	28/M	No	60%	Syncope	SR/ 120 ms /90 degrees	Mobitz type 1 (3:2 and 2:1), RBBB, LPFB	Baseline HV- 175 ms, AH and HV prolongation during atrial pacing at 70 bpm f/b Infrahisian wenckebach (4:3) during atrial pacing at 80 bpm
2	Eduardo M. Andr��a et al	2002	4	Syncope			4 cases of intra/infrahisian Hisian Wenckebach reported Only one intracardiac trace presented in the earticle			
3	Eloi Marijon et al	2008	1	40/M	No	NA	Syncope	SR/ 160 ms/ - 45 degrees	First degree AV block, RBBB, LAFB, intermittent Mobitz type 1 AV block (3:2 and 4:3)	Baseline HV- 54 ms, Infrahisian wenckebach
4	Antonios P. Antiniadis et al	2010	1	60/M	NA	60%	Asymptomatic bradycardia	SR/130 ms/ NA	PR-185 ms, RBBB, LAFB, intermittent 4:3 AV wenckebach alternating with episodes of 2:1 AV block	Baseline HV- 103 ms, Infrahisian wenckebach (3:2) during atrial pacing at CL 750 ms and 2:1 during atrial pacing at pacing CL 700 ms
5	Venketakrishna N et al	2016	1	69/M	NA	60%	Syncope	SR/ 80 ms/ NA	2:1 AV block with intermittent AV wenckebach	Baseline HV- 108 ms, Infrahisian wenckebach
6	Isaac R Whitman et al	2016	1	70/M	Yes	60%	Syncope	SR/ 140 ms/ - 45degrees	1 st degree AV block, LBBB, intermittent 2:1 AV block	Baseline HV- 100 ms, infrahisian wenckebach (3:2)
7	Tai H. Pham et al	2018	1	70/M	No	60%	Syncope	SR/ 120 ms/ -45 degrees	RBBB, LAFB	Baseline HV- 135 ms, Infrahisian wenckebach (4:3)
8	Krishna Kumar Mohanan Nair et al	2018	1	65/M	No	65%	Syncope	SR /130 ms/ 0 degree	LBBB,	Baseline HV- 85ms, Intrahisian Wenckebach
IHD- Ischemic heart disease, EF- Ejection fraction, EPS- Electrophysiology study, RBBB- Right Bundle branch block, LAFB- Left Bundle branch block, LBBB- Left Bundle branch Block, LPFB- Left Posterior fascicular block, NA- Not available										

Case 1



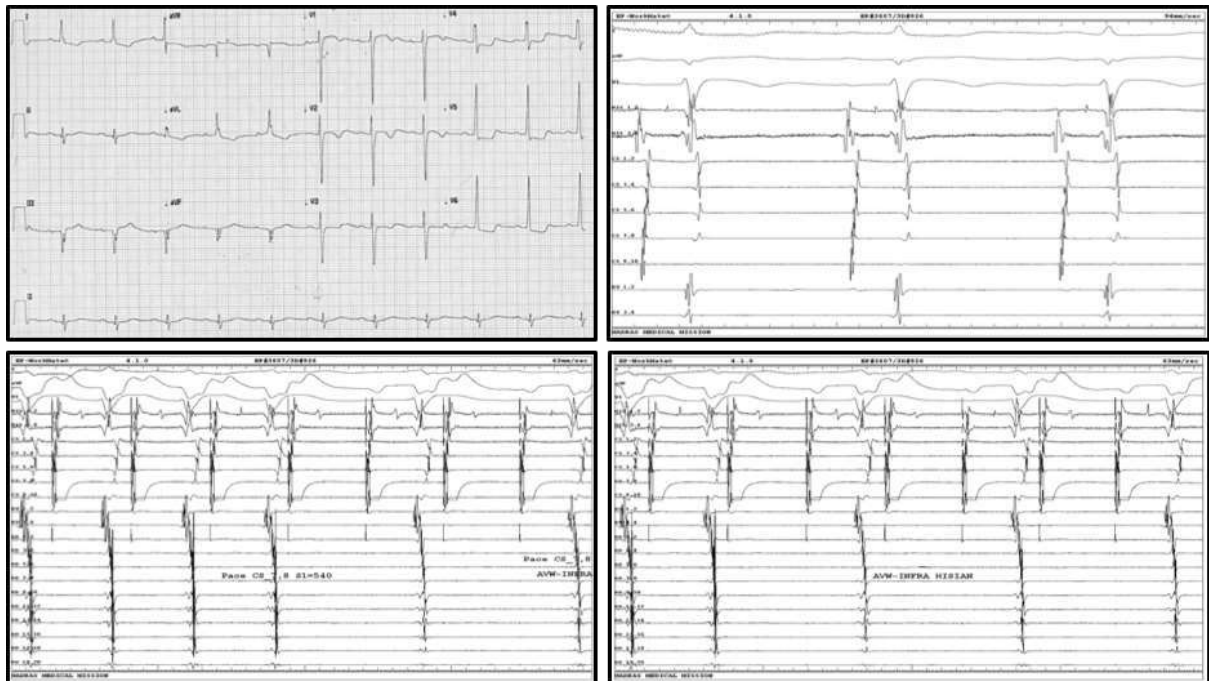
Case 2



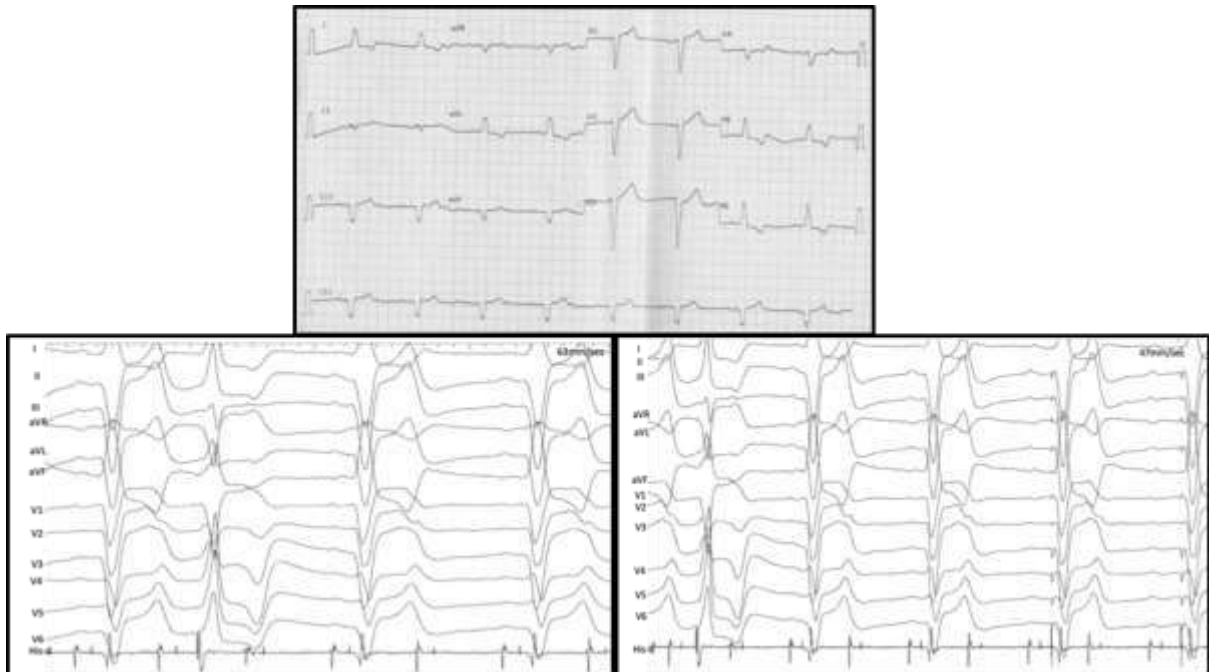
Case 3



Case 4



Case 5



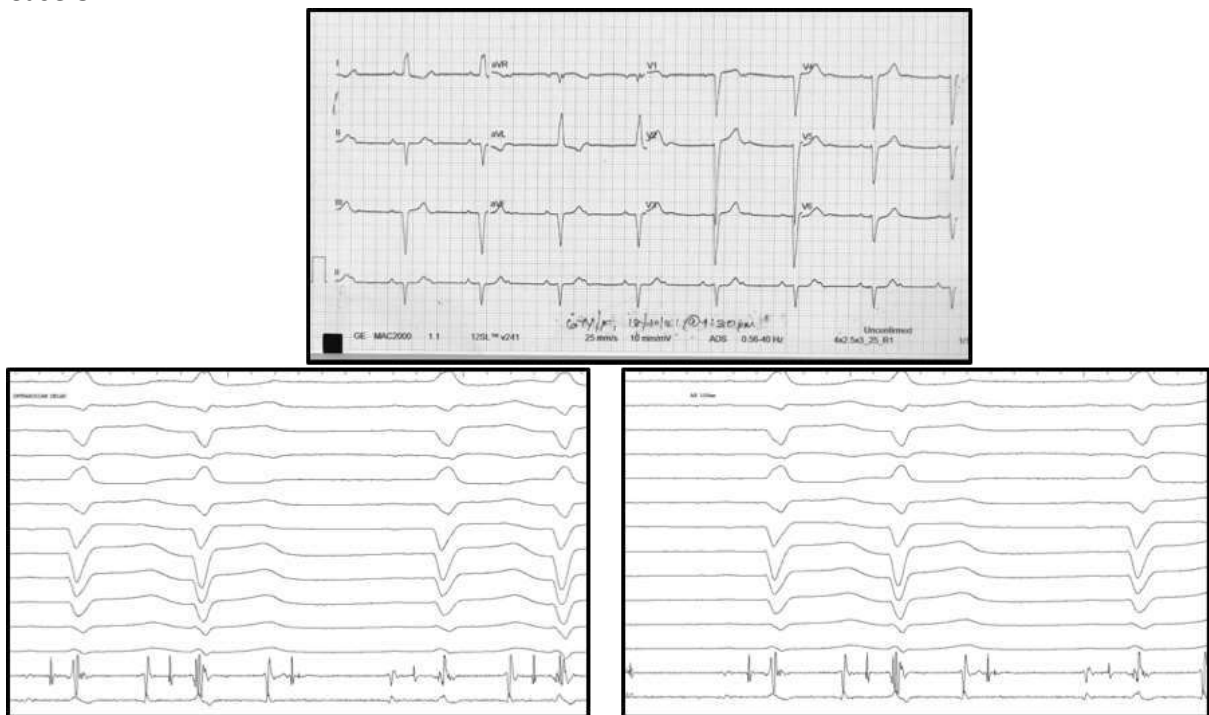
Case 6



Case 7



Case 8



Case 9

Etiologic Profile and Clinical Characteristics of Atrioventricular Block in Young and Middle-aged Inpatients.

Dr Zhongli Chen¹, Dr Yuanhao Jin¹, Prof Keping Chen¹

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OBJECTIVES

Little is known about the etiology distribution and clinical profile of the atrioventricular block in the Asian young and middle-aged population.

MATERIALS AND METHODS

We retrospectively enrolled inpatients ≤50 years old who were diagnosed with AVB at National Center from January 1st, 2020 to December 31st, 2021. Medical records were reviewed to identify the etiology. Age/ sex-specific etiology distribution was calculated. According to AVB type and cardiac change, the relationship between etiology and clinical phenotypes was analyzed.

RESULTS

In the 471 patients with AVB, the median age was 36 and 61.78% were male. 14 etiologies were identified but undetermined etiology accounted for 38.6%. Non-ischemic cardiomyopathy (NICM) (16.6%), complication of cardiac surgery (13.4%), ischemic heart disease (IHD) (7.4%), congenital heart disease (CHD) (6.8%), vagal etiology (4.3%) constituted the top 5 causes for AVB. Cardiac surgery-related AVB was more common in minors (age:0-17), vagal-related AVB is more significant in young adults (age:18-35), and middle-aged adults (age:36-50) were dominated by IHD. Determined etiologies were more common in males. Patients with unknown etiology had four distinct phenotypes according to AVB severity and left ventricle (LV) change. In these patients, NT-proBNP levels were associated with both the severity of AVB (p trend =0.009) and odds of severe phenotype (advanced AVB with LV change).

CONCLUSION

Etiologies in young and middle-aged AVB patients were diverse and presented with age/sex-specific patterns, but with a diagnostic gap. Patients with unknown etiology displayed different clinical phenotypes and NT-proBNP levels were associated with AVB severity and severe phenotype in this group.

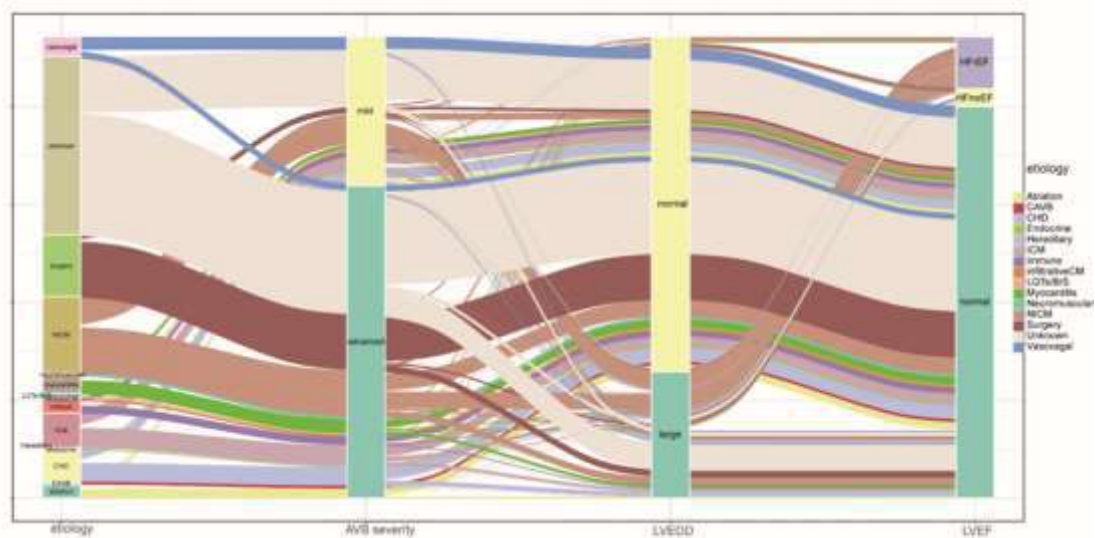
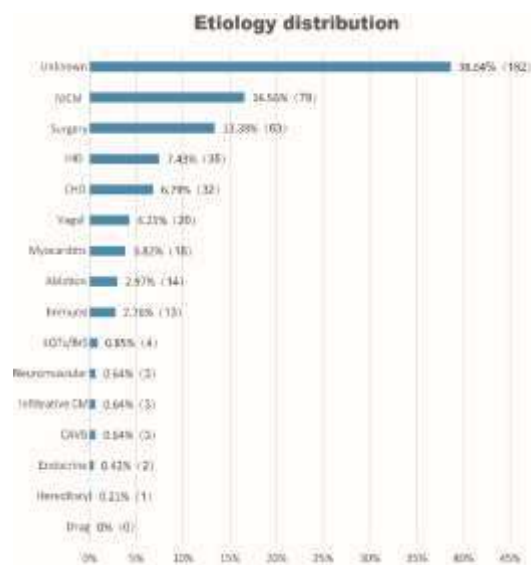
SUPPORTING DOCUMENTS

Figure

Left: Etiology distribution of atrioventricular block (AVB) among young and middle-aged patients

Right: Etiology of AVB in relation to blocking severity and cardiac structure and function.

(Abbreviations: NICM: non ischemic cardiomyopathy, IHD: ischemic heart disease, LQTs: long Q-T syndrome, BrS: Brugada Syndrome, CAVB: congenital atrioventricular block, CM: cardiomyopathy, LVEDD: left ventricular end diastolic diameter, LVEF: left ventricular ejection fraction, HFrEF: heart failure with reduced ejection fraction ($LVEF \leq 40\%$) HFmrEF: Heart failure with mildly reduced ejection fraction ($41\% \leq LVEF \leq 49\%$), severe AVB: advanced AVB was defined as Mobitz Type II AVB/ high -degree AVB/Third-degree AVB, large LVEDD: borderline or elevated LVEDD, LV end diastolic diameter $> 55\text{mm}$ for adult man, $> 50\text{ mm}$ for women and pediatrics)



Protective Effect of Low-Dose versus High-Dose NOACs for the Prevention of Death in Established Atherosclerosis

Prof Riccardo Cappato¹, MD Mauro Chiarito, MD Michela Giustozzi, MD Letizia Riva, MSC Gianluca Bonitta, MD Hussam Ali, MD Pierpaolo Lupo, MD Corrado Lodigiani, Prof Giulio Stefanini

¹*IRCCS MULTIMEDICA, Sesto San Giovanni, Milano, Italy*

Objectives:

We investigated whether, in patients with manifest coronary artery disease (CAD), randomization to Low-dose (D) novel oral anticoagulants (NOACs) more effectively prevents mortality than assignment to High-D NOACs.

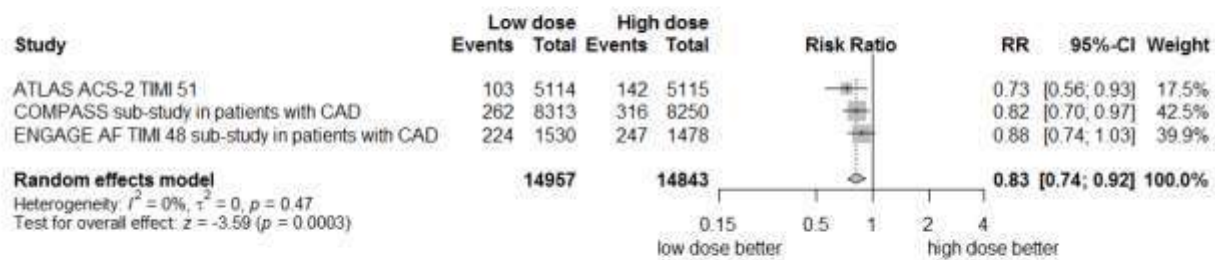
Methods: PubMed/Embase/BioMedCentral/ Google Scholar/ and Cochrane Central Register of Controlled Trials was searched for studies reporting all-cause mortality in patients with various manifestations of CAD in which allocation to control, Low-D or High-D NOACs was designated by protocol. After exclusions, three studies were analysed. Rivaroxaban 2.5 mg versus 5.0 mg twice daily in patients with acute or stable CAD and edoxaban 30 mg versus 60 mg once daily in patients with concomitant atrial fibrillation were used for inter-group comparison.

Results: All-cause mortality occurred in fewer patients in the Low-D (589 of 14,957 [3.9%]) than in the High-D NOAC group (705 of 14,843 patients [4.7%]; RR, 0.83; 95% CI, 0.74 to 0.92; p=0.031; I²=0%). There was no significant difference in fatal bleeding between the two groups (26 [0.2%] versus 33 [0.2%]; RR 0.78; 95% CI, 0.69 to 1.52; p=0.4684). When compared to 14,876 patients in the control group of the three trials, fewer patients died in the Low-D group (RR, 0.78; 95% CI, 0.69 to 0.88; p<0.0001), but not in the High-D group (RR, 0.95; 95% CI, 0.86 to 1.05; p=0.306).

Conclusions: Patients with manifest CAD receiving a Low-D of NOAC therapy had a lower all-cause mortality risk than those receiving a High-D. This benefit, which was not determined by a reduced risk of fatal bleeding, is in need of further assessment.(250)

SUPPORTING DOCUMENTS

Figure



Comparison of Asian-Pacific and non-Asian-Pacific Heart Failure patients with CRT between AdaptResponse and Mid-Q Response

Dr Toon-Wei Lim¹, MD Kengo Kusano², MD Seung-Jung Park³, MB, BChir, PhD Sofian Johar⁴, MS Andrew St. Martin⁵, PhD Janelle van Wel⁶, Ms Federica La Neve⁷, MD Kazutaka Aonuma⁸

¹National University Hospital, Singapore, ²Department of Cardiovascular Medicine, National Cerebral and Cardiovascular Center, Osaka, Japan, ³Sungkyunkwan University School of Medicine, Samsung Medical Center, Seoul, South Korea, ⁴Gleneagles Jerudong Park Medical Centre and Institute of Health Sciences, Universiti, Brunei-Muara, Brunei Darussalam, ⁵Medtronic Cardiac Rhythm Management, United States of America, ⁶Medtronic Bakken Research Center, Maastricht, Netherlands, ⁷Medtronic Study & Scientific Solutions, Rome, Italy, ⁸Department of Cardiology, Faculty of Medicine, University of Tsukuba, Tsukuba, Japan

OBJECTIVES

The AdaptResponse and Mid-Q Response studies have been designed to evaluate superiority of the AdaptivCRT algorithm compared to standard CRT therapy in CRT indicated patients with moderate to wide QRS duration, preserved atrioventricular conduction and left bundle branch block. Asian adults have narrower QRS complexes than Western adults, possibly related to lower height and smaller heart sizes in Asians. Mid-Q Response investigates the hypothesis that AdaptivCRT is beneficial from a lower QRS duration cut-off of 120ms.

MATERIALS AND METHODS

AdaptResponse required a QRS duration ≥ 130 ms for women and ≥ 140 ms for men while Mid-Q Response is enrolling patients with QRS duration ≥ 120 and < 150 ms. AdaptResponse is conducted in 27 countries worldwide (3620 patients randomized, 245 (6.8%) from Asia-Pacific). Mid-Q Response is conducted in 10 countries in Asia and randomized 110 out of 220 patients up to now.

RESULTS

In the AdaptResponse study, comparison of baseline characteristics between Asian and non-Asian Pacific patients showed a significant difference in height, BMI, Systolic Blood Pressure, and NYHA Class ($P < 0.001$). The AdaptResponse Asian-Pacific patients with QRS duration < 150 ms are similar to those enrolled in Mid-Q Response with the only difference being QRS duration ($P < 0.0001$).

CONCLUSION

The similarity in the patient groups is encouraging and the difference in QRS duration confirms that Mid-Q Response is enrolling subjects in the lower QRS range. Whether the differences in patient outcomes between the AdaptivCRT and standard CRT arms in both studies are similar as well will become clear in 2 years.

SUPPORTING DOCUMENTS

Baseline Characteristics	AdaptResponse		P-value	Mid-Q Response	AdaptResponse	P-value
	Other regions (N = 3375)	Asia Pacific (N = 245)		Total subjects (N=94)	Asia Pacific <150ms QRS (N = 58)	
Age (years)	64.9 ± 11.0	65.4 ± 11.7	0.43	67.0 ± 12.4	67.7 ± 11.2	0.73
Female	43.8%	37.1%	0.045	(30.9%)	(44.8%)	0.086
Height (cm)	170 ± 10	162 ± 10	< 0.0001	161.5 ± 9.2	160.0 ± 10.2	0.37
BMI (kg/m ²)	29.2 ± 6.5	24.7 ± 4.8	< 0.0001	23.2 ± 3.9	23.1 ± 4.1	0.93
LV Ejection Fraction (%)	25.5 ± 6.3	24.7 ± 5.7	0.029	26.0 ± 6.5	25.9 ± 5.9	0.79
Sys Blood Pressure (mmHg)	126 ± 20	116 ± 17	< 0.0001	114.4 ± 19.6	116.8 ± 16.3	0.44
Heart Rate (bpm)	72 ± 12	74 ± 12	0.023	73.7 ± 14.1	75.1 ± 12.2	0.54
Paced Heart Rhythm	6.6%	18.8%	< 0.0001	14.9%	15.5%	0.99
QRS Interval (ms)	163 ± 17	164 ± 17	0.40	136.5 ± 9.6	142.3 ± 4.9	< 0.0001
PR Interval (ms)	172 ± 21	175 ± 19	0.014	172.4 ± 23.7	176.2 ± 19.6	0.41
NYHA Class II	48.7%	42.4%	< 0.0001	38.3%	43.1%	0.16
III	50.3%	51.0%		56.4%	44.8%	
IV	0.9%	6.5%		4.3%	12.1%	
Ischemic Cardiomyopathy	31.9%	27.8%	0.20	31.9%	31.0%	1.00
History of AF	12.9%	10.2%	0.23	20.2%	13.8%	0.39

Acute Heart Failure and Sinus Node Dysfunction- Hyperthyroid Induced Reversible Cardiac Insult: a Case Report

Dr Amit Malik¹

¹*Max Hospital Vaishali India, Ghaziabad, India*

77-year old female with progressive shortness of breath, palpitation and syncope for 4 days.

12-lead electrocardiogram (ECG) showed Atrial fibrillation (AF) with ST-segment elevation in lead I, aVL, V2-V3. Patient had spontaneous termination of AF and sinus pause associated with syncope. Initial echocardiogram demonstrated severe hypokinesia of the lateral, anterior, and apical segments with overall impaired left ventricular systolic function (EF 35%). Patient was treated for acute pulmonary edema. Coronary angiography showed normal coronary arteries. Temporary pacemaker insertion done. Patient was treated with Levosimendan infusion (0.1mcg/kg/min for 24 hrs.), Ramipril, Furosemide and Enoxaparin.

Patient family gave history of irregular treatment for Multinodular goiter. Thyroid profile was sent next morning. FT3 was 3.67 pg/ml (VN: 2.6-4.2 pg/ml), FT4 was 2.13 ng/dl (VN: 0.58-1.64 ng/dl) and TSH was 0.04 mcg IU/ml (VN: 0.34-5.6 mcg IU/ml) Antithyroid therapy (Carbimazole) was initiated. Patient's clinical status improved gradually. Episodes of Paroxysmal Atrial fibrillation and sinus pauses reduced in frequency gradually. Temporary pacemaker removed after 72 hours and she was put on telemetry monitoring. Patient was discharged on Ramipril 5 mg once, Apixaban 5 mg twice and Carbimazole 30 mg once daily doses. 6 weeks follow up telemetry revealed normal sinus rhythm, No AF or sinus pauses. Echocardiogram showed normal left ventricular systolic function (EF 60%). Carbimazole and Apixaban continued.

Conclusion: We identified a patient with acute heart failure and sinus node dysfunction in whom treatment of the thyroid disease, along with standard heart-failure therapies, resulted in complete recovery of LV dysfunction and sinus node function.

Acute Heart Failure and Sinus Node Dysfunction Hyperthyroid induced reversible cardiac insult: A case report

Amit Malik MD,FRCP,FACC,FESC
MAX Superspeciality Hospital Vaishali, INDIA

CASE: 77-year old female with progressive shortness of breath, palpitation and recurrent syncope for 4 days.

On admission 12-lead electrocardiogram (ECG) showed Atrial fibrillation (AF) with ST-segment elevation in lead I, aV1, V2-V3. Patient had spontaneous termination of AF and long sinus pause associated with syncope. Initial echocardiogram demonstrated severe hypokinesia of the lateral, anterior, and septal apical segments with overall impaired left ventricular systolic function (EF 35%). Patient was treated for acute pulmonary edema. Diagnostic coronary angiography showed normal coronary arteries. Temporary pacemaker insertion done. Patient was further treated with Levosimendan infusion (0.1mcg/kg/min for 24 hrs.), Ramipril, Furosemide and Enoxaparin.

On further questioning, the patient family gave history of irregular treatment for Multinodular goiter. Thyroid profile was sent next morning. FT3 was 3.67 pg/ml (VN: 2.6-4.2 pg/ml), FT4 was 2.13 ng/dl (VN: 0.58-1.64 ng/dl) and TSH was 0.04 mcg IU/ml (VN: 0.34-5.6 mcg IU/ml). Antithyroid therapy (Carbimazole) was initiated. Patient's clinical status improved gradually. Episodes of Paroxysmal Atrial fibrillation and sinus pauses reduced in frequency gradually. Temporary pacemaker removed after 72 hours and she was put on telemetry monitoring. Patient was discharged on Ramipril 5 mg once, Apixaban 5 mg twice and Carbimazole 30 mg once daily doses. 6 weeks follow up telemetry revealed normal sinus rhythm, No AF or sinus pauses. Echocardiogram showed normal left ventricular systolic function (EF 60%). Carbimazole and Apixaban continued.

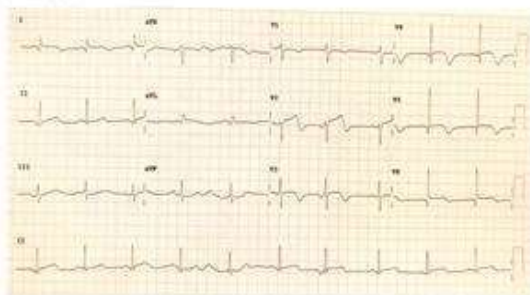


Fig 1 : Initial ECG in sinus rhythm



Fig 2 : Echocardiogram at presentation showed apical involvement

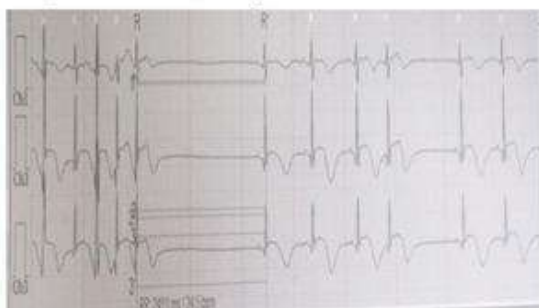


Fig 3: Holter monitoring revealed Paroxysmal AF followed by sinus pause

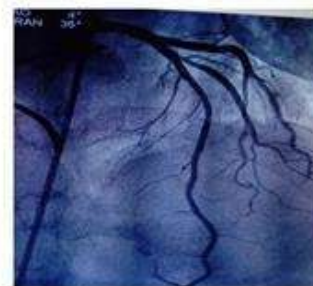


Fig 4: Coronary angiogram revealed normal coronary arteries.

CONCLUSION: We identified a patient with acute heart failure and sinus node dysfunction in whom treatment of the thyroid disease, along with standard heart-failure therapies, resulted in complete recovery of LV dysfunction and sinus node function.

Atrial Fibrillation Ablation for Heart Failure With Preserved Ejection Fraction (HFpEF): a Randomized Controlled Trial

Dr David Chieng^{1,2,3}, Dr Hariharan Sugumar^{1,2,3}, Dr Louise Segan^{1,2,3}, Dr Caleb Tan², Mrs Donna Vizi^{1,2}, Dr Shane Nanayakkara^{1,2}, Dr Ahmed Al-Kaisey^{3,4}, Dr Joshua Hawson^{3,4}, A/Prof Sandeep Prabhu^{1,2,3}, A/ Prof Aleksandr Voskoboinik^{1,2,3}, Dr Joseph Morton^{3,4}, A/ Prof Geoffrey Lee^{3,4}, A/Prof Justin Mariani², A/prof Andre La Gerche^{1,2,3}, Professor Peter Kistler^{1,2,3,5}, Professor Jonathan Kalman^{3,4,5}, Professor David Kaye^{1,2,5}, A/Prof Liang-Han Ling^{1,2,3}

¹*Baker Heart and Diabetes Institute, Melbourne, Australia*, ²*Alfred Health, Melbourne, Australia*,

³*University of Melbourne, Melbourne, Australia*, ⁴*Royal Melbourne Hospital, Melbourne, Australia*,

⁵*Monash University, Melbourne, Australia*

OBJECTIVES

Atrial fibrillation(AF) and HFpEF often concurrently exist. Few therapies have proven benefit in HFpEF. The objectives of this study are to compare the effects of AF ablation on markers of HFpEF severity, including exercise haemodynamics, functional capacity, and quality of life scores.

MATERIALS AND METHODS

Patients with AF and HFpEF underwent clinical evaluation, cardiopulmonary exercise testing, exercise right heart catheterization (ExRHC), natriuretic peptide (NT-proBNP) assay. HFpEF diagnosis required a pulmonary capillary wedge pressure (PCWP) ≥ 15 mmHg at rest or ≥ 25 mmHg at peak exercise on ExRHC as the gold standard. Patients were randomized to AF ablation versus medical therapy, and re-evaluated at 6 months. The primary outcome was change in PCWP on follow-up.

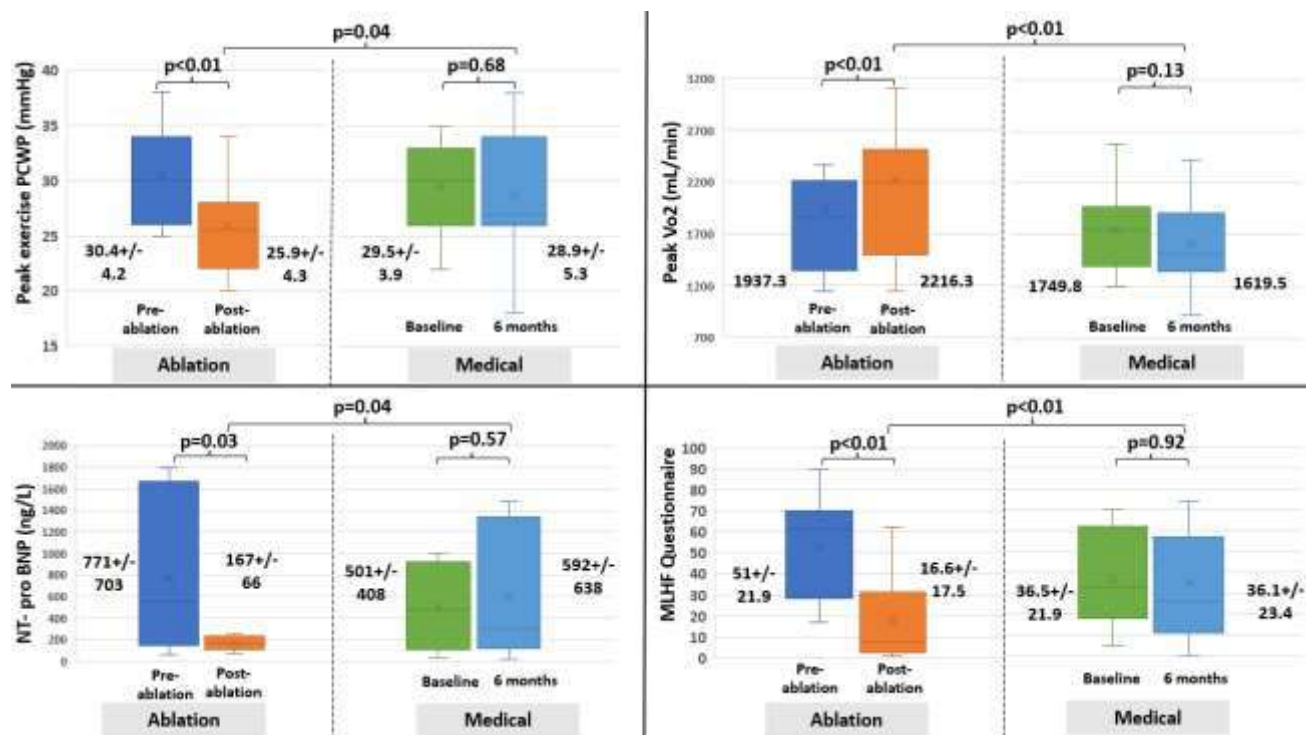
RESULTS

31 patients (mean 66 years, 51.6% females) were randomized to AF ablation(16) versus medical therapy(15). Baseline characteristics were comparable across groups. At 6 months, ablation reduced the primary outcome measure of peak PCWP (30.4 ± 4.2 to 25.9 ± 4.3 mmHg, $p < 0.01$), with improvements in peak VO₂ (1937.3 ± 739.3 to 2216.3 ± 861.9 mL/min, $p < 0.01$), NT-pro BNP (771 ± 703 to 167 ± 66 ng/L, $p = 0.03$), and Minnesota Living with Heart Failure(MLHF) score (51 ± 21.9 to 16.6 ± 17.5 , $p < 0.01$). No differences were observed in the medical arm. Following ablation, 50% (8/16) no longer met ExRHC-based criteria for HFpEF (including 6/8 of those remaining arrhythmia-free) versus 7% (1/15) in the medical arm ($p = 0.02$).

CONCLUSION

In concurrent AF and HFpEF, AF ablation improves invasive exercise haemodynamic parameters, increases exercise capacity, and enhances quality of life. Successful AF ablation may reverse the clinical syndrome of HFpEF in a proportion of these patients.

SUPPORTING DOCUMENTS



Left Atrial Scarring Does Not Predict LV Recovery Post AF Ablation in AF-mediated Cardiomyopathy

Dr Louise Segan¹, Dr David Chieng^{1,2,3}, A/Prof Geoffrey Lee^{3,4}, Dr Joshua Hawson^{3,4}, Dr Ahmed Al-Kaisey^{3,4}, Dr Hariharan Sugumar^{1,2,3}, A/Prof Aleksandr Voskoboinik^{1,2,3}, A/Prof Han-Liang Ling^{1,2,3}, Dr Joseph Morton^{3,4}, Professor Jonathan Kalman^{3,4}, Professor Peter Kistler^{1,2,3}, A/Prof Sandeep Prabhu^{1,2,3}

¹Alfred Health, Prahran, Australia, ²Baker Heart and Diabetes Institute, Melbourne, Australia,

³University of Melbourne, Melbourne, Australia, ⁴Royal Melbourne Hospital, Melbourne, Australia

Objectives: We evaluated the impact of left atrial (LA) electroanatomical characteristics on clinical outcomes in patients with AF and heart failure (HF) without cardiac MRI (CMR) detected left ventricular (LV) fibrosis.

Methods: Consecutive patients with AF and HF (baseline LV ejection fraction (LVEF) <45%) without CMR-detected LV fibrosis underwent LA electroanatomical mapping prior to AF ablation. Global and regional Unipolar and Bipolar voltage, scarring, fractionation and conduction velocity were collected and impact on LV recovery and AF recurrence was evaluated.

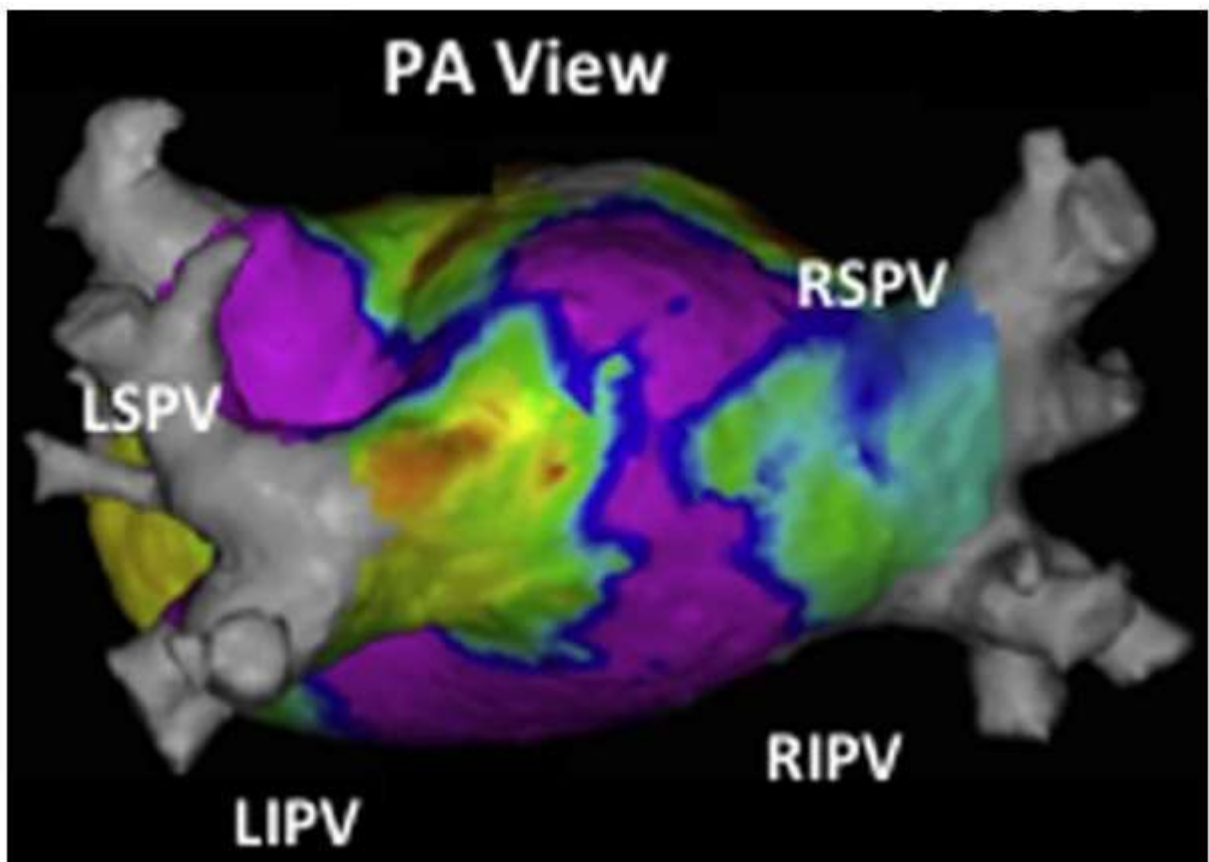
Results: Forty-one patients (12.2% female, mean age 59±12 years) with AF (80.5% persistent AF (PsAF)) and non-ischaemic cardiomyopathy (baseline LVEF 32±8%, LAVI 56±15mL/m²) were included. At 6 months, 68.3% demonstrated complete LV recovery and 36.6% experienced AF recurrence.

Patients were stratified according to the presence (49%) of LA scar (<0.05mV). Baseline characteristics were similar, though PsAF and AF recurrence were higher in the LA scar cohort. On average, 1346±353 points were analysed. In those with LA scar, global scar burden was 1.5±1.3% with higher fractionation (p=0.002) though similar tissue voltage and conduction velocity (all p>0.05, table 1). Global LA scar (x2 5.707, p=0.017) and fractionation (R=0.462, p=0.002) were associated with AF recurrence but not LV recovery (x2 = 0.344, p=0.558; R=0.168, p=0.294). Low voltage burden and voltage heterogeneity were not associated with AF recurrence nor LV recovery (all p>0.05).

Conclusion: left atrial substrate does not predict LV recovery and its presence should not discourage consideration of catheter ablation in the pursuit of rhythm control among the AF-mediated cardiomyopathy population.

SUPPORTING DOCUMENTS

	LA scar N = 20	No LA scar N = 21	P value
Demographic data			
Age	60±10	57±13	0.466
Female gender, %	10.0%	14.3%	0.684
BMI, kg/m ²	30.4±6.9	29.7±4.9	0.594
HTN, %	40%	29%	0.453
Diabetes, %	14.3%	20%	0.637
CHADS ₂ VASc	2.4±1.2	2.1±0.9	0.365
AF characteristics			
PsAF, %	95%	67%	0.022
AF duration, months	12.4±11.1	8.7±7.2	0.214
Ablation strategy: PVI+PWI, %	85%	57%	0.0517
AF recurrence, %	55%	19%	0.016
AF burden, % (mean(SD))	1.4±2.9	1.1±2.4	0.054
Echocardiographic parameters			
Baseline LVEF, %	30±7.3	33±9.0	0.252
Baseline LAVI, mL/m ²	59±17	53±12	0.156
6-month LVEF change, %	17.5±16.5	19.6±9.0	0.601
6m LV recovery (LVEF _≥ 50%), %	60%	76%	0.277
Electroanatomical characteristics			
Points, mean(SD)	1233±150	1340±231	0.086
Voltage			
Global Unipolar voltage (mV)	2.2±0.6	2.6±0.9	0.133
Global Bipolar voltage (mV)	1.4±0.4	1.5±0.6	0.406
Voltage heterogeneity	0.7±0.2	0.5±0.4	0.055
Fractionation, %	24.1±17.5	8.3±13.3	0.002
Scarring, %			
Posterior wall, %	1.5±1.4	-	-
Non-posterior wall segments, %	1.3±4.3	-	-
	0.4±0.6	-	-
Low-voltage, %	27.7±14.7	23.5±14.6	0.36
Conduction velocity, m/s	0.8±0.3	0.8±0.3	0.81



Optimization of Left Ventricular Atrio-ventricular Pacing Delay in LV-only Cardiac Resynchronization Therapy

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¹Hue University of Medicine and Pharmacy, Hue, Viet Nam, ²Hospital 103, Hanoi, Vietnam, ³Cho Ray Hospital, Hochiminh City, Vietnam, ⁴Post Office Hospital, Hanoi, Vietnam, ⁵Viet Tiep Friendship Hospital, Hai Phong, ⁶Hanoi University of Medicine, Hanoi, Vietnam, ⁷Quang Tri General Hospital, Quang Tri, Vietnam

OBJECTIVES

Adaptive LV-only pacing (LVop) is an alternative to biventricular cardiac resynchronization therapy (CRT) in patients with LBBB and good A-RV conduction. We investigate fixed delay LVop with programmed optimal left ventricular atrioventricular delay (LVAVD).

MATERIALS AND METHODS

The LVAVD of de novo and (unoptimized) LVop patients were optimized. The delays from atrial senses to electrocardiogram initial QRS peaks were measured during sensing tests, As-Rpk (assuming R wave). The delays from the LV pacing pulses to initial QRS peaks during LV threshold tests were measured, LVp-Qpk (assuming Q wave). The optimal LVAVD is (As-Rpk) - (LVp-Qpk). Visual fine tuning was done. The final LVAD at rest is the optimal LVAVD minus 15-20 ms, the "dromotropic reserve".

Patients with dual chamber pacemakers (electrodes in RA, LV) and triple chamber CRT devices (RA, RV, LV) programmed to LVop, were studied. Therapeutically, CRT is the same.

RESULTS

For de novo patients, left ventricular ejection fraction (LVEF) measurements were made a few days after implant. For established LVop patients LVEF before and after LVAVD optimization were measured.

- For the 5 de novo patients, LVEF improvements from no pacing to optimal pacing ranged from +5% to +21%, without cardiac remodeling!
- For the 6 established LVop patients, LVEF improved from +5% to +15.6%, on top of the improvements during unoptimized LVop. Expect further improvements with cardiac remodeling.

CONCLUSION

Optimized fixed delay LVAVD dual and triple chamber CRT devices can offer superior performance just from LVAVD optimization. Further improvements are expected from later cardiac remodeling.

SUPPORTING DOCUMENTS

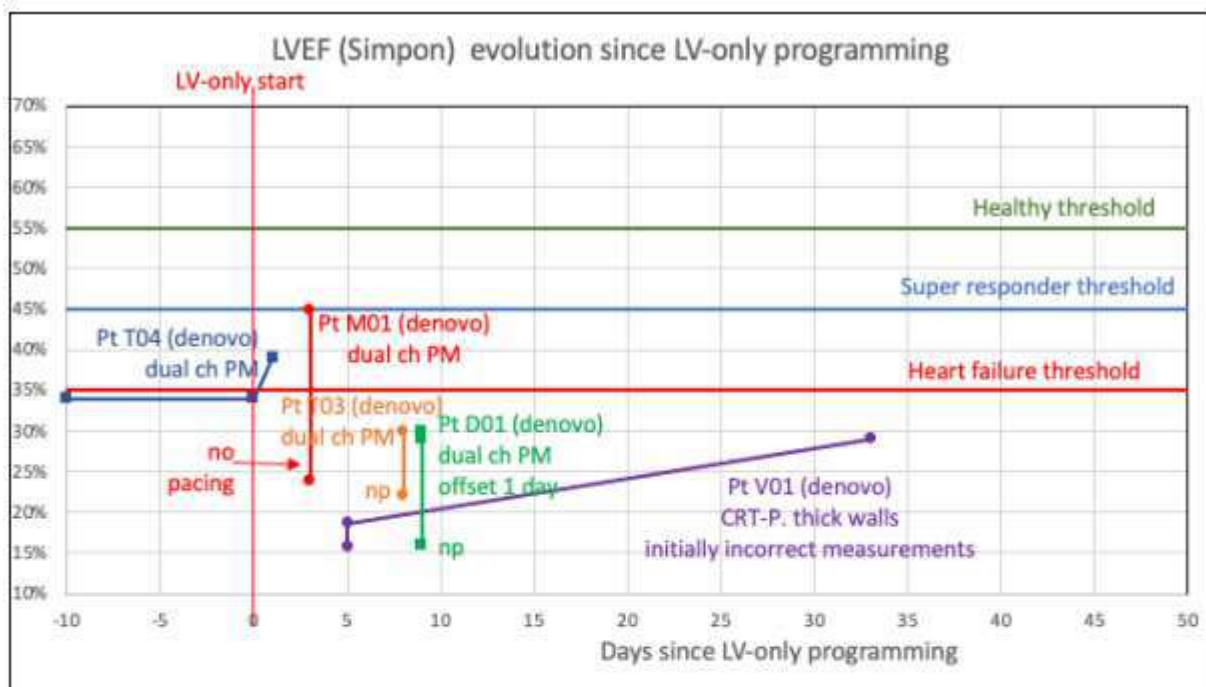


Figure 1. De novo patients. LVAVD Optimization performed shortly after implant.

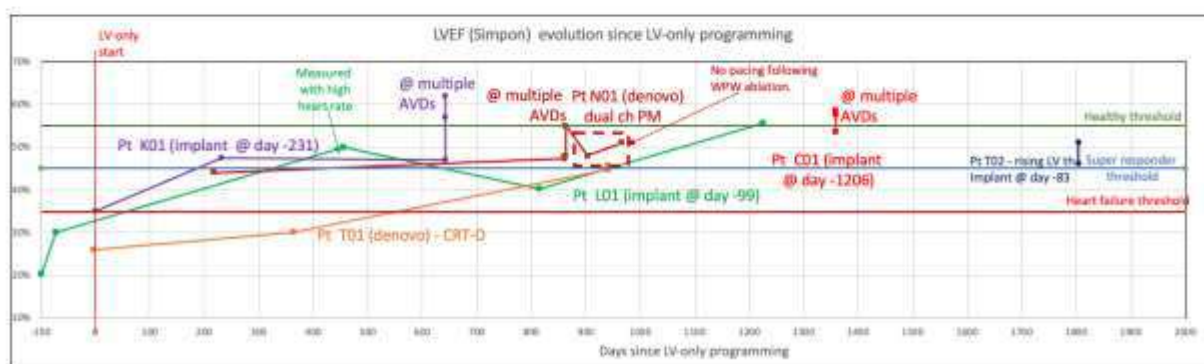


Figure 2. LVop patients, initially unoptimized. Optimization are the vertical lines at the end.

Atrial Fibrillation With Preexcitation Induced Biventricular Dysfunction in Ebstein Anomaly

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CASE PRESENTATION

Ebstein's Anomaly is a rare congenital heart disorder occurring ≈1 per 200 000 live births and accounting for <1% of all cases of congenital heart disease. Downward displacement of septal leaflet of tricuspid valve created a potential substrate for accessory atrioventricular (AV) connection and pre-excitation which cause ventricular dyssynchrony that leads to cardiomyopathy. Surgical approach is indicated when symptoms of cyanosis, exercise intolerance (NYHA III or IV) or cardiothoracic ratio > 0.65 in NYHA I or II exists. We presented a case of Ebstein anomaly with atrial fibrillation and preexcitation on right postero-septal pathway who received multiple ablation and medical therapy despite surgical indication.

A 26 years old male presented with sign and symptoms of right heart failure, hypotension and tachycardia. Laboratory exam showed elevated transaminases. The ECG showed Atrial fibrillation with Wolff Parkinson white (AF-WPW). Echocardiography showed dilated all chamber, reduced left ventricular ejection fraction (LVEF 40%) with global hypokinetic, moderate mitral regurgitation, and tricuspid regurgitation due to septal tricuspid valve apical displacement (10 mm/BSA). The patient underwent two separated ablation procedure which succeeded and 6 months follow-up and monitoring showed improvement of functional capacity, normal sinus rhythm, echocardiographic improvement of left and right heart function which exclude the indication for surgery.

CONCLUSION

Ebstein's anomaly with accessory pathway that could cause dyssynchrony and eventually heart failure can be cured by ablation of the accessory pathway. Improvement of functional capacity, echocardiographic parameters exclude the need for surgery.

SUPPORTING DOCUMENTS

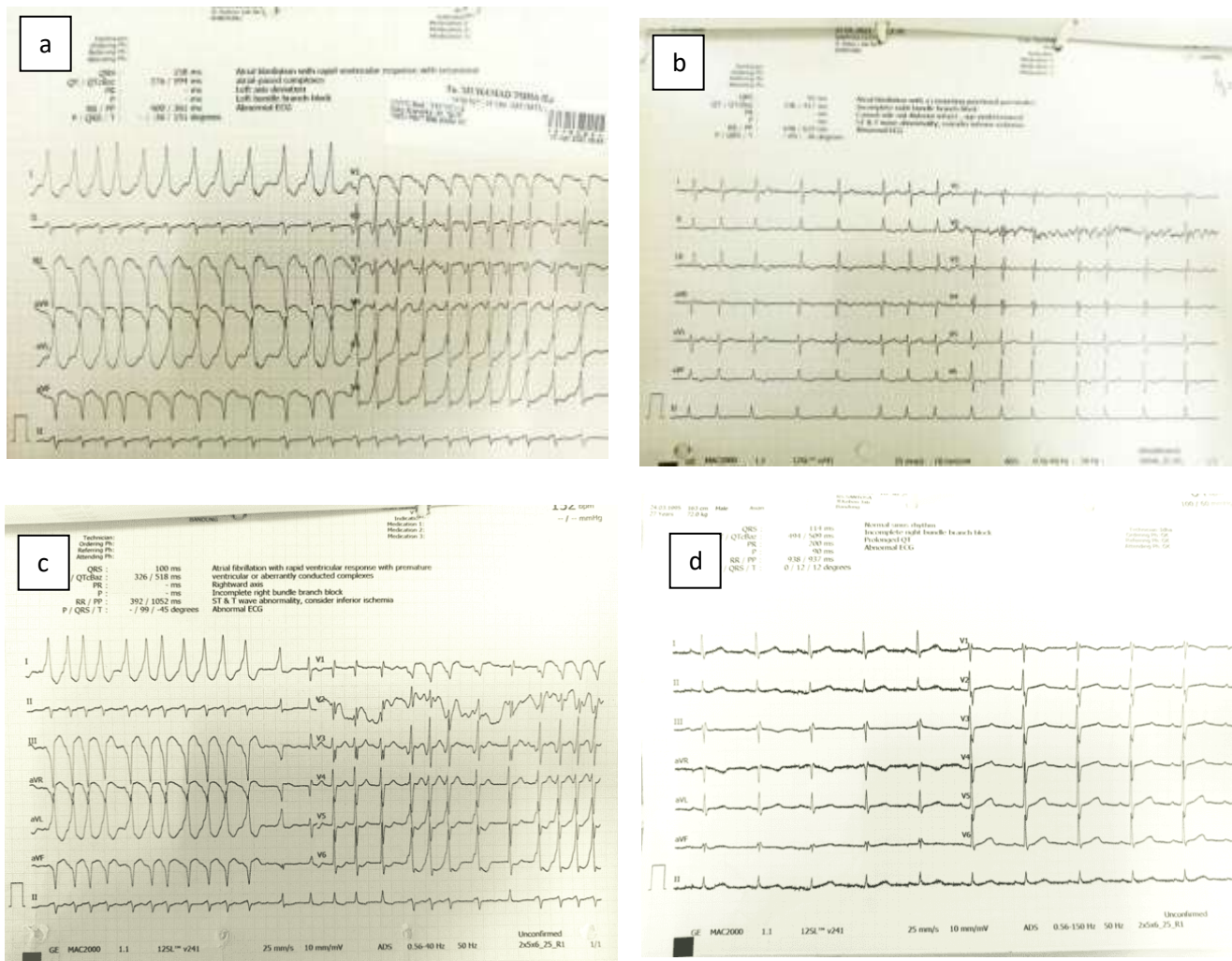


Figure 1. (a) ECG Shown AFWPW on admission; (b) Post ablation showed atrial fibrillation; (c) readmission in 1 month showed recurrence of AF-WPW; (d) After 2nd ablation and optimal medical therapy ECG showed normal sinus rhythm

Cardiac Resynchronization Therapy (CRT) in a Patient With Arrhythmogenic Right Ventricular Cardiomyopathy: a Case Report

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OBJECTIVES

We present a case of a 39-year old male with high-frequency ventricular arrhythmias and symptomatic bradycardia complicated by heart failure. He was diagnosed to have Arrhythmogenic Right Ventricular Cardiomyopathy and successfully underwent cardiac resynchronization therapy.

RESULTS

A 39-year old male with high-frequency ventricular arrhythmias survived sudden cardiac death and presented in the emergency department with loss of consciousness. Family history revealed first-degree relatives with structural heart abnormalities but no premature sudden death. At presentation, 12L- ECG revealed 3rd Degree AV block with complete right bundle branch block and T wave inversions in V1-4 accompanied by epsilon waves, hence he underwent temporary pacing. Transthoracic echocardiogram revealed a reduced LV function (EF 20%) ; also a dilated and dyskinetic RV, dilated RVOT and reduced fractional area change, fulfilling 2 major and 2 minor criteria in the 2019 Modified Task Force Criteria for ARVC/D diagnosis consistent with a definite diagnosis of Arrhythmogenic Right Ventricular Cardiomyopathy. Patient underwent successful cardiac resynchronization therapy and was discharged improved with heart failure medications. On follow-up and device interrogation 1, 3 and 6 months after, patient had multiple episodes of ventricular fibrillation and ventricular tachycardia which were terminated with shocks and burst antitachycardia pacing.

CONCLUSION

Heart failure in patients with arrhythmogenic right ventricular cardiomyopathy are under-recognized and may be detrimental alongside with its concomitant potential lethal ventricular arrhythmias. This case reports illustrates the presentation of heart failure in arrhythmogenic right ventricular cardiomyopathy which was successfully treated with cardiac resynchronization therapy.

Pulmonary Artery Banding and Cardiac Resynchronization Therapy for Dilated Cardiomyopathy and Left Bundle Branch Block

Dr Weidan Chen¹, Dr Ye Lu¹

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Although heart transplantation is a final therapeutic option in pediatric patients with dilated cardiomyopathy (DCM), the shortage of pediatric heart donors is a major obstacle. In adults with DCM characterized by cardiac dyssynchrony, cardiac resynchronization therapy (CRT) is known to be an effective treatment option. However, there is a lack of evidence on the effectiveness of CRT in infants with DCM with left bundle branch block. Several studies have reported improvement in hemodynamics and cardiac performance following CRT in infants with DCM. But there is no report about pulmonary arterial banding and CRT for children with DCM and left bundle branch block. we report pulmonary arterial banding and CRT in an child with DCM and left bundle branch block 1 month of follow-up. The LVEF improved significantly.

Conduction System Pacing and Left-Sided AVJ Ablation in a patient with Partial AVCD Repair.

Dr Basavaraj Sutar¹, Dr P. Vijay shekar, Dr C. Sridevi, chennapragada, Dr Sachin Yalagudri, Dr Muthiah Subramanian, Dr Daljeet kaur, Dr Calambur Narasimhan Narasimhan

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TITLE OF ABSTRACT

Conduction System Pacing and Left-Sided AVJ Ablation in a patient with Partial AVCD Repair.

OBJECTIVES

Conduction system pacing can be an effective alternative to conventional CRT as an adjunct to AVJ ablation

MATERIALS AND METHODS

LBB area pacing is emerging as an alternative to conventional cardiac resynchronization therapy (CRT). We report a case with drug-refractory long-standing AF successfully treated with AVJ ablation with left bundle branch (LBB) area pacing. The patient presented with refractory AF and progressive worsening of heart failure. The presence of an atrioventricular canal defect (AVCD) – post intracardiac repair and a mechanical mitral prosthesis in our patient adds to the complexity of the presentation. The patients with AVCD creates a technical challenge for AVJ ablation from the right side. The displaced conduction system poses a challenge for the LBBA pacing a Presence of mechanical prosthesis in mitral position precludes an antegrade approach to left-sided AVJ ablation. Hence left-sided AVJ was performed through a retrograde approach.

RESULTS

Post-procedure, the patient improved symptomatically. The final QRS duration was 124 ms. TTE after 48 hours showed significant improvement in LV systolic function (Pre discharge EF: 48%). Recovery of LV function is attributed to control of ventricular rates. The patient had no further hospitalizations for heart failure during the follow-up period of 6 months.

CONCLUSION

Heart failure is common in any tachyarrhythmia, AV junction ablation relatively simple and safe procedure that can be done to benefit a specific subset of patients with atrial fibrillation with heart failure.

Pre-Diabetes is Associated with Increases Cardiac Event in Cancer Patients Treated with Anthracyclines

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Objective:

To evaluate the association between pre-diabetes and cardiovascular events in patients treated with anthracyclines containing chemotherapy (ACT).

Methods:

Patients treated with ACT between 2000 and 2019 were divided into diabetes, pre-diabetes, and normoglycemia groups based on the baseline glycemic status. Primary outcome was the major adverse cardiovascular composite events (MACE) of heart failure hospitalization and cardiovascular death. Kaplan-Meier, multivariable COX regression, and Fine and Gray model analysis were applied.

Results:

Among 12649 patients treated with ACT, 3997 (31.6%, median age 61 years old) had pre-diabetes and 5622 (44.45%, median age 67 years old) had diabetes at baseline. Over a median follow-up of 8.7 years, the incidence of MACE was 211 (7.0%) in normoglycemia group, 358 (9.0%) in pre-diabetes group, and 728 (12.9%) in diabetes group. Compared with normoglycemia group, both pre-diabetes (adjusted HR=1.20, 95%CI 1.01-1.43) and diabetes (adjusted HR=1.46, 95% CI 1.24-1.70) were significantly associated with an increased risk of MACE. Further analysis showed that there were 475 (18%) progressed to overt diabetes in the pre-diabetes group after 2 years of the index date and were at greater risk of MACE (Adjusted HR=1.76, 95% CI 1.31-2.36).

Conclusions:

Pre-diabetes was significantly associated with an increased risk of MACE in patients treated with ACTs. Among, those who progressed to diabetes after 2 years demonstrated an increased risk of MACE. Findings support that pre-diabetes as a risk factor for cardiovascular events might optimize management.

Characterisation of Subsets of Tachycardiomyopathy

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Tachycardiomyopathy (TCMP) is a well-defined entity. TCMP has been classified as pure type and impure type, TCMP may completely recover while those with normal hearts may remain with ventricular dysfunction after control of the tachycardia. This study used a novel classification of TCMP and attempted to identify predictors of future course at first presentation.

AIMS

The study aims to characterize TCMP into 2 clinical groups:

- i. Classic TCMP: Complete reversibility over 12 weeks
- ii. Partial TCMP: Partial reversibility over 12 weeks

MATERIAL AND METHODS

Single centre observational study carried out between 2019-2021. Patients presenting with (LVEF<40) suspected secondary to an incessant or frequent arrhythmia were identified. The profiles, were recorded before and immediately after tachycardia termination. The patients were followed up at 12 weeks with echocardiography and clinical outcomes, and data statistically analysed

DISCUSSION

Totally 55 patients were included in the study over a period of 15 months. Of the 55 patients, Classic TCMP was seen in 30 (55%), 7(23%) of whom had atrial tachycardia, 13(43%) had AF, 6(20%) had atrial flutter and 4(13%) had VT. Partial TCMP was seen in 25(45%), 15(60%) of whom had AF, 3(12%) had atrial flutter and 7(28%) had atrial tachycardia. Interestingly, 13(24%) patients had an initial immediate improvement of LVEF, followed by a variable course. we have defined a novel entity which we have called Exaggerated TCMP

CONCLUSION

Classic and Partial TCMP have similar incidence. No robust predictor could be identified to differentiate between these 2 types. We propose a new subgroup of Exaggerated TCMP

CHARACTERISATION OF SUBSETS OF TACHYCARDIOMYOPATHY

Presenting author- Shah HP

Co-authors: Bansal R, Bachani N, Panicker G, Dhirawani B, Lokhandwala YY

Key words: Left ventricular dysfunction, Arrhythmias

ABSTRACT:

INTRODUCTION

Tachycardiomyopathy (TCMP) is a well-defined entity, though large volume studies documenting the course is scanty. TCMP has been classified as pure type and impure type, based on the absence or presence of structural heart disease respectively. However, patients with structural heart disease and TCMP may completely recover while those with normal hearts may remain with ventricular dysfunction after control of the tachycardia. Hence this study used a novel classification of TCMP and attempted to identify predictors of future course at first presentation.

AIM

The study aims to characterize TCMP into 2 clinical groups and study their clinical profiles:

- 1) Classic TCMP: Complete reversibility over 12 weeks
 - i. Partial TCMP: Partial reversibility over 12 weeks

MATERIAL AND METHODS

This was an ambispective single centre observational study carried out between 2018-2020. Patients presenting with left ventricular dysfunction (LVEF<40) suspected secondary to an incessant or frequent arrhythmia were identified and recruited in the study after an informed consent. Patients who had a similar left ventricular dysfunction preceding the onset of arrhythmia were excluded. The demographic profile, baseline ECG and echocardiographic findings were recorded before and immediately after tachycardia termination. The patients were then followed up at 12 weeks with echocardiography and clinical outcomes. For analysis, the subjects were divided into classic and partial subgroups, which were then compared with respect to different parameters using standard statistical analysis.

RESULTS AND DISCUSSION

Totally 55 patients were included in the study over a period of 15 months. The age of the patients was 53.2 ± 11 years; 30(55%) of the patients were males while 25(45%) were females. Overall 24 (44%), 26 (47%) and 5(9%) of the study population presented with NYHA class II, III and IV symptoms respectively. Of the 55 patients, 27 (49%) had atrial fibrillation, 9 (16.3%) had atrial flutter, 15 (27%) had atrial tachycardia and 4 (13%) had ventricular tachycardia. Medical therapy alone was undertaken in 28 (51%) while catheter ablation was performed in 27(49%) of patients. The baseline LVEF was 0.26 ± 0.6 , which increased to 0.5 ± 0.14 at 12 weeks follow up ($p < 0.0001$). Classic TCMP was

seen in 30 (55%) of patients, 7 (23%) of whom had atrial tachycardia, 13 (43%) had atrial fibrillation, 6 (20%) had atrial flutter and 4 (13%) had ventricular tachycardia. Partial TCMP was seen in 25 (45%) patients, 15 (60%) of whom had atrial fibrillation, 3 (12%) had atrial flutter and 7 (28%) had atrial tachycardia. There was no significant difference between the Classic and Partial TCMP groups when compared for age, gender distribution, distribution of arrhythmia and presence of other comorbidities. Interestingly, 13 (24%) patients had an initial immediate improvement of LVEF, followed by a variable course. This immediate improvement was due to a fallacy in the echocardiographic assessment during the tachycardia, and this subgroup was identified as a novel entity which we have called Exaggerated Tachycardiomyopathy.

CONCLUSION

Classic and Partial TCMP have similar incidence. No robust predictor could be identified to differentiate between these 2 types. We propose a new subgroup of Exaggerated Tachycardiomyopathy. Future large studies on these lines are warranted to study the subgroups of Tachycardiomyopathy and further identify predictors of response.

	Classic TCMP(n= 30)	Partial TCMP (n = 25)	Exaggerated TCMP (n = 13)
Mean Age	51	56	55
Gender (Male/Female)	16 (53.3%)/ 14(46.6%)	14 (56%)/ 11 (44%)	5(38.4.5%)/ 8 (61.5%)
Type of arrhythmia			
1. AF	13(43.3%)	15 (60%)	4
2. Atrial Flutter	6(20%)	3 (12%)	5
3. Atrial tachycardia	7 (23.3%)	7 (28%)	4
4. VT	4 (13.3%)	-	
Comorbidities	DM -7 HT-10 Hypothyroid-5	DM-6 HT-8 Hypothyroid -4	DM-3 HT-4 Hypothyroid-3

Identification of Potential Candidate Genes and Dysregulated Mechanisms of Heart Failure

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Background:Heart failure (HF) adversely affects quality of life. This work aims to increase the understanding of the biology of HF in order to identify candidate markers that can provide the most effective diagnosis and treatment.

Methods: Gene expression profiles in HF and non-failing (NF) samples were collected from GSE116250 and GSE141910. Differentially expressed genes (DEGs) between HF and NF were identified, and common genes were obtained using intersection analysis. Enrichment analysis was performed to identify biological mechanisms underlying HF. Further, candidate genes were screened using the least absolute shrinkage and selection operator (LASSO) analysis. The diagnostic role of candidate genes to predict the occurrence of HF was evaluated by meta-analysis and ROC curves. In addition, we also utilized xCell to analyze the differences in immune cell infiltration between HF and NF.

Results A total of 379 common genes were obtained as differentially expressed between HF and NF. Enrichment analysis identified common genes mainly involved in the immune response, Toll-like receptor signaling pathway. Through the LASSO model, we identified eight candidate genes (PHLDA1, C1QTNF2, SPC24, FNDC1, FREM1, SLC16A9, PLA2G2A, and S1PR3). The meta-analysis and ROC curves results suggest that the candidate genes are highly sensitive for the diagnosis of HF. Finally, we found that neutrophil, B cell plasma, and Th1 CD4+ T cell were significantly infiltrated in HF.

Conclusion To identify potential diagnostic and therapeutic candidate genes using gene expression profiling of HF patients. In the future, more efforts are needed to investigate the role of candidate genes in HF.

Fetal Cardiac Arrhythmias – A 25-year Experience and Evolving Trends

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¹*KK Women's and Children's Hospital, Singapore*

Objective

We describe our 25-year experience in the diagnosis and management of fetal arrhythmia.

Materials and Methods

The fetal cardiac databases were reviewed retrospectively from 1997 -2022 and cases of fetal arrhythmias (bradyarrhythmias and tachyarrhythmias) were identified. Epidemiological trends are described. The cases from the last 5 years were compared to those from the preceding 20 years.

Results

45 cases of fetal arrhythmia were detected in the last 25 years. 18 cases were diagnosed in the last 5 years compared to 27 cases in the preceding 20 years. The commonest fetal cardiac rhythm abnormality detected was premature atrial contractions (n=23). The next most common fetal cardiac rhythm abnormality was complete heart block (n=13). 8 fetuses were diagnosed with fetal supraventricular tachycardia (SVT). 4 fetuses with SVT were diagnosed in the last 5 years. Of these, 3 were given transplacental therapy (maternal flecainide n=2, maternal sotalol n=1). Rhythm control was achieved in all cases prior to delivery. There was 1 case of fetal ventricular tachycardia that was diagnosed probable congenital long QTc syndrome. The baby required cardiac pacing and beta-blockers in the neonatal period.

Conclusion

In the last 5 years, there has been an increase in the diagnostic accuracy of fetal arrhythmia. We have had good experience with transplacental therapy for fetal SVTs. We have begun to perform maternal CYP2D6 genetic testing and maternal flecainide levels for better risk stratification. Although uncommon, antenatal management and perinatal planning can help improve perinatal outcomes of fetuses with significant arrhythmia.

Pacing Therapy in Infants With Congenital Heart Block in Single Tertiary Centre in Hong Kong

Dr Sit-Yee Kwok¹, Mr Ngai Lun Ho¹, Dr Kin Shing Lun¹, Dr Rocha Barnabe¹, Dr Nicholson Yam¹, Dr Sabrina Tsao¹, Dr Tak Cheung Yung¹

¹*Hong Kong Children's Hospital, Kowloon Bay, Hong Kong*

Background:

Data in pacing therapy in infants with congenital complete heart block are limited.

Methods:

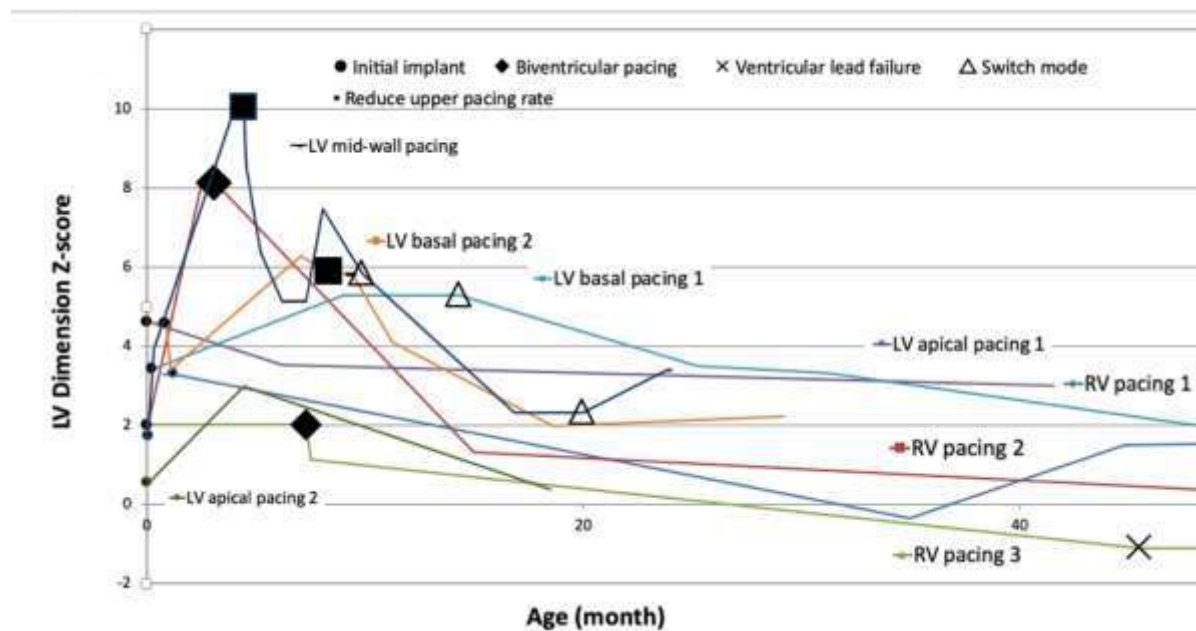
All infants diagnosed with congenital complete heart block and aged < 1 year at pacemaker implantation from 2006 to 2018 were included. The clinical course was reviewed.

Results:

Eight infants were recruited, with a median FU duration of 77.3 months (IQR 35.8-136.2). Two infants (25%) had evidence of low cardiac output, while the rest of them were indicated for pacing therapy either because of asymptomatic extreme bradycardia or wide escape rhythm. The mean age of first pacemaker implantation was 9.9 days (range 1-38), with a mean escape ventricular rate of 53.8 +/- 6.2 bpm and QRS duration of 76.3 +/- 27.8 milliseconds (ms). Epicardial dual-chamber pacing system was implanted for all our infants. Two out of three infants with RV pacing developed RV pacing induced LV dyssynchrony with ventricular failure at 3 and 6 months, and ventricular function improved after the upgrade to biventricular pacing. All patients with LV basal pacing (2/2) developed ventricular dysfunction at 8 and 9 month, with improvement after reducing pacing rate. In contrast, all patients with LV apical pacing (2/2) did not develop heart failure. Three patients had complication of epicardial lead fracture, at a median age of 108 months (range 45-129). The left ventricular end-diastolic diameter demonstrated a trend of normalization over time.

Conclusion: Five out of eight infants (62.5%) with congenital heart block developed subsequent ventricular dysfunction. LV apex appeared to be the most favourable pacing site.

SUPPORTING DOCUMENTS



The change in LV dimension (z-score) in congenital heart block infants after dual-chamber ventricular pacing.

Transcatheter Ablation in Adult Congenital Heart Diseases in Single Tertiary Centre of Hong Kong

Dr Sit-Yee Kwok¹, Prof Hung Fat Tse², Dr Tak Cheung Yung¹, Mr Ngai Lun Ho¹, Dr. Jojo Hai², Dr Sabrina Tsao¹

¹*Hong Kong Children's Hospital, Kowloon Bay , Hong Kong,* ²*University of Hong Kong , Pok Fu Lam , Hong Kong*

Background:

Transcatheter ablation plays a key role in the contemporary management of arrhythmias in patients with adult congenital heart diseases (ACHD).

Methods:

Retrospective review of consecutive transcatheter ablation was conducted for all ACHD patients from Jan 2016 to April 2021, in the only tertiary congenital heart centre (Queen Mary Hospital) in Hong Kong.

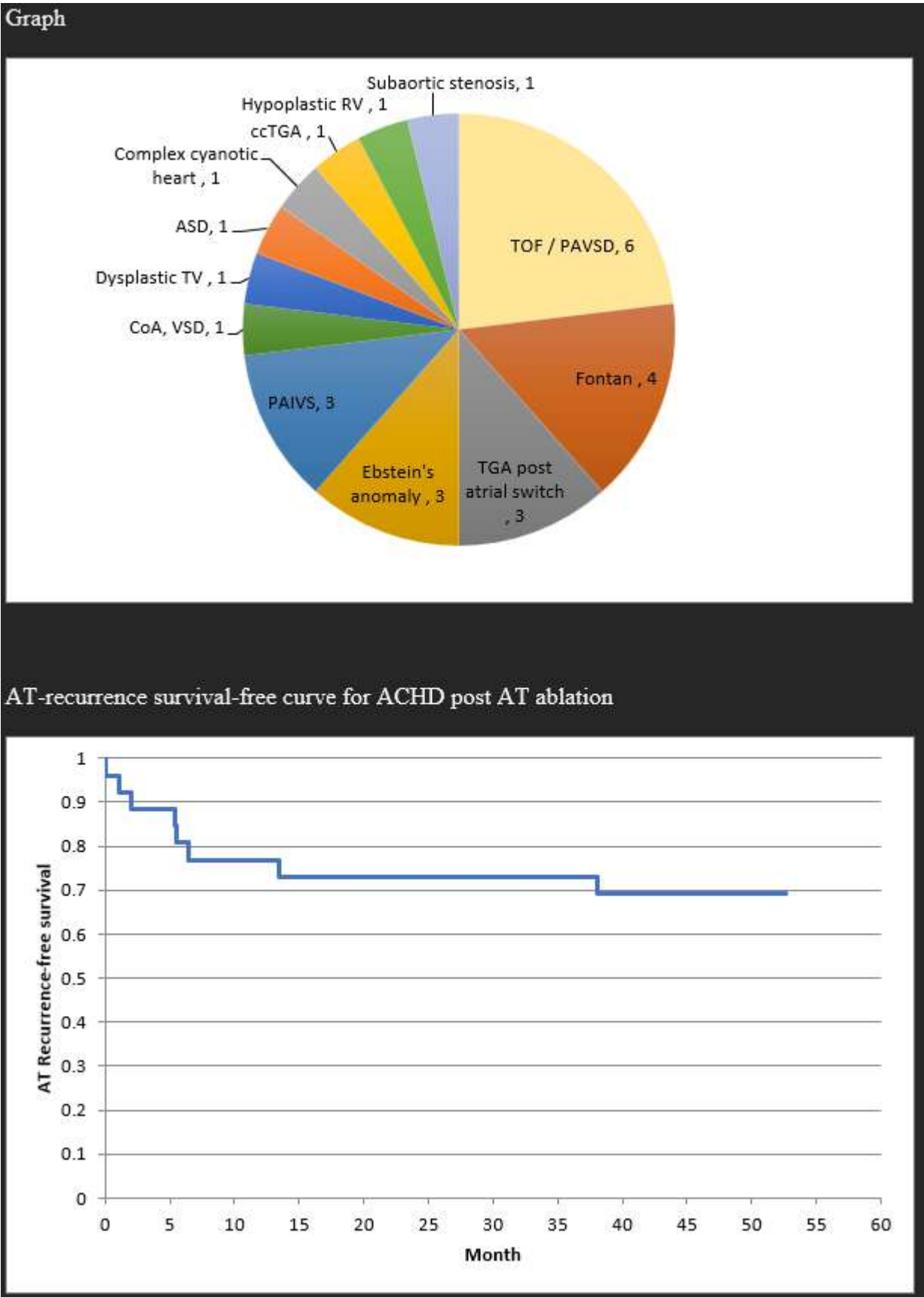
Results:

Twenty-six ACHD patients (15 male) were identified (mean age 35.9 ± 9.7 years). The graph shows the case-mix. The only redo procedure was performed for a ccTGA patient with five identifiable arrhythmic mechanisms. A total of 68 arrhythmia mechanisms was found, with intra-atrial reentrant tachycardia (IART) being the predominant subtypes (48.5%), followed by focal atrial tachycardia (FAT) (13.2%). There was a median of 2 arrhythmia mechanisms per ACHD patient (range: 1-5). CTI dependent IART comprised of 45.5% of mappable IART. There was a total of 24 AT, 2 AF, 4 pathway/AVNRT, 2 PVC ablations. The median follow-up time was 23.8 months (IQR: 15.7-35.4 months). For AT ablations, the overall success rate was 87.5%, with at least one of ATs ablated. In 62.5% of patients there was no inducible AT at the end of the procedure. No major complications were found. The recurrence rate was 34.6% with the median time of recurrence 5.4 months (IQR: 1.7-8.2 months) post ablation. Acute success rate was 100% for non-atrial tachyarrhythmia with no recurrence.

Conclusion:

Multiple atrial arrhythmia mechanisms are common in ACHD patients. Reentrant atrial tachyarrhythmia is the predominant mechanism, and transcatheter ablation had a good acute success rate.

SUPPORTING DOCUMENTS



Clinical Outcome of Non-fluoroscopic Radiofrequency Ablation in Pediatric Atrioventricular Nodal Reentrant Tachycardia

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Objective:

The goal of this study was to investigate the clinical outcome of nonfluoroscopic RF ablation for AVNRT in pediatric patients.

Materials and Methods:

We retrospectively enrolled consecutive pediatric patients with AVNRT received RF catheter ablation guided by nonfluoroscopic intracardiac navigation system (X- group) or fluoroscopic system (X+ group) from multi-centers during 2011 to 2022. We compared the rate of acute success, complication, and recurrence. Procedure time and RF time were also evaluated between groups.

Results:

A total of 78 patients were enrolled with X+ group of 45 children and X- group of 34 children. The median procedure time was 115 mins (IQR: 92.5-145 mins) in X+ group and 110.5 mins (95-136 mins) in X- group ($p=0.98$). The median fluoroscopic time was 24.1 mins (15.1-36.9 mins) in X+ group, while no fluoroscopy use in X- group ($p<0.001$). No advanced AV block was noted in both groups. Acute procedure success rate was 97.8% in X+ group and 100% in X- group ($p=1.0$). Longer follow-up duration in X+ group (97 months vs 18.5 months, $p<0.001$). Recurrence rate was 9.1% in X+ group and 2.9% in X- group ($p=0.38$). No significant difference in arrhythmia-free survival between groups was revealed ($p=0.48$).

Conclusion:

Combining intracardiac navigation system and RF ablation can allow non-fluoroscopic slow pathway ablation for AVNRT in pediatric patients with similar procedure time comparing with fluoroscopic guide RF ablation. Fluoroless RF slow pathway ablation in pediatric patients is safe and effective at mid-term follow up.

SUPPORTING DOCUMENTS

Table 1. Demographic data

	Total (n=79)	X+ (n=45)	X- (n=34)	p value
Age (year)	13.5 (11.9-15.5)	13.7 (11.6-15.9)	13.4 (12.7-15.1)	0.812
Gender c				1.000
Female	35 (44.3%)	20 (44.4%)	15 (44.1%)	
Male	44 (55.7%)	25 (55.6%)	19 (55.9%)	
Body weight (kg)	49.6 (38.8-65)	51 (37.6-64.8)	49.2 (40.8-65.3)	0.866
Body height (cm)	158 (152-170)	157 (150.5-171.5)	158.2 (153-167.3)	0.789
BMI (kg/m ²)	20.0 (17.1-23.9)	20.2 (17.9-24.5)	19.1 (17.0-22.0)	0.381
BSA (m ²)	1.47 (1.28-1.73)	1.48 (1.27-1.74)	1.47 (1.30-1.73)	0.949
Structure heart disease	8 (10.1%)	8 (17.8%)	0 (0%)	0.009**
Congenital heart disease	6 (7.6%)	6 (13.3%)	0 (0%)	0.034*
Previous AVNRT ablation	1 (1.3%)	1 (2.2%)	0 (0%)	1.000
Antiarrhythmic drug c	29 (36.7%)	21 (46.7%)	8 (23.5%)	0.061
Clinical documented tachycardia	70 (88.6%)	43 (95.6%)	27 (79.4%)	0.034*

Table 2. Electrophysiology characteristics

	Total (n=79)	X+ (n=45)	X- (n=34)	p value
Pre-ablation inducibility	74 (93.7%)	41 (91.1%)	33 (97.1%)	0.384
Slow-fast	70 (88.6%)	39 (86.7%)	31 (91.2%)	0.725
Fast-slow	4 (5.1%)	1 (2.2%)	3 (8.8%)	0.309
Slow-slow	3 (3.8%)	2 (4.4%)	1 (2.9%)	1.000
Multiple AVNRT	3 (3.8%)	1 (2.2%)	2 (5.9%)	0.574
No. of slow pathway				0.309
1	75 (94.9%)	44 (97.8%)	31 (91.2%)	
2	4 (5.1%)	1 (2.2%)	3 (8.8%)	
Slow pathway direction c				0.620
Antegrade	49 (62.0%)	30 (66.7%)	19 (55.9%)	
Retrograde	2 (2.5%)	1 (2.2%)	1 (2.9%)	
Bidirectional	28 (35.4%)	14 (31.1%)	14 (41.2%)	
Lower common pathway block	10 (12.7%)	5 (11.1%)	5 (14.7%)	0.738
Continuous AVN curve	26 (32.9%)	20 (44.4%)	6 (17.6%)	0.023*
Other tachycardia c	19 (24.1%)	7 (15.6%)	12 (35.3%)	0.077
AF or AFL c	18 (22.8%)	7 (15.6%)	11 (32.4%)	0.136
Atrial tachycardia	1 (1.3%)	1 (2.2%)	0 (0.00%)	1.000
Atrioventricular reciprocating tachycardia	1 (1.3%)	0 (0%)	1 (2.9%)	0.430
WPW syndrome	1 (1.3%)	0 (0%)	1 (2.94%)	0.430
Accessory pathway	2 (2.5%)	0 (0%)	2 (5.88%)	0.182
Ventricular tachycardia	1 (1.3%)	1 (2.2%)	0 (0%)	1.000

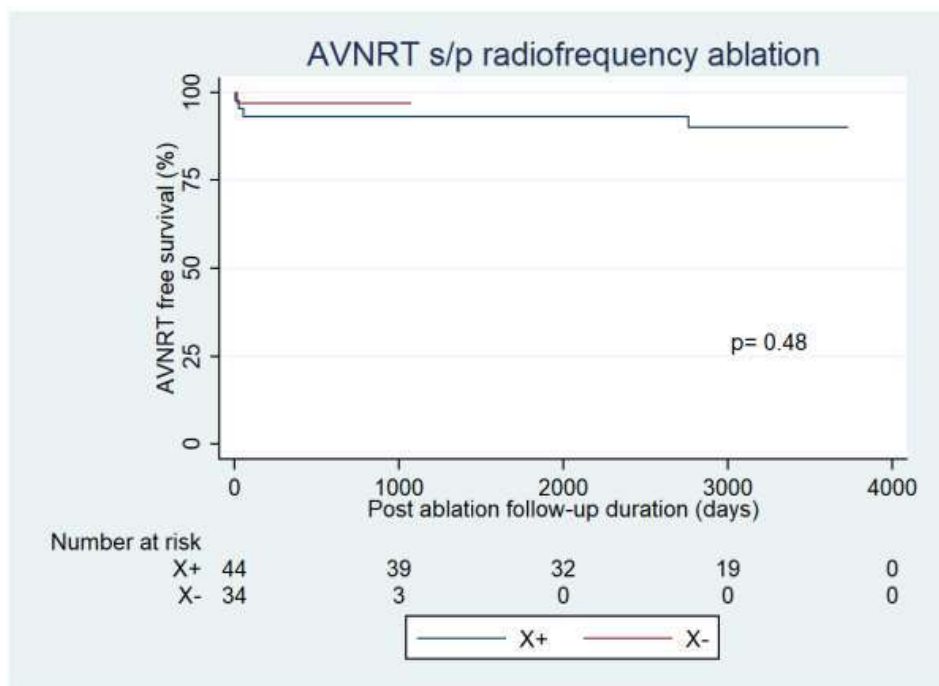
Table 3. Procedural characteristics

	Total (n=79)	X+ (n=45)	X- (n=34)	p value
EAM system	40 (50.6%)	6 (13.3%)	34 (100%)	<0.001**
EAM type c				<0.001**

Ensite	39	(49.4%)	5	(11.1%)	34	(100%)	
Carto	1	(1.4%)	1	(2.2%)	0	(0%)	
Slow pathway location c							0.059
Low Koch	52	(65.8%)	25	(55.6%)	27	(79.4%)	
Middle Koch	25	(31.6%)	19	(42.2%)	6	(17.6%)	
Coronary sinus	0	(0%)	0	(0%)	0	(0%)	
Low and middle Koch	1	(1.3%)	0	(0%)	1	(2.9%)	
Not found	1	(1.3%)	1	(2.2%)	0	(0%)	
Slow pathway treatment result (n=78) c							1.000
Ablation	37	(47.4%)	21	(47.7%)	16	(47.1%)	
Modification	41	(52.6%)	23	(52.3%)	18	(52.9%)	
Acute success	78	(98.7%)	44	(97.8%)	34	(100.0%)	1.000
Procedure time (min)	115	(95-141)	115	(92.5-145)	110.5	(95-136.5)	0.984
Fluoroscopic time (min)	9.4	(0-24.8)	24.1	(15.1-36.9)	0	(0-0)	<0.001**
Major complication	0	(0%)	0	(0%)	0	(0%)	---
Minor complication	5	(6.3%)	2	(4.4%)	3	(8.8%)	0.647
Conduction system injury c							0.231
No	68	(86.1%)	41	(91.1%)	27	(79.4%)	
Transient AV block	7	(8.9%)	3	(6.7%)	4	(11.8%)	
First degree AV block	1	(1.3%)	1	(2.2%)	0	(0%)	
Second degree Mobitz type 1 AV block	1	(1.3%)	0	(0%)	1	(2.9%)	
Right bundle branch block	2	(2.5%)	0	(0%)	2	(5.9%)	
Follow up duration (month)	42	(19-99)	97	(90-108)	18.5	(9-26)	<0.001**

Recurrence (n=78)	5	(6.4%)	4	(9.1%)	1	(2.9%)	0.380

Figure 1. AVNRT free survival after radiofrequency ablation



Genetic Make Up Among Children With Suspected Long QT Syndrome in National Heart Institute

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Objective

Long QT syndrome (LQTS) is characterized by prolonged QT interval that potentially leads to fatal cardiac events . In order to diagnose it correctly, genetic testing plays an important role in determining the presence of Long QT genes especially in asymptomatic borderline QT interval patients. Our objective is to identify the genetic makeup of all patients who are suspected with LQTS based on Schwartz criteria and associated signs and symptoms.

Method

All patients seen in the arrhythmia clinics with suspected LQTS and structurally normal heart were recruited. Patients and first degree family members were counselled and consented. All related clinical history data were collected and blood samples were acquired and were sent to the reference laboratory for genetic testing.

Results

A total of 30 patients were identified with suspected LQTS. 1 patient was excluded due to incomplete clinical data. Table 1 result depicts that all suspected LQTS patients either with or without sign and symptoms have prolonged QTc intervals. Table 2 depicts 14 patients with confirmed LQTS with specific genes expressed presented with significant fatal sign and symptoms and these patients generally inherit the genes from either one of their parents screened via genetic testing.

Conclusion

Suspected LQTS patients with prolong QTc intervals does not necessarily present with sign and symptoms as compared to the confirmed LQTS patients from this study. A larger patients cohort is required to further analyze the genetic makeup especially in the suspected LQTS group that does not present with specific LQTS genes.

SUPPORTING DOCUMENTS

Sign & Symptoms	Y/N	N	QTc (Mean $\pm$ SD)
Bradycardia	Y	14	500.36 $\pm$ 57.53
	N	15	503.13 $\pm$ 58.65
Syncope	Y	9	538.44 $\pm$ 51.20
	N	20	485.30 $\pm$ 52.69
Heart Failure	Y	2	549.50 $\pm$ 27.58
	N	27	498.26 $\pm$ 57.38
VT/VF	Y	8	526.88 $\pm$ 70.64
	N	21	492.24 $\pm$ 49.68
Cardiomyopathy	Y	4	506.75 $\pm$ 67.55
	N	25	501.00 $\pm$ 56.80

Table 1: Sign and symptoms in patients with suspected Long QT syndrome in relation to the QTc values

N (Patients)	Genotype	Type of Long QT	QTc Duration	Bradycardia	Syncope	VT/VF
4	KCNQ1	Long QT 1	> 460ms	-	2	2
2	KCNH2	Long QT 2		1	2	-
3	SCN5A	Long QT 3		1	-	1
2	CACNA1C	Long QT 8		1	1	-
3	KCNJ5	Long QT 13		2	-	1

Table 2: Confirmed case of Long QT Syndrome patients in relation to the QTc values with fatal sign and symptoms presentation

Atrioventricular Reentrant Tachycardia in Infant with ccTGA: Finding the Proper Anti-Arrhythmic Regimen for Recurrent Tachyarrhythmia

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Introduction: Congenitally corrected transposition of the great arteries (ccTGA) is a rare cardiac malformation characterized by the combination of discordant atrioventricular and ventriculoarterial connections (AV-VA discordance). Arrhythmia such as high degree AV block, AV node re-entry tachycardia (AVNRT) are commonly found in ccTGA, but rarely, atrioventricular reentrant tachycardia (AVRT) due to the presence of accessory pathway (AP) might be found. Catheter ablation is the definite treatment for terminating AVRT. Nevertheless, ablation may not always be feasible especially in infants and in developing countries such as Indonesia.

Case Description: A 6-month-old baby came to emergency room with sudden palpitation. ECG showed narrow regular QRS tachycardia with rate of 234 bpm. After successful cardioversion, ECG showed Wolf-Parkinson-White (WPW) pattern suggesting left-lateral AP. Echocardiography examination revealed situs solitus, AV-VA discordance (ccTGA), and secundum ASD. Due to recurrent AVRT and inability to perform catheter ablation, the patient was given anti-arrhythmic drugs consisting of adenosine, bisoprolol, digoxin, and amiodarone IV subsequently switched to oral regimen. After tachycardia termination for four days, patient was discharged with oral amiodarone 6 mg/kg (25 mg b.i.d.) and bisoprolol 4 mg/kg (2.5 mg o.d.) after one month of hospitalization.

Conclusion: We present a rare case of AVRT due to WPW syndrome of left lateral AP in ccTGA. Due to limited facility to perform percutaneous or open-chest ablation of AP, optimal anti-arrhythmic management should be the first-line therapy to prevent recurrence of AVRT

Keyword: Atrioventricular Reentrant Tachycardia, WPW syndrome, Congenitally Corrected Transposition of Great Arteries, Anti Arrhythmic Agent, Catheter Ablation

SUPPORTING DOCUMENTS

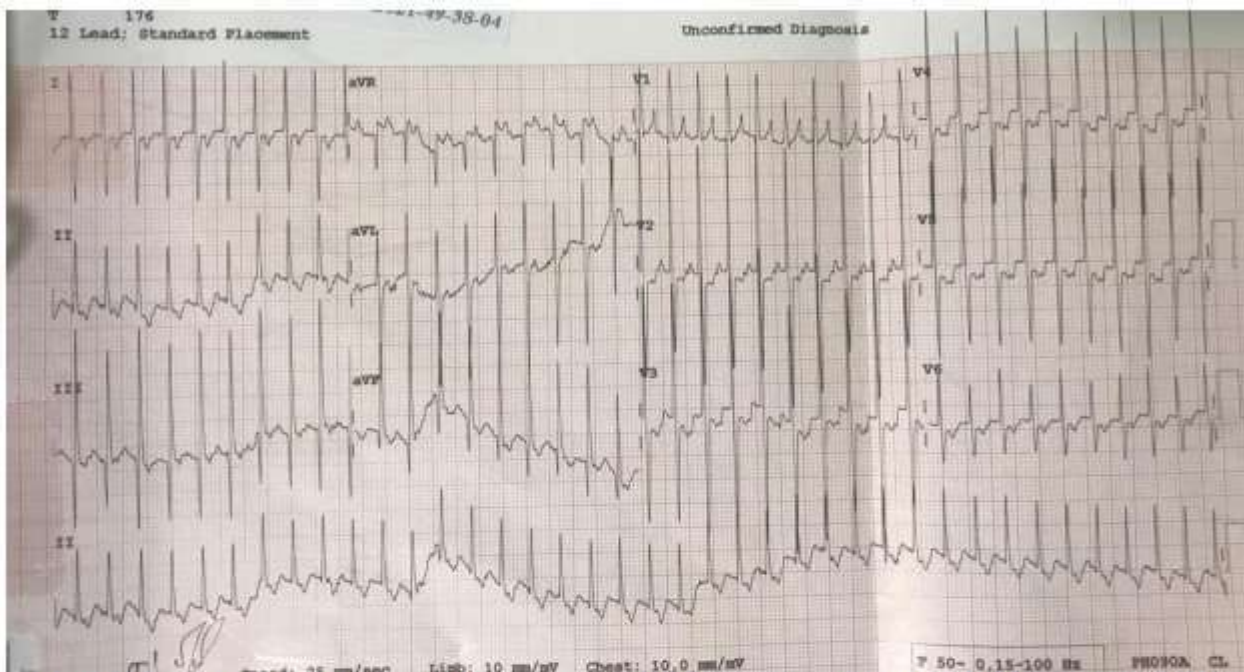


Fig 1. ECG on admission: Narrow complex tachycardia with long RP (suspected with AVRT)

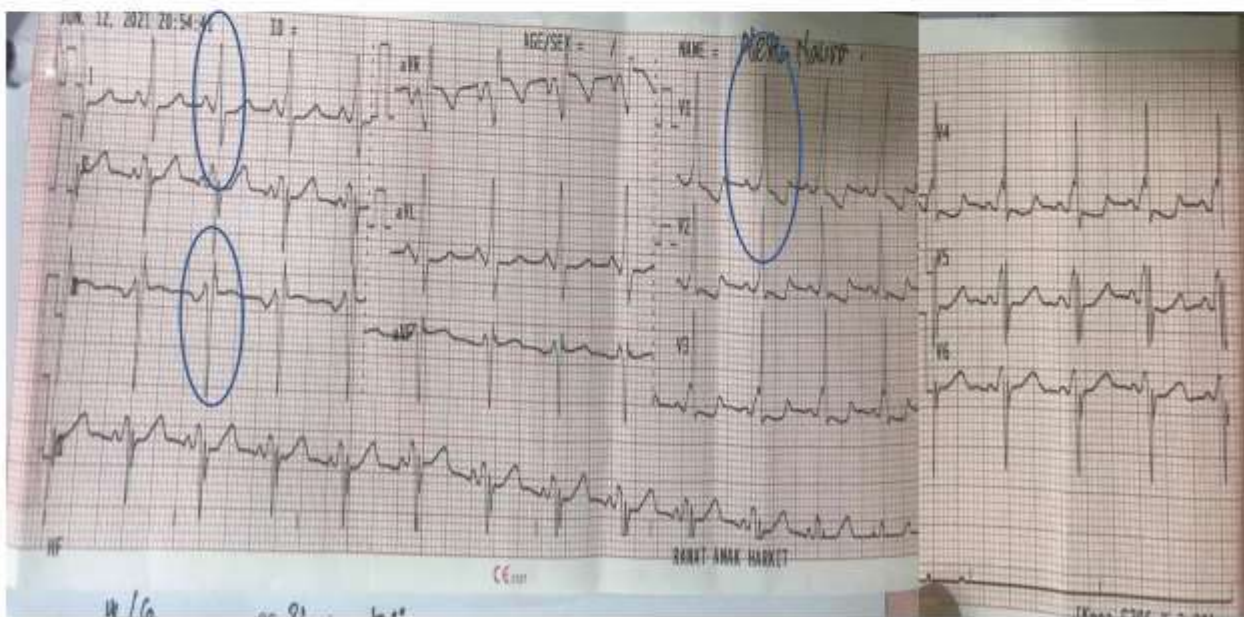
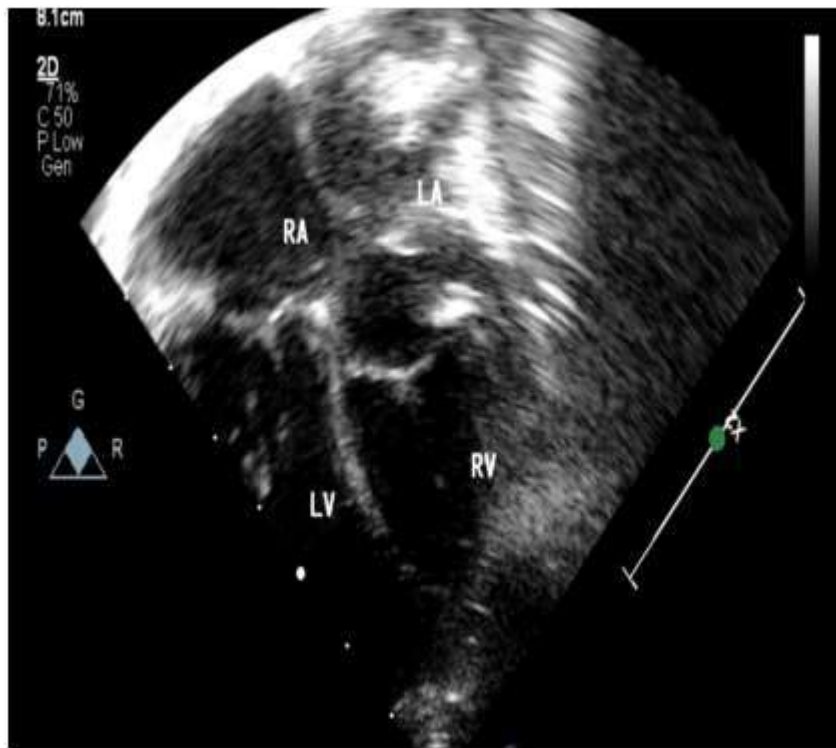


Fig.2 ECG after electrical cardioversion showed short PR interval and delta wave consistent with left lateral accessory pathway



- **Fig 3. Echocardiography showed Situs solitus, AV discordance VA discordance (ccTGA) ASD secundum L-R shunt, PS mild, Bilateral SVC.**

Initial P-wave Deflection and the Risk of Arrhythmia in Heterotaxy Syndrome: a Retrospective Single-center Study

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OBJECTIVES

To present initial P-wave deflection (IPWD) as a representation of probable sino-atrial (SA) node location and its association with arrhythmia in heterotaxy syndrome (HS).

MATERIALS AND METHODS

A retrospective single-center study was conducted involving HS patients admitted from 2017 – 2022. HS was diagnosed by trans-thoracic echocardiography (TTE) performed by our pediatric cardiologists. Only preoperative ECGs were analyzed including any ECGs showing arrhythmias. IPWD was divided into four quadrants based on IPWD at lead I and aVF (positive or negative): right superior (RS): positive I and positive aVF; left superior (LS): negative I and positive aVF; right inferior (RI): positive I and negative aVF; left inferior (LI): negative I and negative aVF.

RESULTS

A total of 142 patients consisting of 52,1% male and 47,9% female were identified. As many as 21,1% patients had documented arrhythmia which was more prevalent in LA- than RA isomerism (26,8% vs 17,4%, $p < 0.001$). In RA isomerism, IPWD were predominantly from the upper quadrant (RS 58,2% vs LS 29,1%). However in LA isomerism, IPWD were evenly distributed (RS 27,8% vs RI 37% vs LS 14,8% vs LI 12%). SA nodes at lower quadrant were associated with higher occurrences of arrhythmia (OR 4,875; 95% CI: 1,83-12,98, $p < 0,01$) specifically RI SA-nodes in subgroup analysis (OR 3,19; 95% CI: 1,16-8,87, $p < 0,026$)

CONCLUSION

IPWD in RA isomerism are mostly from the upper quadrant while it is evenly distributed in LA isomerism. IPWD from lower quadrants, especially at RI, were associated with higher occurrences of arrhythmia.

Cross-sectional Study of Neurodevelopmental Disorders in Patients With Catecholaminergic Polymorphic Ventricular Tachycardia.

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OBJECTIVE

In 2019, a multicenter international study reported that 8% of patients with CPVT1 have intellectual disability (ID). However, this study may have underestimated the prevalence because the study included individuals who demonstrated apparent intellectual disability. We examined the prevalence of ID in a cross-sectional survey.

METHODS

We included patients with symptomatic CPVT1 and excluded those with severe mental and physical disabilities due to ischemic brain injury. Between Jan 2021 and Apr 2022, we obtained information from medical records and examined an intelligence test (WISC-4 or WAIS -4) and brain imaging.

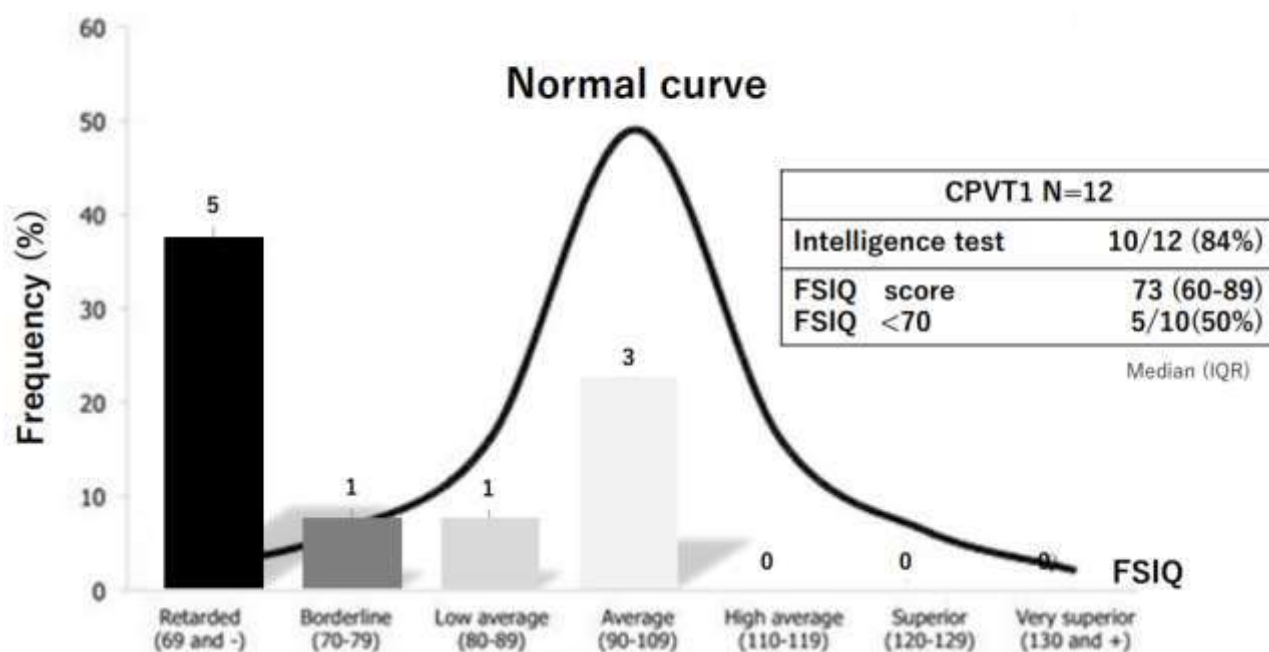
RESULTS

Of 13 patients with CPVT, one patient was excluded; 8/12 (67%) were male; age at initial cardiac symptom was 4.8 (4.0-7.5) years, age at diagnosis was 8.5 (4.9-13.4) years, age at investigation was 19.5 (16.1-20.3) years old. Intelligence test was performed in 10/12 (84%), with full-scale IQ of 73 (60-89) and FSIQ <70 in 5/10 (50%). Two patients who refused intelligence test had already had the issued intellectual disability certificates. Overall, 7/12 (58%) were estimated to have ID. Brain imaging was performed on 8/10 (80%) and showed old brain damage in one patient with ID, but this patient had been diagnosed with a developmental delay before the cardiac event.

CONCLUSION

The prevalence of neurodevelopmental disorders in CPVT patients may be higher than previously reported.

Full-scale IQ (FSIQ)



Forward-Solution Computational ECG Mapping for Ventricular Arrhythmias in Patients with Adult Congenital Heart Disease

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Objective: Forward solution ECG mapping has demonstrated effective source localization in patients with ischemic and non-ischemic cardiomyopathy. Accuracy in patients with adult congenital heart disease (ACHD) is unknown. We hypothesized that forward solution mapping for PVC and VT ablation in patients with ACHD is feasible with good spatial and anatomical resolution.

Materials and Methods: We enrolled consecutive ACHD patients undergoing PVC and VT ablation between 2020-2022. Successful VT and PVC ablation locations were marked on a 3-dimensional cardiac model. ECGs of clinical arrhythmias were analyzed using the forward solution algorithm to generate heatmaps of probable source locations. Regional (free wall versus septal), segmental, center-to-center spatial, and right versus left ventricular accuracy were assessed compared to the site of successful ablation.

Results: Six patients (38 years [35 – 48], EF 61% [56 – 64], female=4) were enrolled. Patients had prior surgical intervention in the RV (67%) and LV (17%). Ten ablation sites were analyzed; the most common were RV apex (30%), moderator band (20%) and LV outflow tract (20%). Regional and segmental mapping outputs were accurate for all arrhythmias (10/10, 100%). Spatial accuracy was 13.5mm ([7.5–15.75]; Wilcoxon P <0.05). Right versus left ventricular accuracy was suboptimal in 2 subjects with double-outlet right ventricle and Williams Syndrome.

Conclusion: Forward solution ECG mapping demonstrated accurate source localization in ACHD. Suboptimal right versus left chamber accuracy may reflect abnormal electrical activation in ACHD. Additional studies are required to determine whether arrhythmia simulation libraries specific to ACHD may improve mapping results.

Is There a Correlation Between Severities of Morphological Abnormality and Accessory Pathways in Ebstein's Anomaly

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Background

Ebstein's anomaly (EA) is associated with arrhythmias in about 50% cases, especially related to accessory pathways (APs). There is no information whether the severity of this electrical abnormality correlates with that of the anatomic defect.

Method

A single centre observational study conducted over a period of 2 years. Consecutive patients with Ebstein's anomaly and APs undergoing electrophysiology (EP) study were included. Demographic parameters, clinical characteristics, electrocardiographic diagnosis, echocardiographic parameters, electrophysiological parameters and outcomes of catheter ablation were recorded.

Results

26 subjects (14 males) were included. The age was 28 ± 14 years. 3 patients had syncope. All 26 patients had right sided APs. 14 (55%) patients had baseline pre-excitation. EP study revealed a single AP in 19 patients, 2 APs in 6 patients and 3 APs in 1 patient. Right inferoparaseptal was the most common location of AP (55%). Mahaim type AP was noted in 5 patients and 4 patients had associated atrial fibrillation. 12 of the manifest APs were deemed high risk with effective refractory period (ERP) less than 250 ms. We created an EP score (based on syncope, need for cardioversion, pre-excited tachycardia, multiple APs, associated arrhythmias and ablation success) and an echocardiographic score (based on tricuspid valve displacement, tethering, annular dilatation, tricuspid regurgitation severity, severity of right atrial and ventricular volume overload and right ventricular dysfunction). However, there was no correlation between the 2 scores.

Conclusion

Among Ebstein's anomaly with APs, all were right sided. There was no correlation between the EP and Echo scores of severity.

STUDY OF ARRHYTHMIAS AND ELECTROPHYSIOLOGICAL CHARACTERISTICS IN RELATION TO ECHOCARDIOGRAPHIC SEVERITY IN EBSTEIN'S ANOMALY

Authors – Kumble YM, Bachani NS, Shah HP, Bansal R, Lokhandwala Y.

Background

Ebstein anomaly (EA) is a rare congenital heart disease with an incidence of 1 in 200000 live births. The cardinal features of EA are the apical displacement and tethering of the tricuspid leaflets (TL) with enlarged right heart chambers, associated atrial septal defect (ASD), and arrhythmogenic potential of the diseased right ventricle (RV) especially presence of accessory pathways (AP), Wolf Parkinson White (WPW), atrial fibrillation (AF) and ventricular arrhythmias.

The clinical course of EA ranges from intra-uterine death to asymptomatic survival into late adulthood. The outlook for fetal EA is deemed appalling. Neonates have a less adverse outcome even though only 50 % survive to 5 years, while adults present with arrhythmic events that decline survival rate regardless of the severity of EA. The frequency of AP ranges from 10-44% with a sizeable percentage having multiple AP. Electrophysiological (EP) evaluation and treatment can be challenging due to the distorted anatomical landmarks.

Egbe A et al, in their study found that outcomes of catheter ablation during preoperative EP study were comparable to surgical arrhythmia therapy.

Wei W et al in their study, noted a predominance of right sided AP location in the lower half of the tricuspid annulus (TA), with about 30 % of them having multiple AP.

Similarly, in a study by Alizadeh A et al, the most common location of AP was the right posterolateral (RPL) region. They reasoned that all patients with EA should undergo EP study as they formed a critical component in management of patients with EA, a recommendation echoed uniformly across multiple studies and case report analysis.

The literature thus far, has emphasized on routine EP evaluation of patients with EA due to a myriad of arrhythmic possibilities, treatment of which can significantly alter the clinical outcome.

Objectives/ hypothesis:

- 1) To study EP parameters specifically in relation to number and location of AP.
 - To study the severity of arrhythmias in terms of hemodynamic instability, number of recurrences and number of pathways.
 - To devise a scoring system for the electrical abnormality.
 - To devise a new scoring system for echocardiographic severity.
 - To see if a correlation exists between our electrical score and the existing (GOSE, Carpentier, Celermajor) standardised scores.

Methods

Design of study : Part Prospective part retrospective observational study.

Inclusion Criteria: Patients with EA who undergo electrophysiology study and catheter ablation.

Exclusion Criteria: Patients who've undergone corrective surgery for EA.

Echocardiographic score was designed and scored based on the displacement and tethering of anterior, posterior and septal TL, TA diameter, severity of TV regurgitation, right atrial and RV volume overload and presence of RV Dysfunction, with a total score amounting to 17.

The EP scoring included historical data of syncope, patients warranting DC shock, and a documented pre-excited tachycardia. The EP data included number of AP, associated AVNRT or atrial tachycardia, antegrade ERP of AP less than 250 and previous ablation failure. Each of the parameters score one point with a total amounting to 12.

Statistical analysis of the data were carried out with SPSS. A Confidence level of more than 95% was considered statistically significant ($p < 0.05$).

Results and discussion

Of the 26 patients, 55% were males and 45% were females. The mean age of our cohort was 28 ± 14 years. 10% of patients had a history of syncope at presentation. 55% had a pre-excited tachycardia, 45% had a concealed AP. 45% had an antegrade ERP of less than 250 ms.

During EP study, all of our patients had a right sided AP. This conforms to the established reports from previous studies. Presence of multiple AP in EA is not uncommon. 25 % of the patients had multiple AP, with one patient having 3 AP, while 75% had a single AP. We found the right postero-septal region (55%) to be the predominant AP location, with right postero-lateral (RPL) location seen in half of our study cohort , either singly or accompanying multiple AP. 20% of the patients had a Mahaim pathway. 15% patients had an associated AF.

50% had either the septal or the posterior TL displaced apically while the other half had both leaflets displaced. Tethering of the anterior TL was seen. Near equal thirds of our patient had mild , moderate or severe grade of tricuspid valve regurgitation, 10% had quantifiable RV dysfunction. 30% had an associated ASD.

The highest standardised GOSE grade seen in our cohort was grade 2(45%).The highest EP score attained was 5 (10%), while the rest majority falling in the score bracket of one and four (35% each). The maximum echocardiographic score attained was 13 (10% ,severe grade), while the vast majority had a moderate grade EA as tabulated with our scoring system.

We did not find a statistically significant association between the location of AP and presence of syncope or pre-excitation, or between the location of the AP and the number of displaced TL. We found no correlation between the total EP score and the standardised GOSE score, and our Echo

score. We also could not find a correlation between our echo and EP score on preliminary analysis. Although on further study of the data, we found a positive correlation between the variables of the standardised GOSE score and the EP and Echo score.

This suggests that additional data may help bring to light a strong correlation between the grading systems, so as to extrapolate evidence and assemble meaningful recommendations, with the aim to improve outcome in EA.

Conclusion

With current data leaning towards routine EP evaluation in EA, we find that to be prudent and constructive. The structural configuration of EA serves as a prelude to arrhythmia, with appearance of first symptoms in some occurring as late as early adulthood. Well timed management of arrhythmias can effect desirable long term outcomes.

Also, the EP evaluation was carried out by a single electrophysiologist to maintain continuity in observations of characteristics in EA.

Limitations

Our study is limited by its sample size.

Nonetheless, this study serves to deliver insights, make reasonable assumptions and provide a framework to further our knowledge about this disease entity.

The Coronavirus pandemic has been a deterrent in the accrual of patients with this rare abnormality.

The echocardiographic observations were not blinded to account for intra-observer variability.

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Tables :

age				
	Freque ncy	Percent	Valid Percent	Cumulative Percent
4	1	4.0	4.0	4.0
5	1	4.0	4.0	8.0
8	1	4.0	4.0	12.0
13	1	4.0	4.0	16.0
15	1	4.0	4.0	20.0
16	2	7.0	7.0	27.0
17	1	4.0	4.0	31.0
21	1	4.0	4.0	35.0
22	1	4.0	4.0	39.0
27	1	4.0	4.0	43.0
28	1	4.0	4.0	47.0
32	3	12.0	12.0	59.0
33	1	4.0	4.0	63.0
34	2	7.0	7.0	70.0
36	2	7.0	7.0	77.0
40	3	11.0	11.0	88.0
46	1	4.0	4.0	92.0
51	1	4.0	4.0	96.0
53	1	4.0	4.0	100.0
Total	26	100.0	100.0	

gender				
	Freque ncy	Percent	Valid Percent	Cumulative Percent
female	12	46.0	46.0	46.0
Valid male	14	54.0	54.0	100.0
Total	26	100.0	100.0	

syncope

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	23	88.0	88.0	88.0
Valid yes	3	12.0	12.0	100.0
Total	26	100.0	100.0	

Pre_excited_tachy

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	9	35.0	35.0	35.0
Valid yes	17	65.0	65.0	100.0
Total	26	100.0	100.0	

Acce_pathway

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1RPL	6	23.0	23.0	23.0
Valid 1MP	4	15.0	15.0	38.0
Valid 1RPS	10	38.0	38.0	76.0
Valid 2RPS	2	8.0	8.0	84.0
Valid 3RPS,RPL,MP	1	4.0	4.0	88.0
Valid 1RPS/RPL	1	4.0	4.0	92.0
Valid 2RPS,RPL	2	8.0	8.0	100.0
Total	26	100.0	100.0	

Numb_Acc_pathway

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	19	73.0	73.0	73.0
2	6	23.0	23.0	96.0
3	1	4.0	4.0	100.0
Total	26	100.0	100.0	

Assoc_avnrt

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No	25	96.0	96.0	96.0
YES	1	4.0	4.0	100.0

Assoc_artial_arrhy

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	22	85.0	85.0	85.0
yes	4	15.0	15.0	100.0
Total	26	100.0	100.0	

ERP_lessthan_250ms

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	15	58.0	58.0	58.0
yes	11	42.0	42.0	100.0
Total	26	100.0	100.0	

total_EP_score

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	7	27.0	27.0	27.0
2	4	15.0	15.0	42.0
3	3	11.0	11.0	53.0
4	10	39.0	39.0	92.0
5	2	9.0	9.0	100.0
Total	26	100.0	100.0	

Gose_score

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid grade 1	16	58.0	58.0	58.0
grade 2	8	42.0	42.0	100.0
Total	26	100.0	100.0	

total_echo_score

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 7.00	10	38.0	38.0	38.0
8.00	3	12.0	12.0	50.0
9.00	4	16.0	16.0	66.0
10.00	3	12.0	12.0	78.0
11.00	2	7.6	7.6	84.6
12.00	2	7.6	7.6	92.2
13.00	2	7.6	7.6	100.0
Total	26	100.0	100.0	

Cross-tabulation :

ERP_lessthan_250ms * Acce_pathway Crosstabulation

Count

		Acce_pathway				
		1RPL	1MP	1RPS	2RPS	3RPS,RPL,MP
ERP_lessthan_250ms	no	6	0	8	1	0
	yes	1	4	4	1	1
Total		7	4	12	2	1

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.360 ^a	6	.154
Likelihood Ratio	11.570	6	.072
N of Valid Cases	26		

total_EP_score * total_echo_score Crosstabulation

Count

		total_echo_score						
		7.00	8.00	9.00	10.00	11.00	12.00	13.00
total_EP_score	1	3	1	1	2	0	1	0
	2	1	1	0	0	0	0	1
	3	1	2	0	0	0	0	0
	4	4	0	2	1	1	1	1
	5	0	0	1	0	1	0	0
Total		9	4	4	3	2	2	2

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.262 ^a	24	.392
Likelihood Ratio	23.250	24	.505
Linear-by-Linear Association	1.342	1	.247
N of Valid Cases	26		

Reliability

Scale: ALL VARIABLES

Case Processing Summary

	N	%
Valid	23	89.0
Cases Excluded ^a	3	11.0
Total	26	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.484	.489	3

Item Statistics

	Mean	Std. Deviation	N
Gose_score	1.4118	.50730	23
total_EP_grade	1.5294	.51450	23
total_ECHO_grade	2.1176	.33211	23

Inter-Item Correlation Matrix

	Gose_score	total_EP_grade	total_ECHO_grade
Gose_score	1.000	.310	.436
total_EP_grade	.310	1.000	-.022
total_ECHO_grade	.436	-.022	1.000

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
5.0588	.934	.96635	3

Intraclass Correlation Coefficient

	Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value 0		
		Lower Bound	Upper Bound	Value	df1	df2
Single Measures	.238 ^a	-.048	.568	1.939	16	32
Average Measures	.484 ^c	-.159	.798	1.939	16	32

Intraclass Correlation Coefficient

	F Test with True Value 0 ^b
	Sig
Single Measures	.054 ^a
Average Measures	.054 ^c

Two-way mixed effects model where people effects are random and measures effects are fixed.

- The estimator is the same, whether the interaction effect is present or not.
- Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.
- This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Long Term Outcome of Cardiac Pacemaker Implantation in Pediatric Population

Dr Deepanjan Bhattacharya¹, Dr Narayanan Namboodiri¹, Dr Baiju S Dharan¹, Dr Krishna Kumar Mohanan Nair¹

¹SCTIMST, Trivandrum, India

OBJECTIVES

The aim of this study is to assess the long-term outcome of pacemaker implantation in children less than 18 years of age. Objectives include to study the indication of PPI in this population, along with types of leads and pacing mode used, various pacemaker parameters and their trends during follow-up and any re-interventions or upgradation required.

MATERIALS AND METHODS

We prospectively analyzed the long-term outcomes of PPI in children below 18 years of age, with respect to indications, techniques, need for reinterventions and complications.

RESULTS

235 children were included with M:F ratio being 1.1, and median of implantation of 7 years. 43.4% underwent epicardial PPI, and the commonest indication being congenital CHB (50.2%) followed by post-operative CHB (28.1%). 65.5% underwent VVI pacemaker implantation. 41.3% had associated CHD out of which VSD was commonest, followed by ASD. Over a median follow-up of 8 years, mean percentage of pacing was $82.1 \pm 29.2\%$, with stable lead thresholds. 23.8% patients underwent PG change at median duration 97 months for battery depletion, 3.4% underwent lead change for lead dysfunction at median duration 52 months while 4.3% patients had surgical site infection. 6.38% had post implantation ventricular dysfunction at a median duration of 83 months, and overall mortality was 2.9%, with major predictors being age at implantation below 28 days, maternal lupus antibodies, CHD and post-implantation ventricular dysfunction.

CONCLUSION

PPI in children has favourable outcomes with age at implantation below 28 days, maternal lupus antibodies, CHD and post-implantation ventricular dysfunction associated with adverse outcomes.

Early Dose of Adenosine, Postradiofrequency Ablation of Accessory Pathway in Determining Acute Procedural Success (Early Study)

Dr Anand Manickavasagam¹, Dr Siva Nagewara Rao Guttikonda², Dr Dinakar Bootla², Dr Sirish Chandra Srinath Patloori¹, Dr Ashish Jain², Dr David Chase¹, Dr Raja Selvaraj², Dr John Roshan¹
¹*Christian Medical College, Vellore, India, Vellore, India,* ²*JIPMER,, Puducherry, India*

Objective

To determine whether the administration of intravenous adenosine at 10 minutes after ablation of accessory pathway (AP) would have the same diagnostic accuracy as waiting for 30 minutes in predicting resumption of AP conduction.

Materials and Methods:

This prospective interventional study was conducted in two centers after obtaining ethics committee approval. Post ablation of the AP, intravenous adenosine was administered at 10 minutes to look for dormant pathway conduction. The response was recorded as positive (presence of pathway conduction), negative (absence) or indeterminate (not able to demonstrate AV and VA block and inability to ascertain AP conduction).

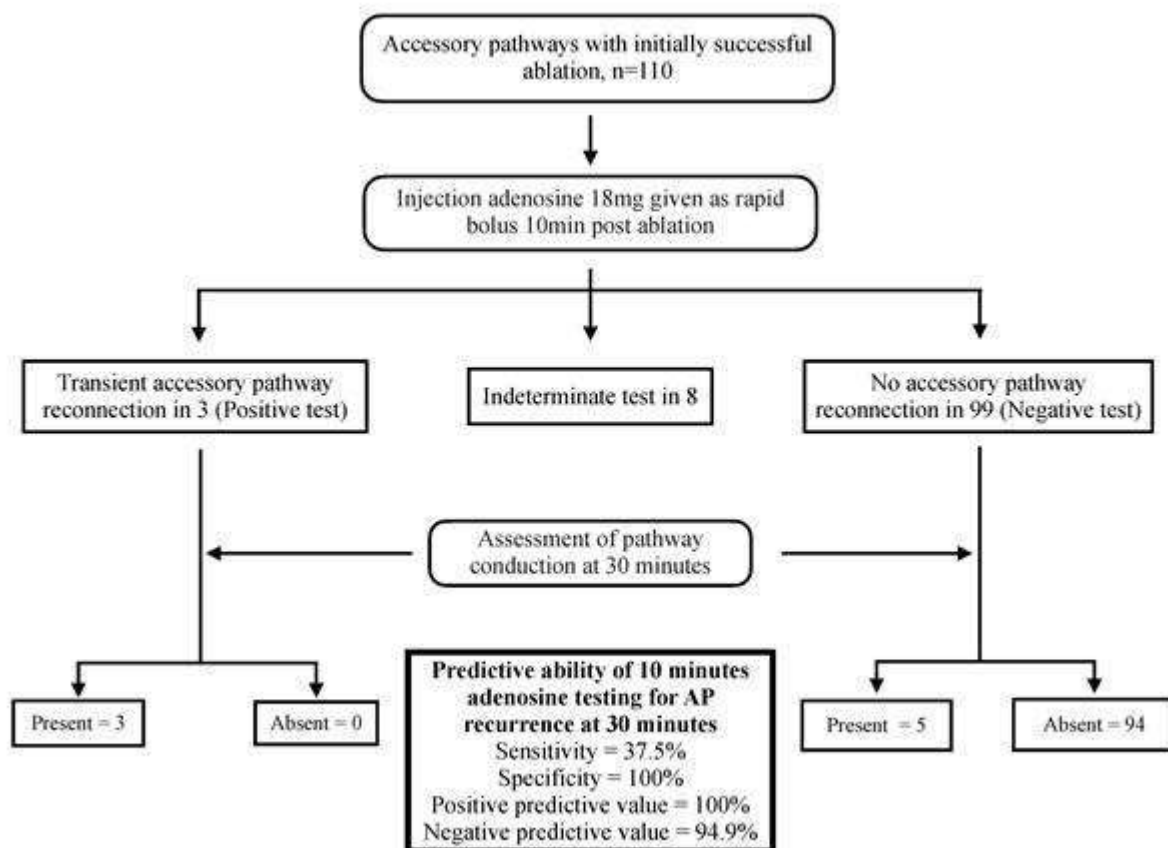
Results:

The study included 110 procedures performed in 109 patients. Adenosine administration at 10 minutes showed positive result in 3 cases (2.7%), negative result in 99 cases (90%) and indeterminate result in 8 cases (7.3%). Reconnection of accessory pathway at 30 minutes post ablation was seen in 8 cases (7.3%). Of these 8 cases, 10minutes adenosine administration showed positive test in 3 patients and negative test in 5 patients. Adenosine test at 10 minutes has a sensitivity, specificity, positive predictive value, and negative predictive value of 37.5%, 100%, 100% and 94.9% in identifying the recurrence of accessory pathway conduction at 30 minutes, respectively.

Conclusion:

Absence of pathway conduction on administration of adenosine 10 minutes post ablation does not help predict the absence of resumption of conduction thereafter.

SUPPORTING DOCUMENTS



Lower Common Pathway Block in AVNRT Mimicking Atrial Tachycardia

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¹*Department of Cardiology and Vascular Medicine, Universitas Padjadjaran, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia*

CASE PRESENTATION

Differentiate Atrioventricular Nodal Reentry Tachycardia (AVNRT) from other forms of Supraventricular Tachycardia (SVT) during Electrophysiologic Study (EPS) is important in catheter ablation. However, diagnosis of AVNRT might be confusing especially in the presence of block. We report a case report of a woman with symptoms of palpitation in which EPS showed AVNRT with lower common pathway block mimicking Atrial Tachycardia (AT).

A 53-years old woman was referred for an EPS and catheter ablation. Quadripolar catheters were placed in His Bundle (HB), Right Ventricle Apex (RVA), High Right Atrium (HRA), and Coronary Sinus (CS). Initially, SVT was thought to be AT because: (1) a short CL with 2:1 AV conduction and Wenckebach AV block; (2) burst pacing from RVA showed VA dissociate; (3) burst pacing from HRA showed cross-over and normal AV-BCL. A suggestive diagnosis of AVNRT with lower common pathway block was made based on the findings that extra stimulus pacing from HRA showed double AH jump, echo beat, normal ERP, and earliest atrial activation at HB region. Sulfas Atropine 5mg was administered intravenously. Atrial extra-stimulus induced SVT with 1:1 AV conduction, PPI-TCL > 114 ms, and SA-VA > 85 ms. Successful ablation at a slow pathway was achieved. Post ablation EPS showed a single echo beat without inducible SVT.

CONCLUSION

EPS should be performed before catheter ablation to obtain a diagnosis of SVT. Careful maneuvers during EPS could re-evaluate diagnosis and mandatory for successful ablation therapy.

SUPPORTING DOCUMENTS

Figure 1.

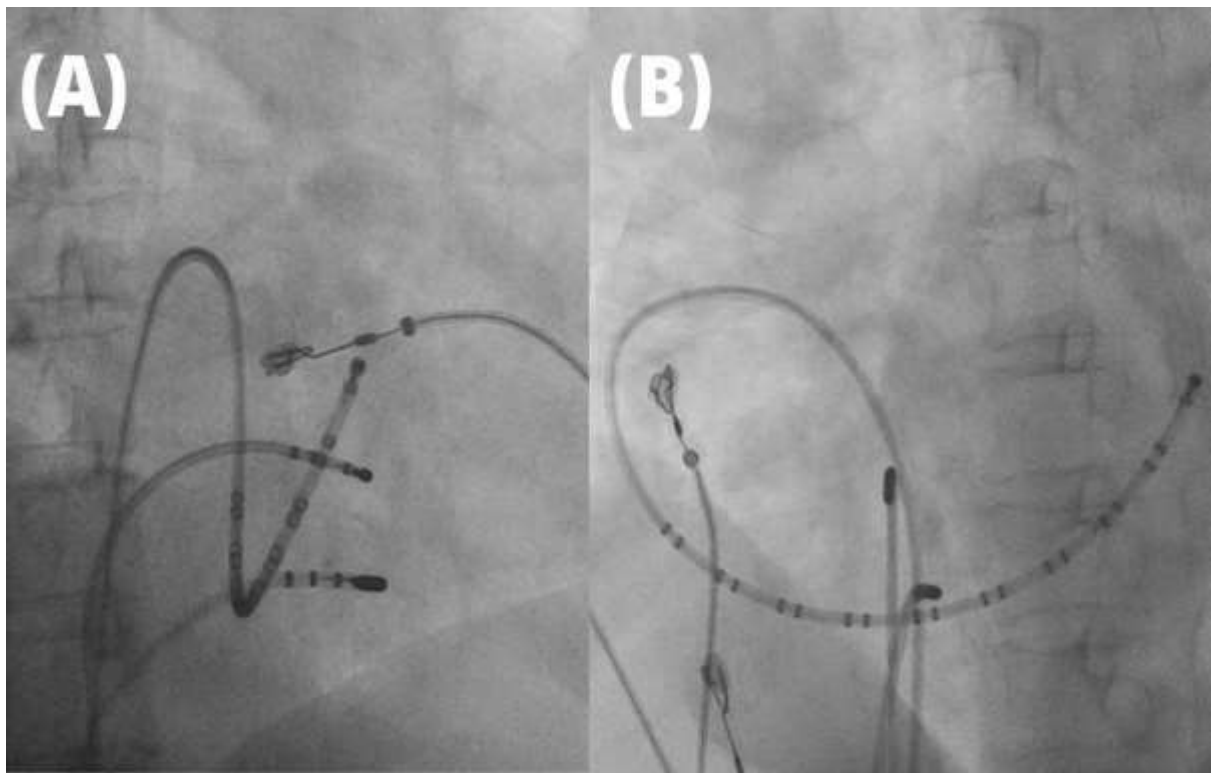


Figure 2.



Deep Learning Analysis of Sinus Rhythm Electrocardiograms to Classify Paroxysmal Supraventricular Tachycardia Types

Dr Soonil Kwon¹, Mr Jangwon Suh², Mr Jimyeong Kim², Dr Hoojin Ju¹, Dr Hyo-Jeong Ahn¹, Dr Sunhwa Kim³, Prof So-Ryoung Lee¹, Prof Wonjong Rhee², Prof Eue-Keun Choi¹, Prof Seil Oh¹

¹*Seoul National University Hospital, Seoul, South Korea*, ²*Seoul National University, Seoul, South Korea*, ³*Presbyterian Medical Center, Jeonju, South Korea*

Objectives: We aimed to investigate whether deep learning analysis can classify underlying Atrioventricular Nodal Reentry Tachycardia (AVNRT) from concealed Atrioventricular Reentry Tachycardia (cAVRT) using sinus rhythm electrocardiograms (ECGs).

Materials and Methods: We collected the patients with AVNRT or cAVRT, and their 12-lead ECGs with sinus rhythm between 2001 and 2021. The diagnosis of each patient was validated with an electrophysiology study. The deep learning model (Figure A) was trained to classify sinus rhythm ECGs with underlying AVNRT and cAVRT. ResNet-34 was used, and it was pre-trained with the PhysioNet/CinC Challenge 2021 dataset to overcome the limited dataset size. The deep learning model was validated with the 10-fold cross-validation. Grad-CAM visualization was adopted to analyze which ECG segment is important for the model to classify the two arrhythmias.

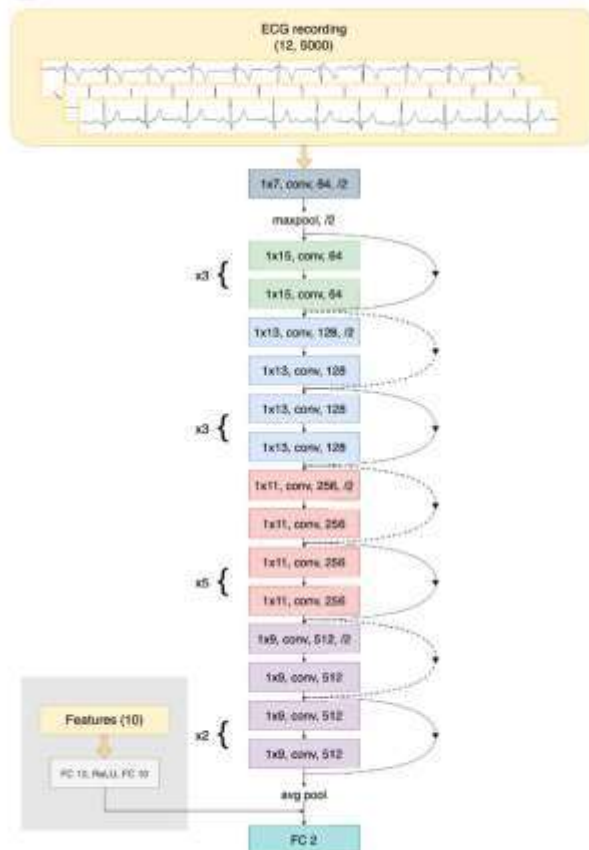
Results: A total of 696 patients with AVNRT and 305 patients with cAVRT were analyzed. Compared to the AVNRT group, the cAVRT group had a comparable age but a significantly higher male proportion; age 46.6 vs. 44.4 years ($p=0.775$); male 47.7 vs. 63.3% ($p=0.002$). The deep learning model showed 0.71 (95% CI 0.67-0.74) for AUROC, 0.83 (95% CI 0.80-0.86) for AUPRC, 0.71 (95% CI 0.67-0.75) for sensitivity, and 0.59 (0.51-0.66) for specificity (Figure B). Grad-CAM analysis showed that the model focused on the QRS complex and the ST segment for classifying AVNRT, while it focused on the ST segment for classifying cAVRT (Figure C).

Conclusion: Deep learning classification of AVNRT and cAVRT was feasible with sinus rhythm ECGs.

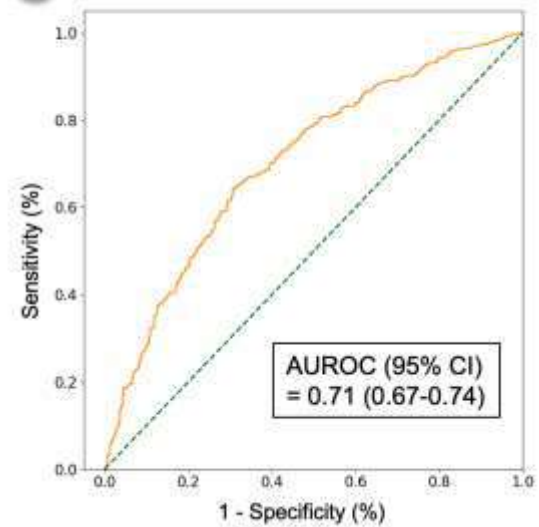
SUPPORTING DOCUMENTS

Figure

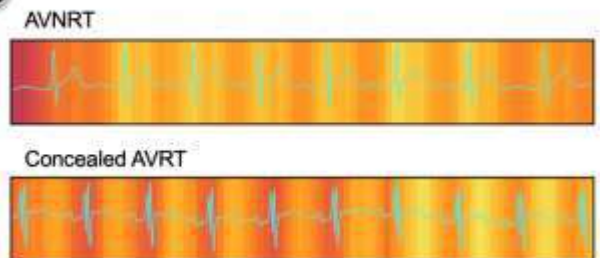
A Deep learning architecture



B ROC analysis



C Grad-CAM visualization



Radiofrequency Ablation of Incessant Atrial Tachycardia after COVID-19 Infection

Dr Tam Adrian Aya-Ay¹, Dr. Michael-Joseph Agbayani¹, Dr. Elaine Alajar¹, Dr. Bernadette Mariño¹, Dr. Hensor Dauigoy¹

¹*Philippine General Hospital, Manila City, Philippines*

OBJECTIVES

We present a case of a 38-year old male with no known comorbidities who presented with incessant focal atrial tachycardia complicated by tachycardia-mediated cardiomyopathy and COVID-19 infection. He successfully underwent 3D Cardiac Mapping + radiofrequency ablation of the right superior pulmonary vein.

MATERIALS AND METHODS

RESULTS

A 38-year old male presented with persistent palpitations and tachycardia associated with heart failure symptoms. On work up, 12L- ECG showed sustained focal atrial tachycardia with heart rate (HR) ranges 170-190bpm with positive p-wave axis in lead I, II, III, AVF and upright in lead V1. He was initially started on HR lowering medications and given electrical synchronized cardioversion which were both unsuccessful. A week later, patient developed COVID-19 pneumonia and subsequently completed isolation as per local government protocol. During the course of admission, a POCUS echocardiogram was done which showed a newly depressed left ventricular ejection fraction (EF) of 22% compared from a previous 44% two weeks earlier. Hence, patient eventually underwent successful 3D-mapping and radiofrequency ablation of the right super pulmonary vein via transseptal approach. He was then successfully discharged with Metoprolol 200mg twice daily alongside with other heart failure medications.

CONCLUSION

Development of COVID-19 infection can run the risk of worsening and clinical decompensation among patients with incessant tachyarrhythmia and there are still no established data regarding the safety of doing radiofrequency ablation post COVID-19 infection. This case report illustrates doing a successful radiofrequency frequency ablation post COVID-19 infection in a patient who developed incessant atrial tachycardia.

Intracardiac Electrograms (EGMS)- Can Be a Clue to Indicate Epicardial Accessory Pathways?

Dr Amira Shaik¹, Dr Varsha Prakash¹, Dr Prakash Vadagenalli¹

¹*M S Ramaiah Medical College, Bengaluru, India*

Objective: Posteroseptal accessory pathways (PSAP) quite often result in failed ablation with a higher incidence of epicardial location of AP. Surface electrogram has a low Sensitivity and high Specificity in suggesting Epicardial APs. Intracardiac EGM pattern could suggest an epicardial location avoiding unnecessary and failed radiofrequency lesions.

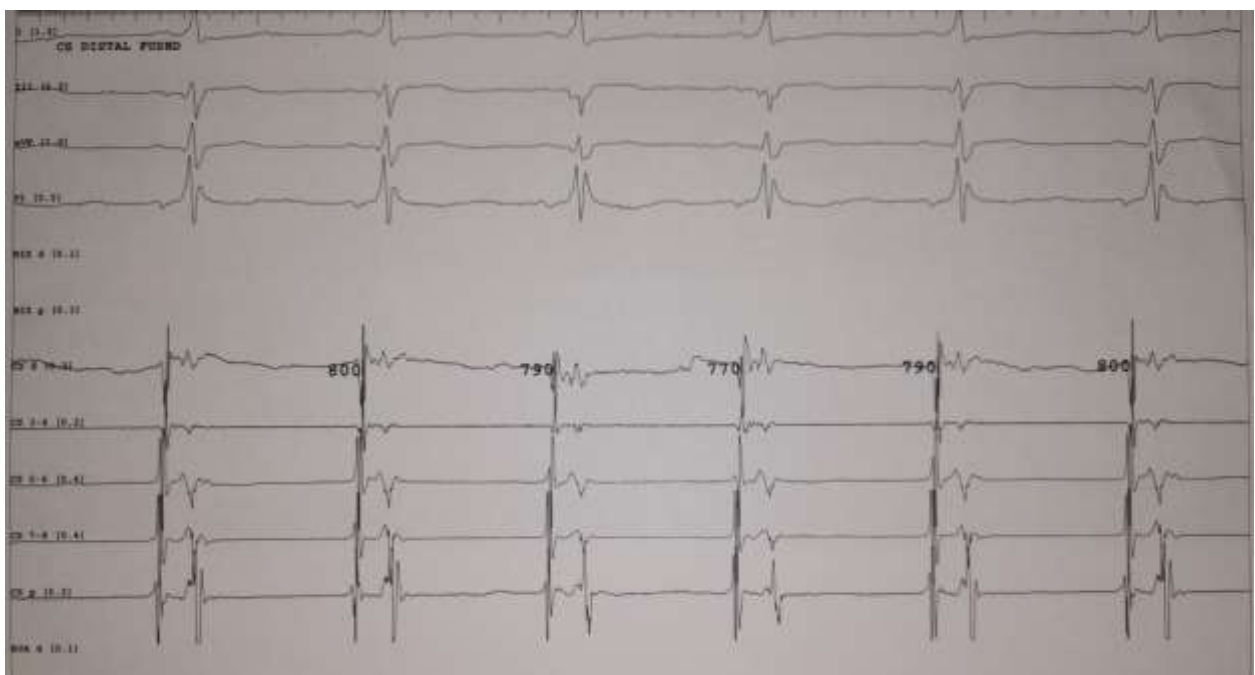
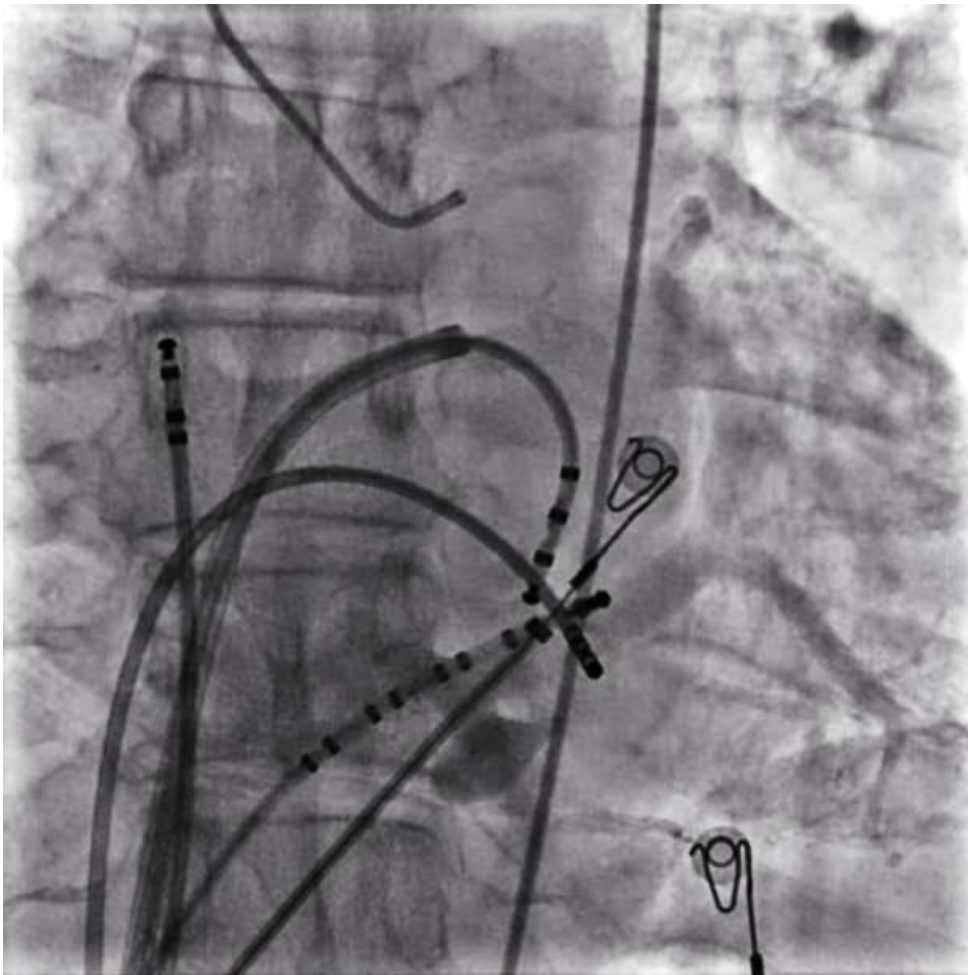
Materials and methods: Describing a case series of five patients with intracardiac EGM showing a peculiar pattern of antegrade AV fusion in the mid CS dipoles recording suggestive of a broadband AP in the left posteroseptal location.

However delivery of Radiofrequency (RF) energy at that site via trans-septal approach failed to eliminate the accessory pathway. Coronary sinus (CS) angiogram revealed CS diverticulum in three cases & a dilated CS in two. Mapping revealed AV fusion with a pathway potential at the neck of the CS diverticulum. Application of RF energy at this site resulted in loss of preexcitation and AV separation.

Results: In all five patients RF ablation of epicardial accessory pathway located at CS Diverticulum/ dilated CS was performed via transvenous approach. Mean number of therapies delivered were 3 (2-7) with 20 – 30 watts. Mean procedure time was 68 minutes (33-128 minutes). There were no complications. All five patients are asymptomatic at follow up with no manifest preexcitation or documented arrhythmias.

Conclusion: Intracardiac Electrograms with fused AV signals in the mid CS dipoles mimicking existence of a broadband left Posteroseptal AP, are a clue to suggest the possibility of CS diverticulum and the presence of Epicardial AP in its proximity.

SUPPORTING DOCUMENTS



You Can Run, but You Can't Hide: an Unorthodox Location of Focal Atrial Tachycardia

Dr Yuen Hoong Phang¹, Dr Mohanaraj Jayakumar¹, Dr Chee Wei Leong¹, Dr Ahmad Faiz Mohd Ezanee¹, Dr Vijayendran Rajalingam¹, Dr Kai Soon Liew¹, Dr Kantha Rao Narasamuloo¹, Dr Saravanan Krishinan¹

¹*Hospital Sultanah Bahiyah/ Ministry Of Health, Alor Setar, Malaysia*

We present a redo case of tachycardia-induced cardiomyopathy in a 27 years gentleman with a history of focal atrial tachycardia catheter ablation over the left upper pulmonary vein performed 10 years ago.

He complained of recurrent palpitation and decreased effort tolerance with NYHA 2. ECG was noted to be long RP tachycardia with a heart rate of 100-120, with P wave upright in all leads, and an echocardiogram noted an EF of 45% with segmental RWMA and LVIDD 6cm.

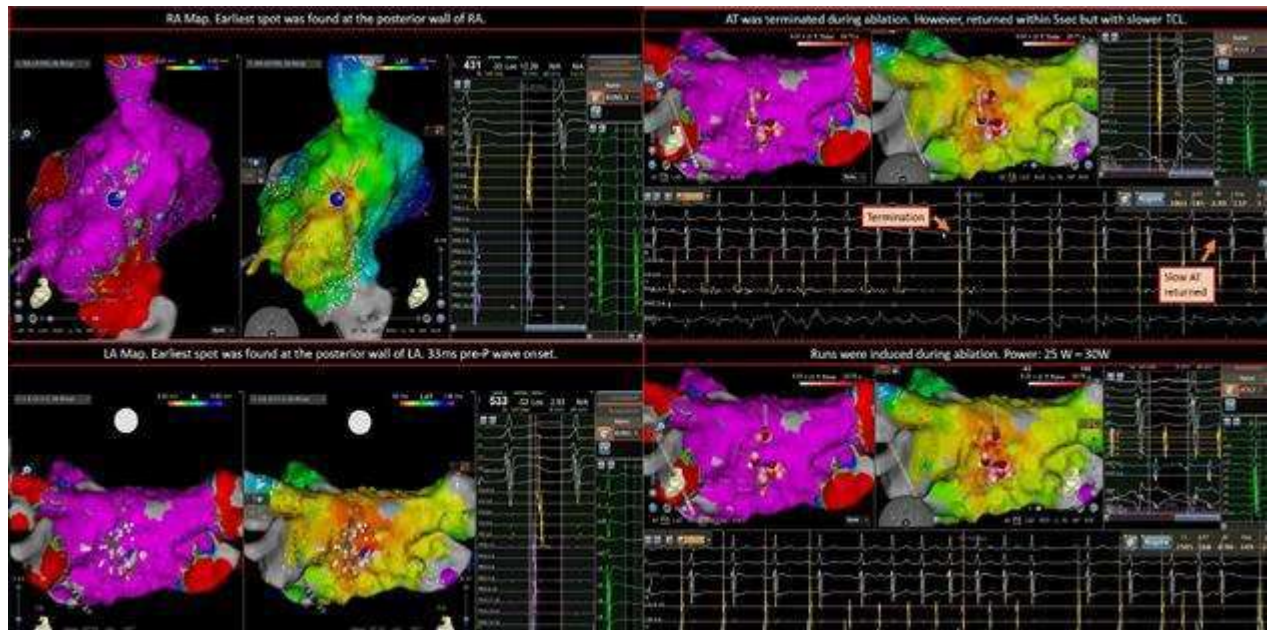
EPS was started with a CS catheter to high RA, and another to CS, which noted eccentric activation during tachycardia. We then proceeded Carto 3D system with a Pentaray-Nav catheter. Mapping was started from RA and noted the earliest spot was found at the posterior wall, which was later than P wave onset.

We proceeded with a transeptal puncture and mapped the LA. The earliest activation site was located at the posterior wall of LA, 33 ms pre-P wave onset. The signal was consistent, with a sharp descent unipolar signal. AT was terminated during ablation but recurred within 5 seconds with a slower cycle length. The ablation region was micro-mapped, and the earliest signal was capture at the superior posterior wall, with catheter contact terminating the tachycardia. Ablation was done using @60°C 25W, inducing atrial runs during ablation. Post ablation, AT was not inducible.

Bisoprolol was stopped post-procedure.

4 weeks later, he was in NYHA 1, remained in sinus rhythm and echocardiogram noted EF 65% with no RWMA and LVIDD 5.8cm.

SUPPORTING DOCUMENTS



Assess the Properties and Outcome of Special Supraventricular Tachycardia Cases Using Three-dimension Navigation System.

Dr Quoc Tran¹

¹*Tam Duc Heart Hospital, Ho Chi Minh City, Viet Nam*

Objective

Radiofrequency catheter ablation (RFCA) is traditionally performed under fluoroscopic guidance, however procedure time and radiation exposure by fluoroscopy depends on many variables such as experience of the operator or complexity of the heart, target position. Nowadays, three – dimension navigation system (3D) applied in such special SVT cases appeared as an ambitious approach. The aim of this study was to assess the properties and outcome in the group using 3D mapping compared to traditional approach.

Materials and Methods

A retrospective chart review was performed in our center from Jan 2022 to July 2022 collected 83 patients.

Result

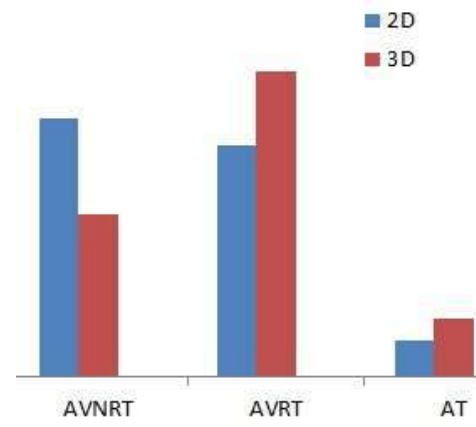
57 and 26 patients underwent RFCA traditional fluoroscopic guidance and mapping using Ensite Precision system, respectively. The gender between two groups was not different but the patients in 3D group was statistical younger and had more structural heart disease than in 2D group (32 ± 23.4 vs 42 ± 15.9 ys, $p=0.04$ and 6% vs 1.2% , $p=0.01$, respectively). The acute procedural success in 3D group was higher significantly compared to 2D group (100% vs 94.7% , $p=0.02$). The target around parahisian site occurred commonly in 3D (9.8 vs 6.0% , $p=0.02$). In addition, the rate of failed initial ablation was prominent in 3D group (23% vs 1.75% , $p=0.01$).

Conclusion

RFCA with 3D mapping in SVT are shown to be more successful and helpful in special populations such as parahisian accessory pathway, or re-ablation procedure.

SUPPORTING DOCUMENTS

	3D	2D	P
Age	32 ± 23.4	42 ± 15.9	0.048
Structural Heart D	6%	1.2%	0.011
Re-ablation Procedure	23%	1.75%	0.01
Parahisian site	9.8%	6.0%	0.02
Acute success	100%	94.7%	0.02
Procedure time	91±38	70±43	0.13
Fluroscopy time	21±12	23±12	0.55



Novel Endpoints for Recurrence After Catheter Ablation of Atrioventricular Nodal Reentry Tachycardia

Dr Hyoungseok Lee¹

¹Korea University College Of Medicine And Korea University Medical Center, Seoul, South Korea

Objective

Catheter ablation is the curative treatment of symptomatic atrioventricular nodal reentrant tachycardia (AVNRT), however, the association between endpoints of the procedure and recurrence has not yet been clearly identified.

Therefore, we aimed to demonstrate whether novel procedural endpoints using window period and inducibility can predict recurrence.

Materials and Methods

This is a retrospective study in patients who successfully performed RFCA after being diagnosed with AVNRT from 2005 to 2021. The predictive power of recurrence was assessed by logistic regression using a novel endpoint. It is the addition of inducibility applied to the conventional procedure endpoint which is AH jump and 1 echo with echo window within 40 ms.

Results

Among a total of 1,567 consecutive patients were successfully treated with AVNRT ablation, 22 patients (1.43%) showed recurrence after the procedure in 1,533 cases, excluding 34 cases with follow-up loss.

When AH jump was applied alone to the non-recurrent and recurrent groups (table 1), the odd ratio (OR) was 1.06; whereas AH jump and 1 echo with echo window within 40 ms were applied together, the OR was 0.948. And AH jump, 1 echo with echo window within 40 ms and inducibility were applied together, the OR was 0.400.

Conclusion

This study demonstrated that when inducibility applied to AH jump and 1 echo with echo window within 40 ms, which are known procedure endpoints, the ORs seems to be decreased, suggesting inducibility applied to the existing procedure endpoint during catheter ablation of AVNRT may have a predictive power of recurrence.

SUPPORTING DOCUMENTS

Table 1. Procedure endpoint with None-recurrence and Recurrence

	Non-recurrence (n=1,511)	Recurrence (n=22)	OR (95% CI)	p Value
AH jump(-)	1,079 (71.4%)	16 (72.7%)	1.06 (0.415- 2.747)	0.892
AH jump(±) with 1 echo and echowindow within 40ms	1,361 (90.9%)	20 (90.9%)	0.948 (0.219- 4.101)	0.943
AH jump(±) with 1 echo, echowindow within 40ms and inducibility(-)	1,120 (74.1%)	13 (59.0%)	0.400 (0.158- 1.012)	0.053

Combined Supra-and-subvalvular Approach for Right Accessory Pathway under Anterior Tricuspid Valve

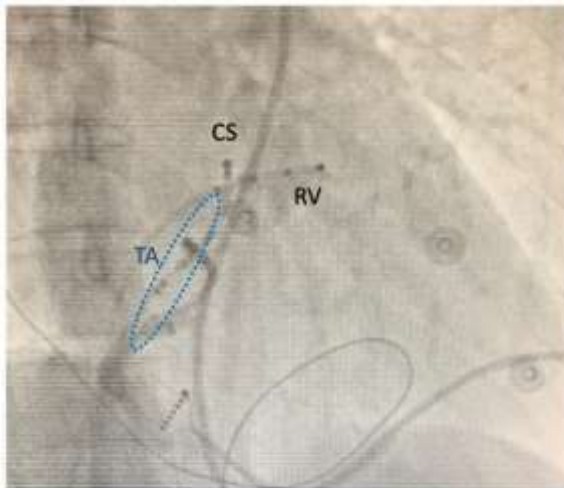
Dr Nangong Xiong¹, Dr Wentao Gu¹, Dr Weizhuo Liu¹, Dr Xinping Luo¹, Dr Jian Li¹

¹*Huashan Hospital Fudan University, Shanghai, China*

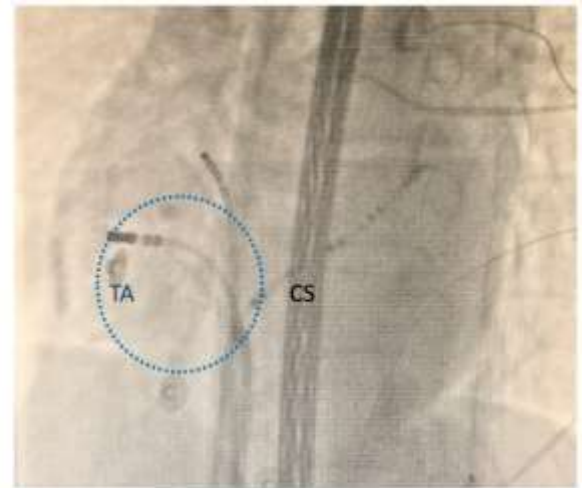
Objective:

To evaluate the effectiveness of combined supraventricular plus subvalvular approach to right accessory pathway under the anterior tricuspid valve. **Materials and Methods** Patients undergoing right accessory pathway under anterior tricuspid valve were enrolled. Conventional supraventricular approach was used in group A for ablation. While in the other patients (group B), a combined supraventricular plus subvalvular approach was applied, in which supraventricular approach was used for target mapping and first radiofrequency delivery, and subsequently, subvalvular ablation using a reverse-S catheter position was immediately performed with the help of a long sheath from the opposite side of valve. Procedural and follow-up data were collected from the patients. **Results** 9/10 procedures in group A and all 8/8 procedures in group B were successful with a similar mean procedural time ($p=0.83$). Group B has a shorter ablation time than group A, counted from the beginning of mapping till the final pathway elimination ($P<0.01$). After 6-month follow up, 1 patient from group A suffered from disease recurrence while all patients in group B achieved long-term success **Conclusion** Combined supraventricular and subvalvular approach was feasible in right anterolateral accessory pathway ablation by facilitating catheter stability during radiofrequency application with considerable mapping and ablation efficiency.

SUPPORTING DOCUMENTS

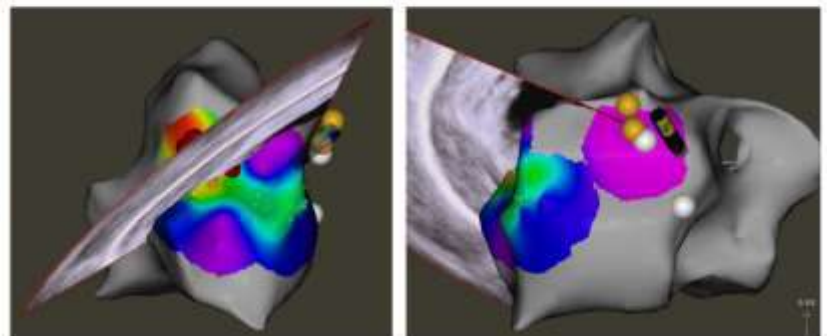
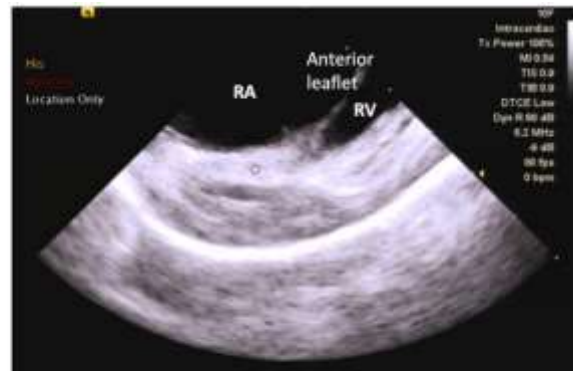
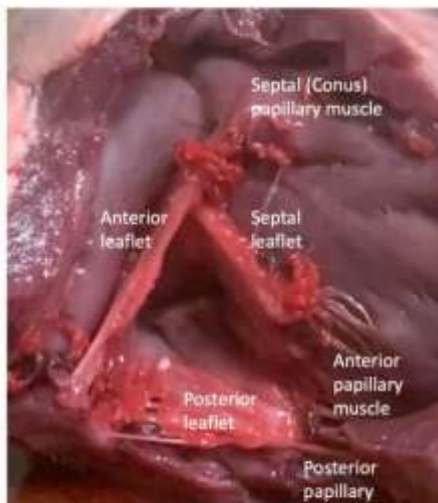


RAO



LAO

Porcine Illustration



Endocrinopathies Leading to Misdiagnosis of Gene Negative Long QT Syndrome

Dr Praloy Chakraborty¹, Dr Jason D. Roberts^{2,3}, Dr Michael H. Gollob^{1,4}

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Background

Despite having a genetic etiology, 30% of patients with LQTS are 'gene elusive'.

Objective

We describe a series of six patients of 'gene negative' LQTS where a detailed clinical workup demonstrated endocrinopathies as the cause of QT prolongation.

Methods: N/A

Results

Two patients (case 1: 32 years/ F, case 2: 43 years/F) presented with hypotension, QT prolongation (QTc=584 ms and 553 ms, respectively), and recurrent torsades de pointes (TdP). Due to presence of unprovoked hypoglycemia, the ACTH challenge test was planned and established the diagnosis of adrenal insufficiency in both cases with resolution of symptoms and normalization of the QT interval with Corticosteroid therapy. Two patients (case 3: 64 years/F, case 4: 61 years/F) were referred due to the incidental observation of QT prolongation. In case 3, elevated serum parathyroid hormone (13.5 pmol/L), normal Ca²⁺, and normal 25-hydroxy vitamin D confirmed a diagnosis of normocalcemic hyperparathyroidism. In case 4, hypocalcemia was observed in association with normal 25-OH Vitamin D level and a reduced serum PTH (0.64 pmol/L), indicating a diagnosis of hypoparathyroidism. Lastly, two pediatric cases (case 5: 15 years/M, case 6: 11 years/F) presented with recurrent syncope QT prolongation (QTc of 475 ms in both patients). Biochemical assessment noted hypocalcemia (case 5: 1.42, case 6: 1.44 mmol/L) and elevated PTH (case 5: 20.4, case 6: 36 pmol/L), establishing a diagnosis of pseudohypoparathyroidism in both. Treatment with calcium and calcitriol normalized the QTc in the last three cases.

Conclusions

Endocrinopathies should be considered in the diagnosis of 'gene negative' LQTS.

CLINICAL PREDICTORS OF CARDIAC SYNCOPE RECEIVING AN INSERTABLE CARDIAC MONITOR IN PATIENTS WITH UNEXPLAINED SYNCOPE

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OBJECTIVES

The prognosis of syncope is related both to underlying comorbidities and etiology, with cardiac syncope (CS) having a higher risk for mortality and cardiovascular events than the syncope of non-cardiac causes. Although a novel insertable cardiac monitor (ICM) is an effective tool for diagnosing unexplained syncope, the decision to implant an ICM with a high pretest likelihood of CS should contribute to economic costs reduction and avoid unnecessary complications. We investigated the clinical factors for CS after ICM implantation in patients with unexplained syncope.

MATERIALS AND METHODS

This was a retrospective observational study that included consecutive 31 patients implanted with an ICM for the indication of syncope between September 2016 and August 2021. The initial examinations for the syncope evaluation included a detailed history, physical examination, blood test, 12-lead electrocardiogram and transthoracic echocardiography.

RESULTS

Of the 31 patients, recurrent CS occurred in 13 (41.9%) during the follow-up period (676±469 days). Among several clinical factors, presence of minor injuries related to syncope ($p = 0.017$) and higher brain natriuretic peptide (BNP; $p = 0.043$) were significantly associated with CS. Moreover, multivariable analysis showed that both minor injuries related to syncope (odds ratio, 11.2; 95% confidential interval, 1.4-88.4; $p = 0.022$) and BNP higher than 64.0 pg/ mL (odds ratio, 7.0; 95% confidential interval, 1.1-44.2; $p = 0.038$) were independent predictors of CS after ICM implantation.

CONCLUSION

A history of minor injury secondary to syncope and higher BNP level were independent predictive factors of CS in patients receiving ICM for syncope.

Improvement of Right Ventricular Systolic Function in Association with Reduced Appropriate ICD Therapy

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Background: A recent study showed that right ventricular fractional area change (RVFAC) was associated with a significantly increased risk of SCD despite of LVEF. The purpose of this study was to evaluate the association of RVFAC and appropriate implantable cardioverter-defibrillator (ICD) therapy.

Methods: Consecutive patients who underwent initial ICD implantation except for hypertrophic cardiomyopathy and Brugada syndrome and long QT syndrome were retrospectively enrolled. Primary endpoint was defined as any appropriate ICD therapy. Right ventricular dimensions and functions were also measured to be analyzed. The change of RVFAC after implantation was re-evaluated one year later

Results: In total, 172 patients (60.3±13.6 years, 131 males) including 64 ischemic cardiomyopathy (37.2%) were enrolled. Ninety patients received an ICD as a secondary prophylaxis. Mean left ventricular ejection fraction (LVEF) and RVFAC were 38.3±14.3% and 35.8±8.82%, respectively. Regarding appropriate ICD therapy events, the best cut-off value of RVFAC was 34.8%. The odds ratio of low RVFAC was 2.73 (95%CI: 1.456-5.121, P=0.00174). In multivariate analysis, only low RVFAC is an independent predictor of appropriate ICD therapy (HR: 3.53, 95%CI:1.78- 6.99, P<0.001). Secondary prophylactic cohort with low RVFAC showed highest incidence of appropriate ICD therapy. Among patients with RV dysfunction, RVFAC was normalized in 39% patients during follow up. This recovered group showed significantly lower incidence of appropriate ICD therapy than unrecovered group (P=0.037).

Conclusion: RVFAC and its improvement may be important to stratify the prognosis of ICD patients.

Impact of Manual Editing on T-wave Alternans Values in Myocardial Infarction or Heart Failure Patients

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T-wave alternans (TWA) is a useful non-invasive predictor of sudden cardiac death (SCD) in patients with myocardial infarction (MI) or heart failure (HF). However, TWA values are frequently overestimated due to noise or artifacts. We evaluated the extent of change in the TWA values during manual editing.

The Korean noninvasive Risk Evaluation study for sudden cardiac DEath From INfarction or heart failure (K-REDEFINE) registry prospectively measured TWA using ambulatory ECG data in patients with MI and HF at 25 tertiary referral hospitals in South Korea. In all patients, pre- and post-editing Maximal TWA (Max-TWA) values were obtained in each channel. Manual editing was performed by 2 cardiologists.

Ambulatory ECG recording were performed in 1,101 MI and 383 HF patients (Male 74.2%, Age 61±13 years old). Max-TWA values were available in both leads V1 and V5 among 1329 (89.6%) of 1484 patients. There was a significant decrease in Max-TWA values during manual editing: 53±28 vs. 43±17 µV in V1 lead, P<0.001; 60±42 vs. 55±24 µV in V5 lead, P<0.001. A significant decrease in Max-TWA values was also observed when patients were divided into HF and MI subgroups. Additionally, proportion of patients with Max-TWA ≥ 65 µV (a cut-off value for predicting SCD in previous studies) dramatically reduced from 32 (422/1329) % to 28% (370/1329) (P=0.031). Max-TWA values in each lead and proportion of patients with Max-TWA ≥ 65 µV significantly decreased by manual editing. Therefore, manual editing should be performed when Max-TWA values are used for the risk assessment of SCD.

Association between dynamic structural change and lethal arrhythmic events in patients with hypertrophic cardiomyopathy

Dr Joo Hee Jeong¹, Professor Jong-Il Choi¹, Professor Yun Gi Kim¹, Doctor Yun Young Choi¹, Doctor Kyong Jin Min¹, Doctor Hyoung Seok Lee¹, Professor Jae-min Shim¹, Professor Mi-Na Kim¹, Professor Seong-Mi Park¹, Professor Young-Hoon Kim¹

¹*Korea University Anam Hospital, South Korea*

Objectives:

Risk factors for sudden cardiac death (SCD) in hypertrophic cardiomyopathy (HCM) have been established, which include echocardiographic assessment of left ventricular hypertrophy and left ventricular ejection fraction. However, less is known about the temporal change of HCM after diagnosis and its association with lethal arrhythmic events (LAE). We aimed to investigate structural change measured by echocardiography in adult HCM, and further assessed its association with LAEs.

Materials and Method:

This study is based on cohort of HCM patients in a single-center: patients with diagnostic codes of HCM were extracted from 1998 to 2021. LAE was defined as composite outcome of aborted SCD, ventricular arrhythmia, and implantable cardioverter-defibrillation implantation.

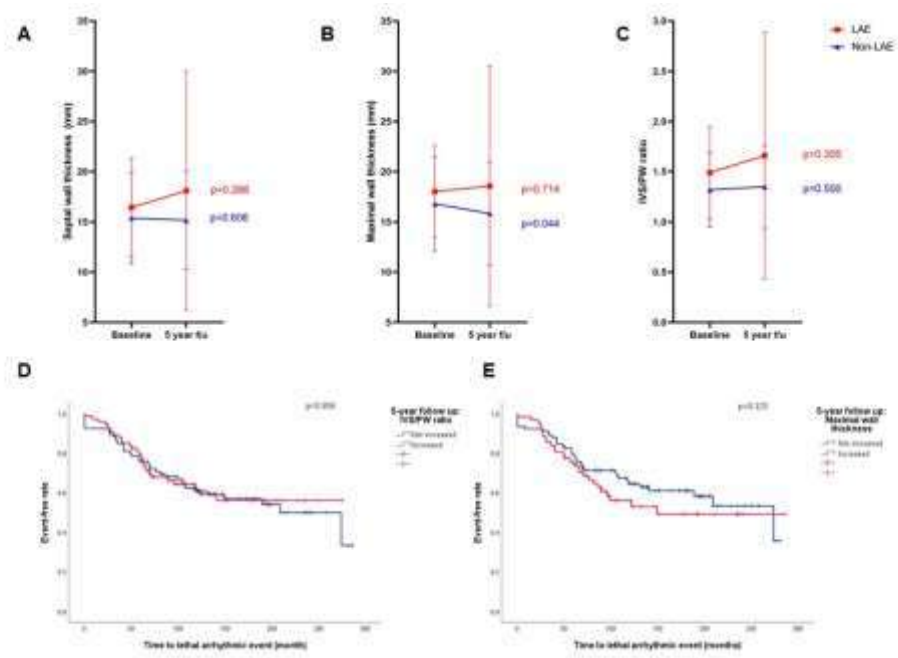
Results:

Among 611 HCM patients, 153 patients with 5-year follow up echocardiographic data were studied. LAE occurred in 63 patients (41.2%). Compared with non-LAE group, LAE group presented younger age of onset (56.0 ± 15.9 vs. 62.1 ± 15.1 years-old, $p=0.017$), higher proportion of septal HCM (65.0 vs. 47.7%, $p=0.033$), higher interventricular septum (IVS)/posterior wall (PW) ratio (1.5 ± 0.4 vs. 1.3 ± 0.3 mm, $p=0.013$), and higher calculated risk of SCD (1.8 ± 1.0 vs. $1.4 \pm 0.7\%$, $p=0.011$). There was no significant difference in cumulative occurrence of LAE regarding the change of IVS/PW ratio or maximal wall thickness at 5-year period.

Conclusion:

Although echocardiographic parameters did not show significant temporal change at 5-year follow up according to LAE occurrence, asymmetric wall thickness of hypertrophied ventricle was associated with risk of LAE. Non-structural clinical markers may be needed in stratifying subsequent probability of lethal arrhythmia.

SUPPORTING DOCUMENTS



Obesity is Not Associated with Sudden Cardiac Death

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¹Korea University Anam Hospital, South Korea , ²Soongsil University, Department of Statistics and Actuarial Science, Seoul, South Korea

Objectives:

The linkage and causal relationship of obesity and sudden cardiac death (SCD) is not fully established. This study investigated the impact of body weight status, measured by body-mass index (BMI) and waist circumference (WC), on the risk of SCD, based on a nationwide database of health insurance system.

Materials and Methods:

A total of 4,234,341 participants who underwent medical check-up in 2009 were included. Influence of confounding risk factors (age, sex, social habits, and metabolic disorders) were further analyzed.

Results:

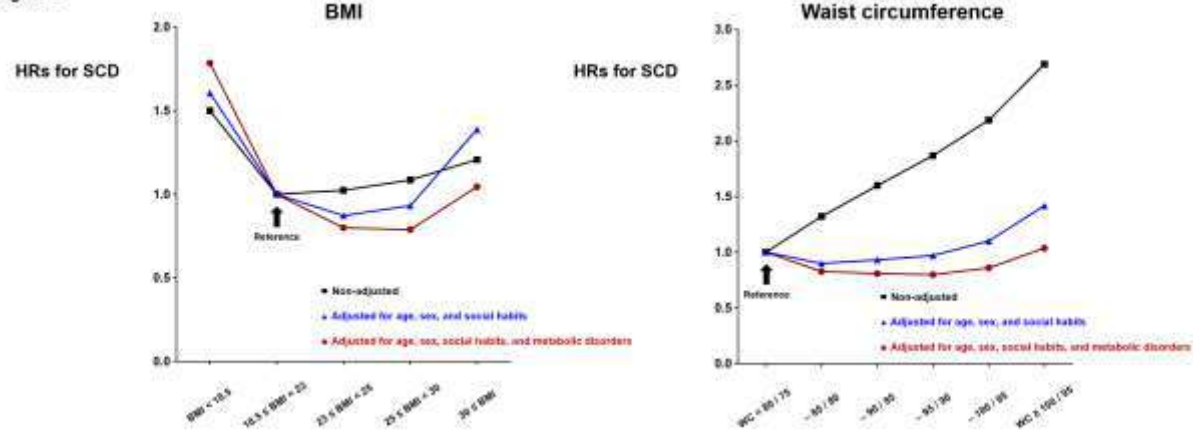
During 33,345,378 person*years of follow-up, SCD occurred in 16,352 cases. BMI resulted a J-shaped association with risk of SCD, in which obese group ($BMI \geq 30$) had 20.8% increased risk of SCD compared with normal body weight group ($18.5 \leq BMI < 23.0$) (95% confidence interval [CI]=1.12–1.31; $p < 0.001$). WC showed a robust linear association with the risk of SCD, with 2.69-fold increased risk of SCD in highest WC group as compared with the lowest WC group (95% CI=2.50–2.89; $p < 0.001$). However, after adjustment of covariates, neither BMI nor WC was associated with the risk of SCD. In multivariate model, sex was the strongest predictor for SCD (HR=2.35, 95% CI=2.25–2.46; $p < 0.001$), followed by smoking, diabetes mellitus, and hypertension.

Conclusion:

Obesity assessed as BMI and WC is not associated with SCD risk after adjustment of confounding risk factors. Rather than focusing on obesity per se, integrated approach with extended to consideration of pre-existing metabolic disorders as well as people demographics and social habits might provide better understanding and prevention of SCD.

SUPPORTING DOCUMENTS

Figure 2



Mutant Nav1.5 With Dominant-Negative Effect Does Not Correspond to the Severe Phenotype.

Dr Ayami Tano¹, Dr Koichi Kato², Mr Hideyuki Jinzai², Dr Daisuke Fukumoto³, Dr Seiko Ohno⁴, Dr Yoshihisa Nakagawa², Dr Minoru Horie²

¹*Department of Neurology, Shiga University of Medical Science, Otsu, Japan,* ²*Department of Cardiovascular Medicine, Shiga University of Medical Science,* ³*Osaka Kaisei Hospital, Osaka, Japan,* ⁴*Department of Bioscience and Genetics, National Cerebral and Cardiovascular Center, Suita, Japan*

OBJECTIVES

Loss-of-function (LOF) variants of SCN5A are known to cause various arrhythmic syndromes. Recent studies demonstrated dominant-negative (DN) effect of LOF-SCN5A variants via channel dimerization and its association with phenotype penetrance but not with severity. We identified compound heterozygous SCN5A variants, p.G833R and p.T1396P, in a family with bradyarrhythmia. In this study, we analyzed functional property of these variant to understand the association between disease severity and DN effect of SCN5A variants.

MATERIALS AND METHODS

A whole-cell patch-clamp analysis was performed for the functional analysis of the mutant Nav1.5s expressed in HEK cells. Coupling effect of mutated channels was assessed by co-expressing WT and mutant plasmids in various combinations with or without a channel-dimerization cancelling peptide, difopein.

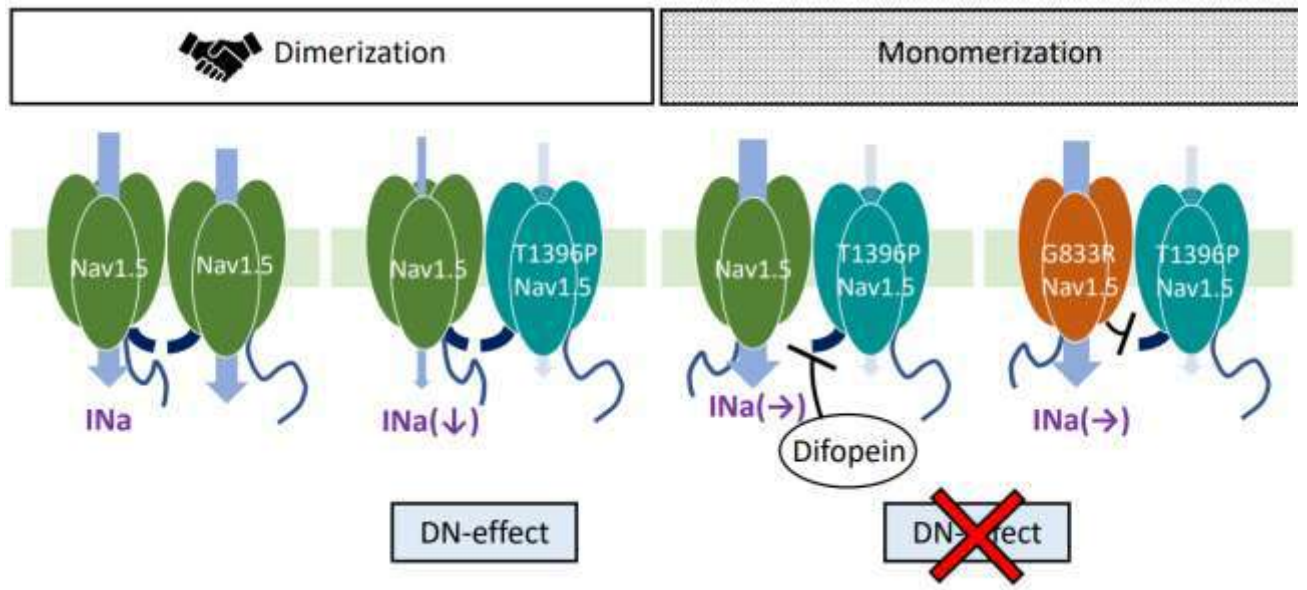
RESULTS

HEK cells expressing T1396P showed complete loss of sodium current, whereas those expressing G833R did not show any functional alterations. Cells expressing WT/T1396P mimicking heterozygote demonstrated significant reduction of current density, that was so called a DN-effect. The effect was canceled by co-expression of difopein, implying that T1396P manifested DN-effect via channel dimerization. When co-expressing T1396P/G833R together, T1396P did not manifest DN-effect. It suggests that G833R worked as a dimerization canceller. However, the proband carrying both T1396P and G833R showed obviously severe phenotype than her mother carrying only T1396P, suggesting that cancellation of dimerization by G833R did not weaken phenotype severity.

CONCLUSION

Our result supports the Nav1.5-dimerization concept and consequent DN-effect by LOF-SCN5A variants. The role of dimerization-canceller for phenotype expression should be studied further.

SUPPORTING DOCUMENTS



Genotypes Identified by Next-generation Sequencing in Idiopathic Ventricular Fibrillation

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¹*Korea University College of Medicine and Korea University Anam Hospital, Seoul, Republic of Korea*, ²*Division of Cardiology, Department of Internal Medicine, Korea University College of Medicine and Korea University Anam Hospital, Seoul, Republic of Korea*

Objective

Idiopathic ventricular fibrillation (IVF) is a diagnosis of exclusion, which is diagnosed when the cause of ventricular fibrillation cannot be identified despite thorough clinical examination. We aimed to investigate genotypes of IVF probands to undercover concealed disease using next-generation sequencing (NGS).

Materials and Methods

This study is based on single-center cohort of aborted sudden cardiac arrest without identified causes and structural heart disease from 2016 to 2020. Clinical data and genetic data using NGS panel (Illumina, Inc., San Diego, CA, USA) were analyzed.

Results

A total of 15 IVF patients were studied, and the mean age of onset was 43.5 ± 12.2 years-old. All patients were male, and were implanted with implantable cardioverter-defibrillators. 12-lead electrocardiography revealed sinus rhythm in 14 patients, and mean heart rate and QTc interval was 63.8 ± 8.4 and 408.6 ± 31.7 . None of the patients revealed significant electrocardiography change that can be associated with SCD. Mean left ventricular ejection fraction was $58.1 \pm 5.1\%$. Drug provocation test with flecainide and epinephrine resulted non-significant QT prolongation in 1 of 13 patients. 14 patients underwent the NGS panel, and 13 patients were detected with certain genotypes. The most frequent variant was TTN ($n=5$), followed by RYR2, KCNQ, CACNA1C ($n=2$). AKAP9, TRPM4, DSG2, DTNA, DSP, SCN5A, PKP2 variants were also identified.

Conclusions

NGS-based genetic testing identified substantial proportion of genetic variants in patients initially diagnosed with IVF. The molecular diagnostic approach suggests further clinical evaluation and follow-up in IVF patients with positive genotypes, with possibility of concealed inherited arrhythmia and cardiomyopathy.

Is Post-acute Sequelae Covid-19 (Long-COVID) a Post-viral Postural Orthostatic Tachycardia Syndrome?

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Objectives

To compare autonomic function and health-related quality of life (HRQoL) in those with post-acute sequelae of Covid-19 (PASC), postural orthostatic tachycardia syndrome (POTS) and healthy controls.

Methods

A total of 60 participants were recruited (PASC=20, POTS=20, controls=20). There were no significant differences in age or other demographics between groups. PASC was defined as ≥ 3 months of persistent unexplained symptomology post SARS-CoV-2 infection. 10-minute active standing test was undertaken using Finapres[®] NOVA to measure beat-to-beat haemodynamic response. Composite Autonomic Symptom Score (COMPASS-31) was used to assess autonomic symptomology and the Euroqol 5-Dimension (EQ-5D) survey to assess HRQoL (scale of 0-1 with '1' representing full health). The 5-point hypermobility questionnaire (5-PHQ) was used to assess generalized joint hypermobility (defined as score ≥ 2).

Results

95% of PASC subjects fulfilled the standing test criteria for POTS (≥ 12 heart rate, bpm: 42 ± 10 vs. 48 ± 14 in POTS and 16 ± 6 in controls; $p < .001$) and significantly increased autonomic symptoms per COMPASS-31 score as compared to controls (39 ± 11 vs. 51 ± 15 in POTS and 12 ± 14 in controls; $p < .001$). Individuals with PASC and POTS had higher rates of joint hypermobility than controls (45% vs. 75% vs. 25% respectively; $p = .006$) and significantly reduced HRQoL utility scores (0.61 ± 0.04 vs. 0.64 ± 0.03 vs. 0.94 ± 0.09 respectively; $p < .001$).

Conclusion

Autonomic dysfunction and reduced HRQoL is prevalent in sufferers with PASC and bear high similarity to those with POTS. This is in keeping with the often-observed post-viral illness-mediated POTS. Our data calls for routine involvement of autonomic physicians in the care of subjects with PASC.

SUPPORTING DOCUMENTS

		POTS	PASC	CONTROLS	p Value
DEMOGRAPHICS					
	n=	20	20	20	
	Age (mean $\pm$ SD)	32 (10)	39 (12)	33 (12)	.174
	Female (%)	90	85	85	.866
	BMI (kg $\pm$ SD)	27 (5.6)	27 (7.8)	24 (2.7)	.289
	Caucasian (%)	100	95	90	.349
	University Educated (%)	85	95	75	.239
AUTONOMIC TESTING					
Standing Test	SBP resting (mean mmHg $\pm$ SD)	129 (16)	125 (14)	116 (17)	.029
	SBP standing (mean mmHg $\pm$ SD)	137 (19)	135 (18)	127 (17)	.009
	HR resting (mean bpm $\pm$ SD)	82 (13)	75 (14)	68 (7)	.002
	Maximum standing HR (mean bpm $\pm$ SD)	129 (14)	117 (14)	85 (9)	<.001
	Delta HR (mean bpm $\pm$ SD)	48 (14)	42 (10)	16 (6)	<.001
Compass-31	Total Score (mean score $\pm$ SD)	51 (15)	39 (11)	12 (14)	<.001
POTS Diagnosis	POTS diagnosis (%)	100	95	8	<.001
HYPERMOBILITY					
	Generalised Joint Hypermobility (%)	75	45	25	.006
QUALITY OF LIFE- EQ-5D-5L					
	Visual Analogue Scale (mean $\pm$ SD)	44.4 (17)	36.7 (15)	84.8 (12)	<.001
	Utility Score (mean score $\pm$ SD)	0.64 (0.02)	0.61 (0.04)	0.94 (0.09)	<.001
	Fatigue Severity Score (mean score $\pm$ SD)	55 (10)	52 (14)	26 (14)	<.001

Catheter Ablation of Cardiac Arrhythmias during COVID-19 Pandemic in Cambodia

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Abstract

Catheter ablations of cardiac arrhythmias are nowadays frequently guided by electro-anatomic mapping systems. Technical staff with medical training, or medical staff with technical training, is needed to assist the operator. Travel restrictions due to current COVID-19 pandemics have limited the in person availability for technical support staff. These limitations make us to perform the feasibility of remote support with an internet based communication platform. A total cardiac arrhythmias 25 patients (Male: 10 cases, Female: 15 cases) with different arrhythmias such as Atrial fibrillation(1case), Atrial flutter(5cases), Atrial tachycardia(2cases), Right and Left Ventricular Arrhythmias (19cases), having undergone ablation procedures between 2020 to 2022. Acute procedure success was obtained 25 cases, no complications. Our experience with remote support for electro-anatomic mapping for complex electrophysiological ablation procedures, showed the feasibility and safety of this approach. It increases the availability of technical support for reducing the costs. Remote support for electroanatomic mapping may therefore facilitate continuous care for patients with arrhythmias during the COVID-19 pandemics. Due to its advantages beyond COVID-19 pandemics related problems, it will likely play a greater role in the future.

Key Words: Cardiac arrhythmias, Covid-19 Pandemic, Electro-anatomic mapping, Technical remote support.

Half Versus Normal Saline Irrigation for Catheter Ablation of Outflow Tract Ventricular Arrhythmias (HALF)

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Background

Animal studies demonstrated that deeper lesions could be achieved during radio-frequency catheter ablation (RFCA) by using half saline (HS) compared to normal saline (NS) as irrigation.

Objectives

This study sought to compare the efficiency and safety of HS and NS for irrigation during RFCA of idiopathic outflow tract ventricular arrhythmia (OT-VA).

Methods

In this multicenter, randomized controlled study, a total of 167 patients undergoing RFCA of OT-VA were randomized 1:1 to receive HS- or NS-irrigated ablation. Acute success was defined as the absence of induced targeted premature ventricular contraction (PVC) at the end of the procedure. The 6-month success was defined as a $\geq 80\%$ reduction of pre-procedural PVC burden.

Results

After excluding 14 lost to follow-up, 153 patients (77 in HS group and 76 in NS group) were analyzed. Patients in HS group had shorter total ablation time (259.5 ± 155.5 S vs. 355.6 ± 230.7 S, $P = 0.04$) than that in NS group. The acute and 6-month success rate were similar between the HS and NS group (92.2% vs. 90.8%, $P = 0.75$; 90.9% vs. 92.1%, $P = 0.79$, respectively). No significant difference was observed in the incidence of steam pops between the HS and NS group (2.6% vs. 1.3%, $P = 1.00$).

Conclusions

Irrigation with HS is similarly effective and safe with NS during OT-VA ablation. However, irrigation with HS could save the ablation time.

Ventricular Fibrillation due to Early Repolarization Syndrome Concomitant with Wolff-Parkinson-White Syndrome

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Introduction: Ventricular fibrillation (VF) in Wolf-Parkinson-White (WPW) syndrome can occur because of several causes, such as degeneration from atrial fibrillation (AF), iatrogenic, or concomitant with structural or channelopathy disease. Early repolarization syndrome (ERS) could be the cause of VF.

Case description: A 28-year-old man presented to the emergency department with palpitation one hour before admission. ECG confirmed diagnosis pre-excited AF. After synchronized cardioversion delivered,

ECG showed WPW pattern suggestive left lateral accessory pathway (AP). Radiofrequency ablation for left lateral AP had been successfully performed. However, electrophysiology study after ablation found that

VF was easily inducible. 12-lead ECG after that showed no delta waves seen, but there was concave STsegment elevation at V1-V4, followed with notched J point at inferolateral lead, suggesting malignant pattern of early repolarization. Further examination to find the cause of VF (right ventricle biopsy, cardiac MRI, echocardiography, and Brugada provocation test) showed no abnormality was found.

Conclusion: The cause of VF of this patient was more likely from ERS after excluding every possible causes. So the final diagnosis was inducible VF due to ERS concomitant with WPW syndrome

Keywords: Early repolarization syndrome, ventricular fibrillation, WPW syndrome

SUPPORTING DOCUMENTS

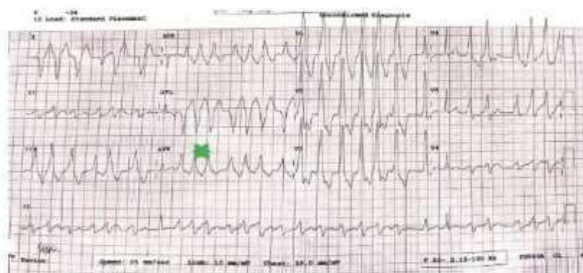


Fig 1. ECG at admission showed pre excited AF

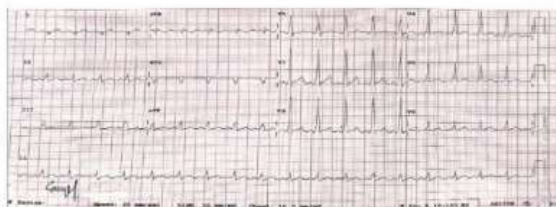


Fig 2. ECG after cardioversion showed delta waves pattern suggestion left lateral accessory pathway



Fig 3. Successful RFA of left lateral accessory pathway (showed with A-V separation at CS1-2)

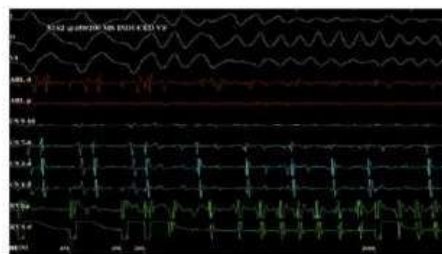


Fig 4. Programmed ventricular stimulation at EP study after RFA showed VF was inducible at s1S2 450/200 ms.

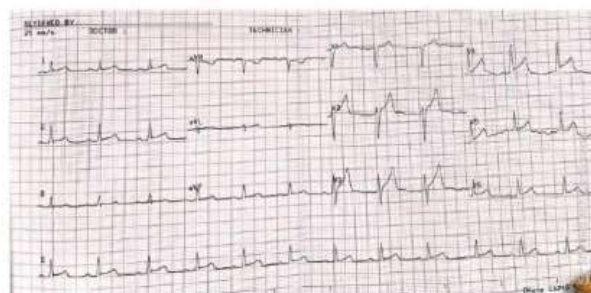


Fig 5. ECG after ablation showed concave ST segment elevation at V1-V4 and notched J point at inferolateral lead suggesting malignant early repolarization pattern

Fever-Induced Brugada Syndrome: The Forgotten ST-Segment Elevation, Insight From Rural Area

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Introduction: Brugada syndrome is an abnormal ECG pattern characterized by coved type ST-segment elevation pattern (Type 1) in right precordial leads associated with malignant arrhythmia that can lead to sudden cardiac death (SCD). Brugada pattern might appear more prominent in certain situation such as fever. We aim to highlight the importance of identifying fever-induced-Brugada in emergency settings especially in rural area such as Indonesia.

Case Illustration: We present 2 cases of a 59-year-old man and a 35-year-old male with fever > 39°C. Our first patient in Bontang, Kalimantan had chronic cough accompanied by night sweating for the past 1 month while our second patient in Lampung, Sumatra had right lower abdominal pain for the past 3 days. Both patients' initial ECG showed an rSR' pattern in V1 and V2, with coved ST segment elevation > 2 mm in V1 followed by an inverted T wave consistent with a type 1 Brugada pattern. Laboratory findings of both patients showed leukocytosis of 22.000 and 15.000, respectively. Our first patient was later diagnosed with active tuberculosis infection then subsequently treated with broad-spectrum antibiotics and anti-tuberculosis drugs while our second patient was diagnosed with acute appendicitis and underwent appendectomy. Fever resolved within 2 days with normal ECG findings when both patients were no longer feverish.

Conclusion: It is necessary to identify the classical ST-segment elevation pattern of type 1 Brugada and point out the trigger especially in patients with signs and symptoms of infection so that appropriate treatment can be given.

Predictive Score for Recurrent Ventricular Arrhythmias in Symptomatic Brugada Syndrome Patients after ICD Implantation

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Objective: Previous studies found abnormal electrocardiographic(ECG) patterns associated with ventricular arrhythmias(VAs) in Brugada syndrome, but the data was limited in asymptomatic patients. This is the largest cohort on factors predictive of VAs in patients with Brugada syndrome in a secondary prevention fashion.

Methods: This is a retrospective single-center cohort study, included all adult patients with symptomatic Brugada syndrome with an implantable cardioverter-defibrillator(ICD) implantation during 12.5 years at Khon Kaen University. The interested ECG parameters were analyzed. The primary outcome was the first appropriate ICD therapy recorded by device interrogation. Predictors of ICD therapy were executed by using Cox proportional hazard model and cut-points were calculated.

Results: There were 105 patients (mean age 52.16 ± 11 years, 99.05% males) who met the study criteria and 60 patients had ICD therapy. A median time to first ICD therapy was 33.5(range 3-122) months. Three from thirteen ECG factors were independently associated with ICD therapy consisting of aVR sign, corrected Tpeak Tend(Tpec) dispersion, and maximum Tpec duration ≥ 115 msec with an adjusted hazard ratio(HR) of 2.12 (95%confidence interval(CI) 1.09-4.16;p=0.03), 1.04 (95%CI 1.02-1.05;p<0.01) and 2.92 (95%CI 1.24-6.89;p=0.01), respectively. The predictive score was $[(0.75 * \text{aVR sign}) + (0.04 * \text{Tpec dispersion}) + (1.07 * \text{maximum Tpec duration} \geq 115 \text{ msec}) + (0.06 * \text{wide QRS complex in lead V2})]$, with area under the curve of 0.963. A cut-point of 2.10 indicated risk of ICD therapy with sensitivity and specificity of 81.7% and 97.8%, respectively.

Conclusion: Our novel predictive score showed excellent discrimination to predict the first appropriate ICD therapy in symptomatic Brugada syndrome patients in Thailand population.

Triggers of Ventricular Fibrillation in Patients with Infero-Lateral J waves

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Objective: Infero-lateral J waves in the surface electrocardiogram (ECG) are associated with an increased risk of life-threatening ventricular arrhythmias. The objective of this study was to investigate the electrocardiographic and electrophysiological features of the onset of ventricular fibrillation (VF) in patients with infero-lateral J waves.

Materials and Methods: We retrospectively studied 28 premature ventricular contractions (PVCs) triggering VF that were observed in 22 patients (36 ± 16 years old, 19 male) with infero-lateral J waves. All patients survived recurrent VF episodes. A 12-lead ECG morphology of VF-triggering PVCs was documented in all patients.

Results: Location of J-point elevation at baseline was inferior wall only in 7, lateral wall only in 3, and infero-lateral in 12 patients. The VF-triggering PVCs exhibited right bundle branch block configuration in 21 (75%), superior axis deviation in 25 (89%), various QRS duration (range 114 - 204 ms), and various coupling interval (range 250 - 374 ms). Endocardial ablation eliminated PVCs in 7 patients. One patient had PVCs that were not successfully ablated endocardially and were controlled by quinidine. Seven patients underwent epicardial mapping/ablation. Of these, VF-triggering PVCs were eliminated by ablation at the left ventricular (LV) postero-lateral epicardium in 5 and right ventricular (RV) inferior epicardium in 2 patients, where local abnormal electrograms recorded.

Conclusion: The initiation manner of VF in patients with infero-lateral J waves appears to have a heterogeneous electrocardiographic and electrophysiological characteristics. VF-triggering activities emanate from the LV as well as RV where possibly corresponds to the arrhythmogenic substrate.

Genetic Testing in Children with Brugada Syndrome: Results from a Large Prospective Registry

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Objectives: The aim of this study is to define the diagnostic yield of a wide gene panel with ACMG standardized variant classification in a large cohort of pediatric BrS. Furthermore, a correlation between the clinical outcomes and the genetic background of children with BrS in comparison with adult BrS is aimed.

Materials and Methods: All consecutive patients diagnosed with BrS, between 1992 and 2022 were enrolled in the UZ Brussel monocentric BrS registry. Inclusion criteria were: 1) BrS diagnosis; 2) Genetic analysis for BrS performed with a large gene panel and 3) classification of gene variants following current ACMG guidelines. Pediatric patients were defined if ≤ 12 years of age.

Results: A total of 452 BrS patients were included, 38 pediatric patients and 414 adult patients.

Among children with BrS, 17 patients (44.7%) had a P/LP variant (P+), all in SCN5A gene. No P/LP variants could be identified in 21 (55.3%) pediatric patients (P-). After a mean follow-up of 142.7 months, 3 children (7.9%) experienced a VA, treated with appropriate ICD shock. Inappropriate shocks occurred in 3 pediatric patients (7.9%).

At survival analysis, P- pediatric patients had higher VA free survival during the follow-up, compared with P+ pediatric patients. There was no difference in VA free survival between pediatric and adult BrS patients both without (P-) and with (P+) a P/LP variant.

Conclusion: In a large BrS cohort, the diagnostic yield for P/LP variants in the pediatric population is 44.7%. P+ children with BrS have a worse arrhythmic prognosis.

Clinical Values of Placing Higher Intercostal Leads in Brugada syndrome : Insights from SADS-TW Registry

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OBJECTIVES

Diagnosis of Brugada syndrome (BrS) is based on type 1 morphology (Coved type) in standard intercostal spaces (4th ICS) or higher intercostal spaces (2nd or 3rd ICS). We aimed to investigate the diagnostic accuracy of the higher intercostal leads in Taiwanese population and clarify if there is any difference in clinical presentations, genetic mutation or prognosis.

MATERIALS AND METHODS

Patients enrolled in Sudden Arrhythmic Death Syndrome- Taiwan registry from 2010/01/01 to 2021/07/30 were retrospectively reviewed. 163 patients were enrolled if their ECGs of V1, V2 in 2nd, 3rd and 4th ICS showed type 1 Brugada pattern in at least ≥ 1 leads. Baseline characteristics, clinical presentations, SCN5A mutation status, cardiovascular mortality were analyzed.

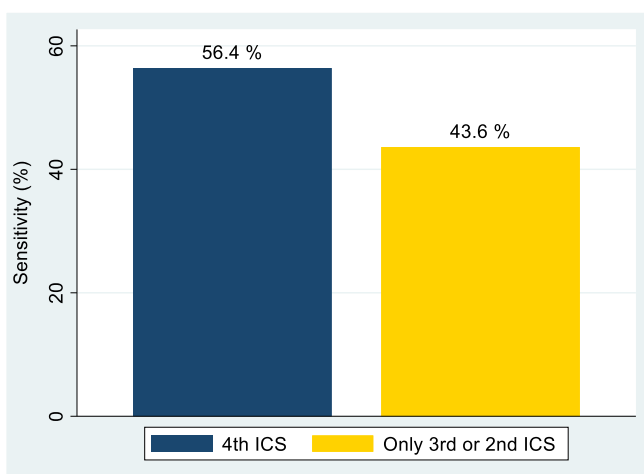
RESULTS

When applied standard leads (V1-2 in 4th ICS) alone, 56.4% patients could be diagnosed of BrS, the remaining 43.6% patients were only diagnosed by higher leads (V1-2 in 2nd or 3rd ICS). The mean age of the patients diagnosed by higher intercostal leads was younger compared to the patients diagnosed by standard leads (42.2 ± 14.7 year-old vs. 46.8 ± 14.6 year-old, $p = 0.048$). 27.2% of patients diagnosed by standard leads had hypertension, compared to 4.2% patients diagnosed by higher intercostal leads ($p < 0.001$). No any difference was observed in clinical presentation, positive family history, SCN5A mutation or mortality (mean follow up time = 3.96 ± 3.45 years, $p = 0.211$) between the two groups.

CONCLUSION

Higher intercostal leads (V1-2 in 2nd and 3rd ICS) could significantly increase diagnosis rate (43.6%) in Taiwanese BrS population although it could not affect clinical prognosis.

SUPPORTING DOCUMENTS



Graph.1 Diagnosis Rate of stander intercostal leads (4th ICS) and only higher intercostal leads (3rd and 2nd ICS)

	Lead V1, V2 in 4 th ICS (n=92)	Lead V1, V2 only in 2 nd or 3 rd ICS (n=71)	P-value
Age – yr	46.8 ± 14.6	42.2 ± 14.7	0.048
Male Sex – no. (%)	80 (87.0%)	64 (90.1%)	0.53
Body height – cm	169.6 ± 1.5	168.4 ± 0.8	0.45
Body weight – kg	64.4 ± 1.4	65.2 ± 1.6	0.93
Hypertension - no. (%)	25 (27.2 %)	3 (4.2 %)	<0.001
Diabetes mellitus - no. (%)	8 (8.7 %)	2 (2.8 %)	0.121
Hyperlipidemia - no. (%)	21 (22.8 %)	8 (11.2 %)	0.056
Coronary artery disease - no. (%)	16 (17.4 %)	7 (9.9 %)	0.171
Family history of syncope, SCD or BrS - no. (%)	27 (29.3 %)	26 (36.6 %)	0.326
Presentation			0.785
asymptomatic - no. (%)	36 (39.1%)	27 (38.0%)	
palpitation - no. (%)	11 (12.0%)	11 (14.5%)	
chest discomfort - no. (%)	19 (20.7%)	19 (26.8%)	
dyspnea - no. (%)	2 (2.8%)	0 (0%)	
syncope - no. (%)	13 (14.1%)	8 (11.2%)	
seizure - no. (%)	2 (2.8%)	0 (0%)	

sudden death, VT, VF - no. (%)	9 (9.8%)	6 (8.5%)

Table 1 Baseline Characters

	Lead V1, V2 in 4th ICS (n=83)	Lead V1, V2 only in 2nd or 3rd ICS (n=57)	P- value
Genetic Test			
SCN5A mutation positive	17 (20.5%)	9 (15.8%)	0.483
BrS- associated genes : Pathogenic or Likely Pathogenic	33 (39.8%)	26 (45.6%)	0.475

Table 2 Genetic Mutation

	Lead V1, V2 in 4th ICS (n=92)	Lead V1, V2 only in 2nd or 3rd ICS (n=71)	P-value
CV events -no. (%)	16 (17.4%)	7 (9.9%)	0.171
All-cause death - no. (%)	2 (2.2%)	0 (0%)	0.211

Table 3 Outcome

Left Coronary Cusp Ablation For Epicardial Substrates Of Left Ventricular Summit Arrhythmia

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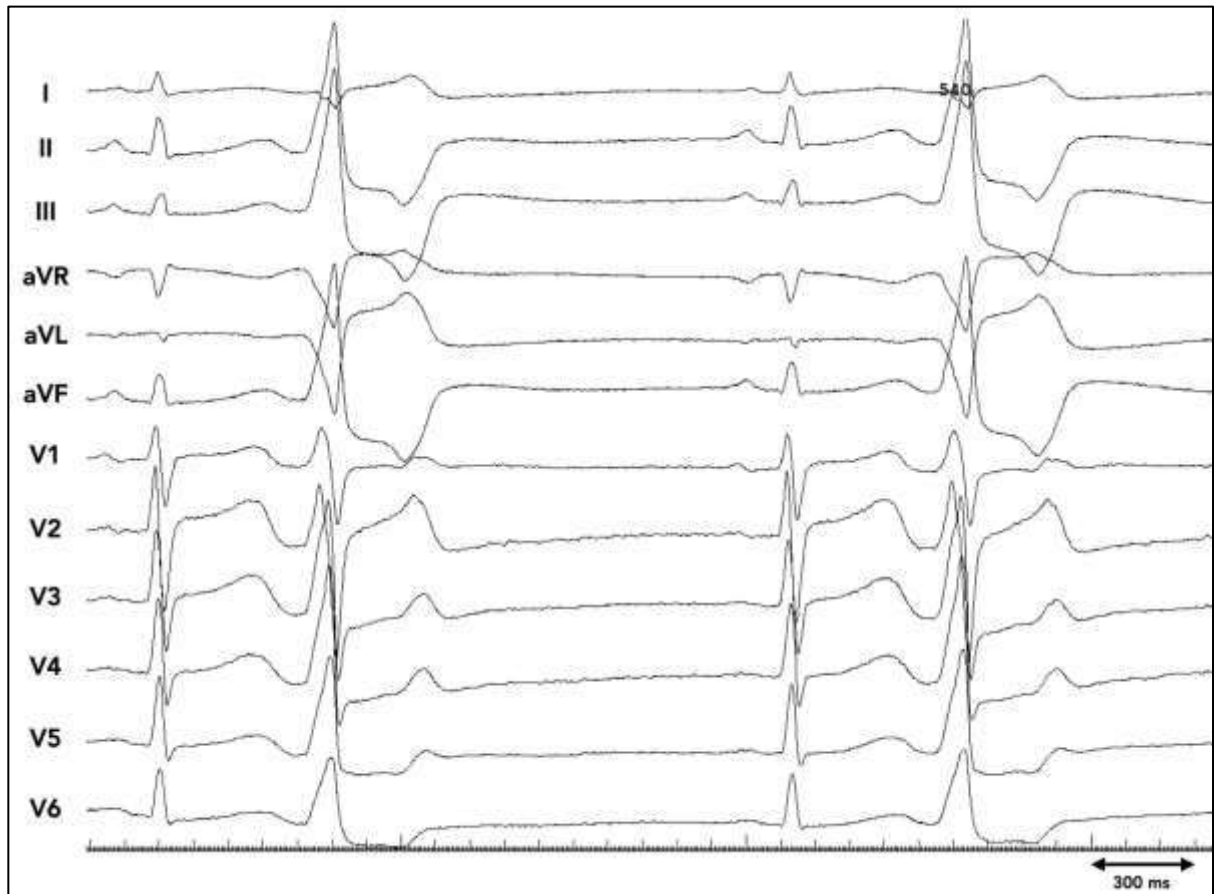
Objective To prove that epicardial substrates in LV summit region could be modified and eliminated transmurally from radiofrequency ablation at the left coronary cusp.

Materials and Methods A 44-year-old man without structural heart diseases was referred for catheter ablation of symptomatic frequent premature ventricular contraction (PVC) manifested as single morphology without salvos of ventricular tachycardia. Twelve-lead electrocardiographic features were suggestive of epicardial LV summit origin in the vicinity of anterior interventricular vein (FIGURE 1). Left ventricular outflow tract mapping was performed by using 8-Fr 3.5-mm irrigated tip, 1-6-2 mm interelectrode spacing, bidirectional ablation catheter under retrograde transaortic approach.

Results Distal bipolar electrode recorded local abnormal ventricular activities (LAVA) at basal margin of the left coronary cusp approximately 11 mm below the left main coronary ostium both during PVC and sinus rhythm. LAVA was the earliest signals during PVC displaying as high frequency low-amplitude potentials distinct from far-field ventricular electrogram 33 ms preceding QRS onset (FIGURE 2 and 3). Pacing with variable output failed to capture QRS complex. Radiofrequency energy application at this site acutely terminated and suppressed PVC. LAVA during sinus rhythm was completely abolished after successive attempts of RF energy applicataion (FIGURE 4 and 5) above and below the left coronary cusp. PVC eventually became non-inducible.

Conclusion Epicardial LAVA in the LV summit can be mapped and completely eradicated by using a single catheter approach at the left coronary cusp with measurable procedural endpoints.

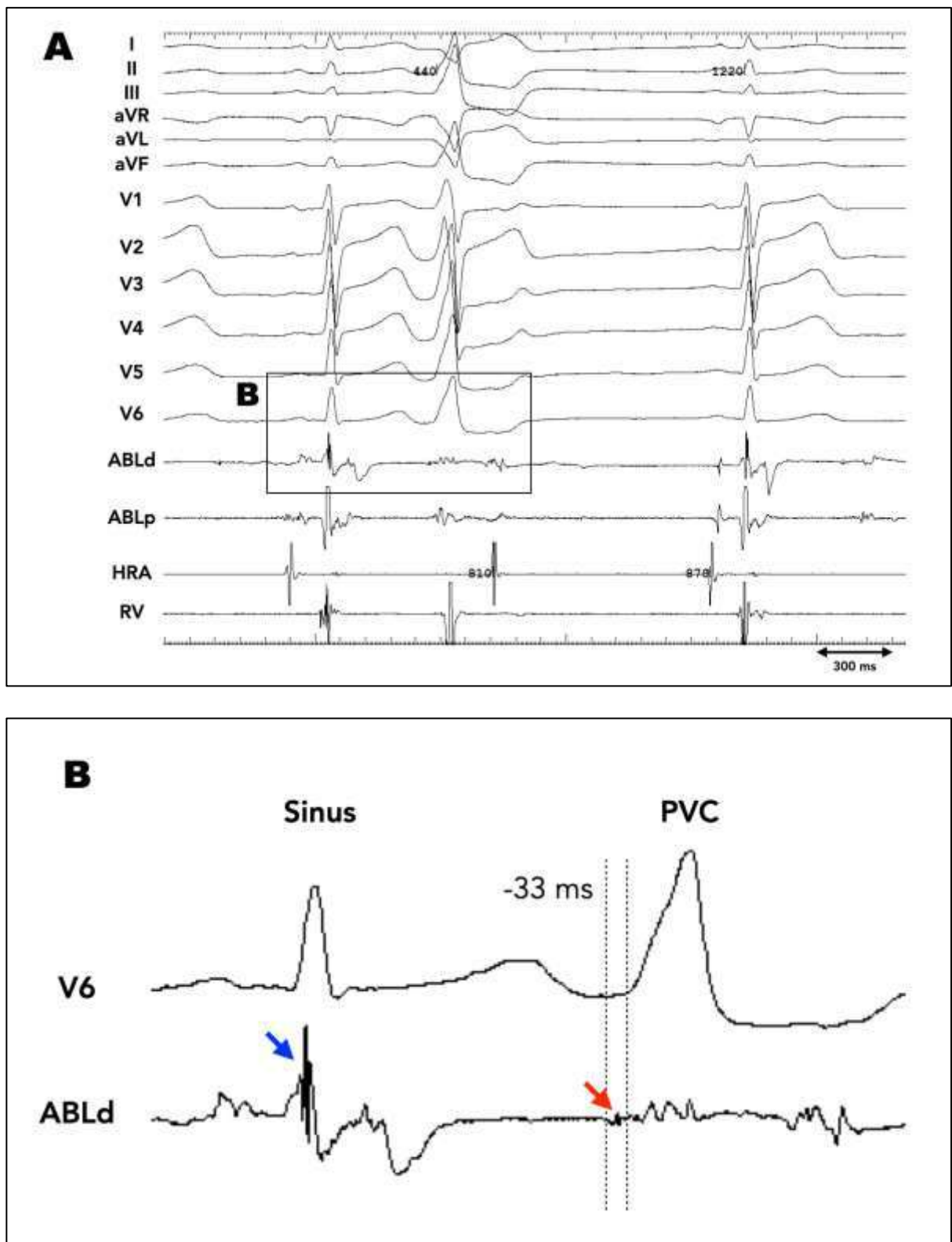
FIGURE 1



Twelve-lead electrocardiogram demonstrated sinus rhythm with PVC in bigeminal pattern. PVC displayed QRS duration of 138 ms, rightward inferior axis, rS pattern in lead V1 with R/S ratio of 0.67, precordial R/S transition in lead V3, R wave pattern break in lead V2 (R/S ratio = 0.54), QS morphology in lead I with steep notch on the downstroke deflection, absence of Q wave in inferior leads, delayed time to maximum deflection of 85 ms in lead II, MDI = 0.61 in precordial leads and Q wave ratio of 1.57 in lead aVL/aVR. All surface electrocardiographic features of PVC were consistent with apical site of epicardial LV summit origin in the vicinity of anterior interventricular vein (inaccessible area).

MDI = maximum deflection index; PVC = premature ventricular contraction.

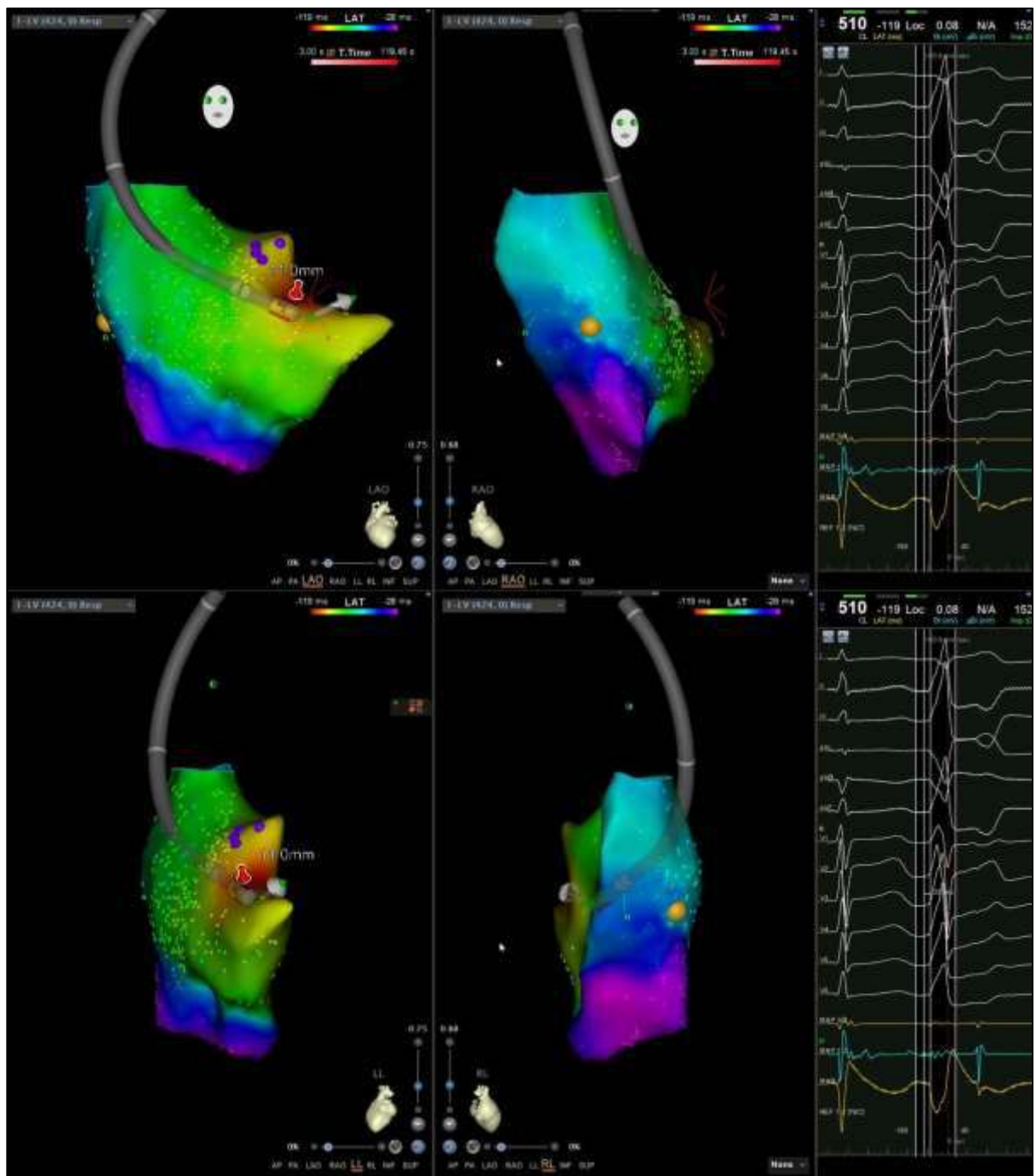
FIGURE 2



A. Distal bipolar electrode of 3.5-mm irrigated tip ablation catheter, 1-6-2 mm interelectrode spacing, placed at basal margin of the left coronary cusp recorded LAVA both during sinus rhythm and PVC. **B.** LAVA was the earliest signal during PVC displaying as high frequency low-amplitude potentials distinct from far-field ventricular electrogram 33 ms preceding QRS onset (red arrow) and initial fractionated signal buried in the far-field ventricular potentials during sinus rhythm (blue arrow).

ABLd = distal bipolar electrode of ablation catheter; ABLp = proximal bipolar electrode of ablation catheter; HRA = high right atrial catheter; LAVA = local abnormal ventricular activities; RV = right ventricular apex catheter.

FIGURE 3

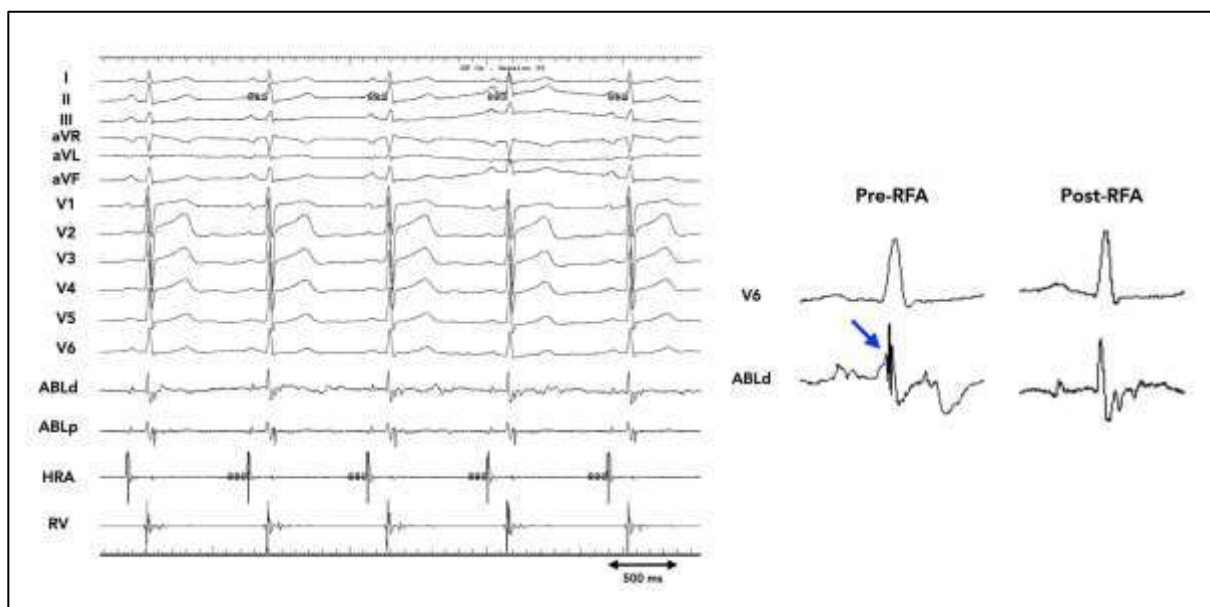


Three-dimensional activation mapping of clinical PVC with manual LAVA signal annotation at the left ventricular outflow tract, right coronary cusp, noncoronary cusp and left coronary cusp in the right/left anterior oblique and right/left lateral projections. LAVA recorded at basal margin of the left coronary cusp approximately 11 mm below left main coronary ostium was the earliest

activation signal preceding QRS onset by 33 ms with sharp QS complex on the unipolar electrogram.

purple tag = left main coronary ostium; yellow tag = His potentials; LAO = left anterior oblique; LL = left lateral, MAP = unipolar recording of the ablation catheter; MAP 1-2 = distal bipolar electrode of the ablation catheter; MAP 3-4 = proximal bipolar electrode of the ablation catheter; RAO = right anterior oblique; RL = right lateral; Other abbreviations as in FIGURE 1.

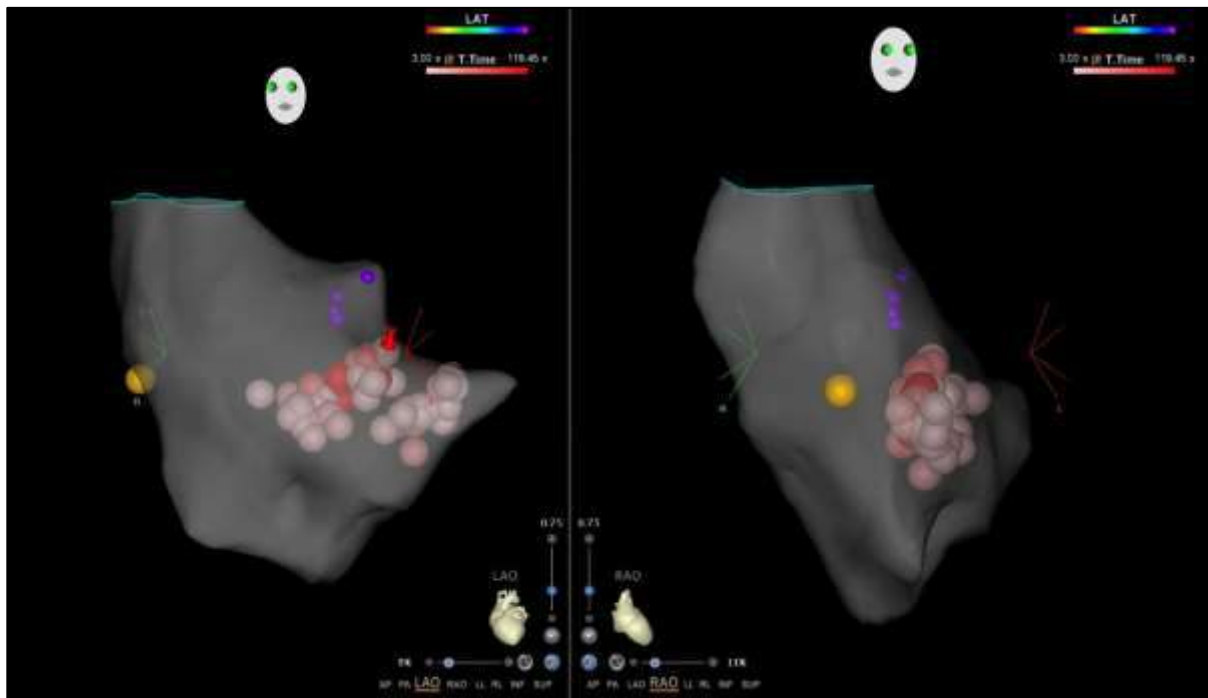
FIGURE 4



Surface electrocardiogram and intracardiac electrogram after successive attempts of radiofrequency energy application on the LAVA site, above and below the left coronary cusp. PVC disappeared and became non-inducible. Initial fractionated signal buried in the far-field ventricular potentials during sinus rhythm (blue arrow) before ablation was completely eradicated.

Pre-RFA = before radiofrequency ablation; Post-RFA = after radiofrequency ablation; Other abbreviations as in FIGURE 1 and 2.

FIGURE 5



Three-dimensional electroanatomical mapping in left and right anterior oblique projections revealed all 35 ablation sites both above and under the left coronary cusp. Radiofrequency energy was delivered by using power-controlled mode with temperature limit at 50°C (power 30-35 W, 60-120 seconds, local impedance 155-186 ohms, impedance drop not greater than 10%).

purple tag = left main coronary ostium; red pin = successful ablation site; yellow tag = His potentials.

Mid to Long Term Outcome of Left Versus Right-sided Ventricular Ectopic/Tachycardia Ablation

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¹NHCS, Singapore

OBJECTIVES

This study aims to compare outcomes of left versus right-sided ventricular ectopic (PVC) or ventricular tachycardia (VT) following acutely successful ablation.

METHODS

245 patients (117 left-sided) who underwent PVC/VT ablation since 2018 were prospectively included. Patients were categorized into either Left or Right-sided PVC/VT depending on the earliest local activation on intracardiac electrogram or substrate mapping. Primary outcome was all-cause mortality. Secondary outcome included 1-year arrhythmia recurrence.

RESULTS

Patients with left-sided PVC/VT were more likely older, males with diabetes, hypertension, hyperlipidemia, ischemic or valvular heart disease, lower LVEF, prior ICD implantation, on antiarrhythmic drugs, as well as VT as indication for ablation (all $P < 0.001$).

In-hospital mortality was 1.6% and 5.3% at 1-year. Left-sided ablations were associated with higher complications ($P = 0.002$), 3-month ($p = 0.01$) and 1-year mortality ($P = 0.016$) but not in-hospital mortality ($P = 0.051$). Overall 1-year recurrence rate was 10.1% which was not significantly different. On univariate analysis, left-sided origin, age, hypertension, prior MI, VHD, prior ICD, longer radiofrequency, procedure and fluoroscopy time were associated with 1-year mortality, but was not significant on multivariate analysis. Mitral valve prolapse (MVP) was associated with higher 1-year arrhythmia recurrence (OR 6.24; 95%CI 1.51 – 25.83, $P = 0.012$) on multivariate analysis.

CONCLUSION

Patients undergoing left-sided PVC/VT ablations were expectedly at higher risk of complications with a trend towards increased in-hospital mortality due to underlying comorbidities. However, long term success is comparable to right-sided ablations. Further studies are required to evaluate MVP as a predictor for PVC/VT recurrence in context of possible underlying malignant MVP syndromes.

Table 1: Outcomes

Variables	Total (n = 245)	Right-sided (n=128)	Left- sided (n = 117)	p- value
In-hospital all-cause mortality	4	0	4	0.051
Complication (%)	8	0	8	0.002
- Cardiac tamponade			4	
- New AV Block			1	
- Inadvertent RV puncture (epicardial approach)			1	
- APO			1	
- Stroke			1	
3-month all-cause mortality (%)	4	0	4	0.01
Variables	Total (n = 188)	Right-sided (n= 95)	Left- sided (n = 93)	p- value
1-year all-cause mortality (%)	10	1	9	0.016
Recurrent symptoms (%)	31	21	11	0.095
Recurrence of arrhythmia (%)	19	12	7	0.143
Redo ablation	3 (9.7)	2 (0.0)	1 (29.2)	0.530

Impact of novel double-balloon technique for epicardial ventricular arrhythmias refractory to conventional chemical ablation.

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Objective: Ethanol injection to the coronary vein (CV) (EICV) has become alternative options to the refractory ventricular arrhythmias (VA) to the conventional ablation. However, some would be also refractory to the EICV, because of the anatomical limitation that the culprit lesion should have the CV which can be cannulated and without collateral flows bypassing ethanol.

We investigated the feasibility of the alternative EICV using double balloon technique (Heart rhythm 2020;17: 2126-34) to the VA without optimal CV.

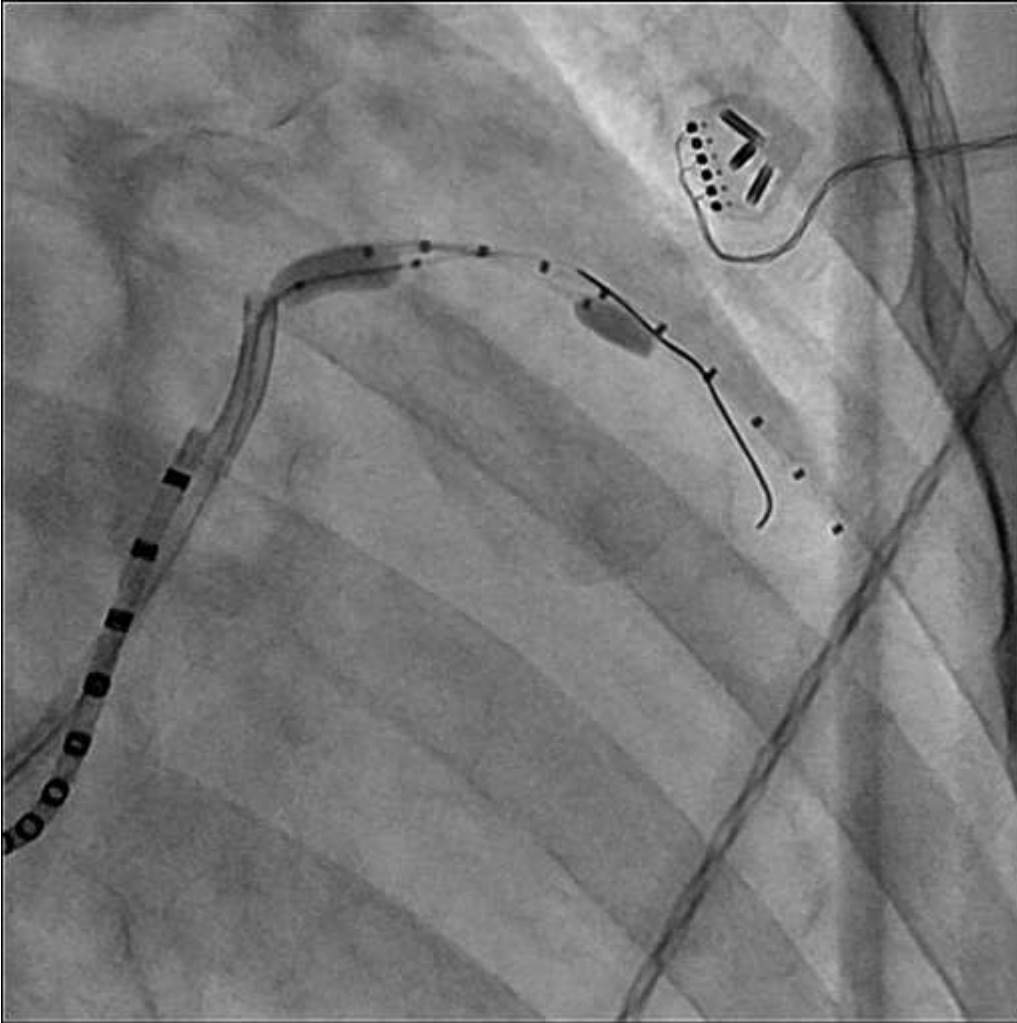
Methods: VA in 4 patients originated from left ventricular (LV) summit and 1 patient from apical epicardium.

All patients who were refractory to RFCA were considered to treat with EICV. However, all patients had rich collateral branches which drained ethanol away off in anterior interventricular vein (AIV) or mid-cardiac vein (MCV), which suggested we could not perform EICV by using conventional methods. We placed two balloons in tandem where the culprit site, and injected the ethanol between both balloons. We injected 10ml of an ethanol in each patient.

Result: The median observation period was 185.6±217.0 days, and VA in 4 out of 5 patients cured. We experienced no harmful adverse event during all through the procedures.

Conclusion: The double-balloon technique for VAs might be effective that were refractory to conventional EICV.

SUPPORTING DOCUMENTS



Effects of Ablation on Right Ventricular Function in Right Ventricular Outflow Tract Premature Ventricular Complexes

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¹*Yongin Severance Hospital, Yonsei University, Yongin, South Korea*, ²*Severance Hospital, Yonsei University, Seoul, South Korea*, ³*Gangnam Severance Hospital, Yonsei University, Seoul, South Korea*

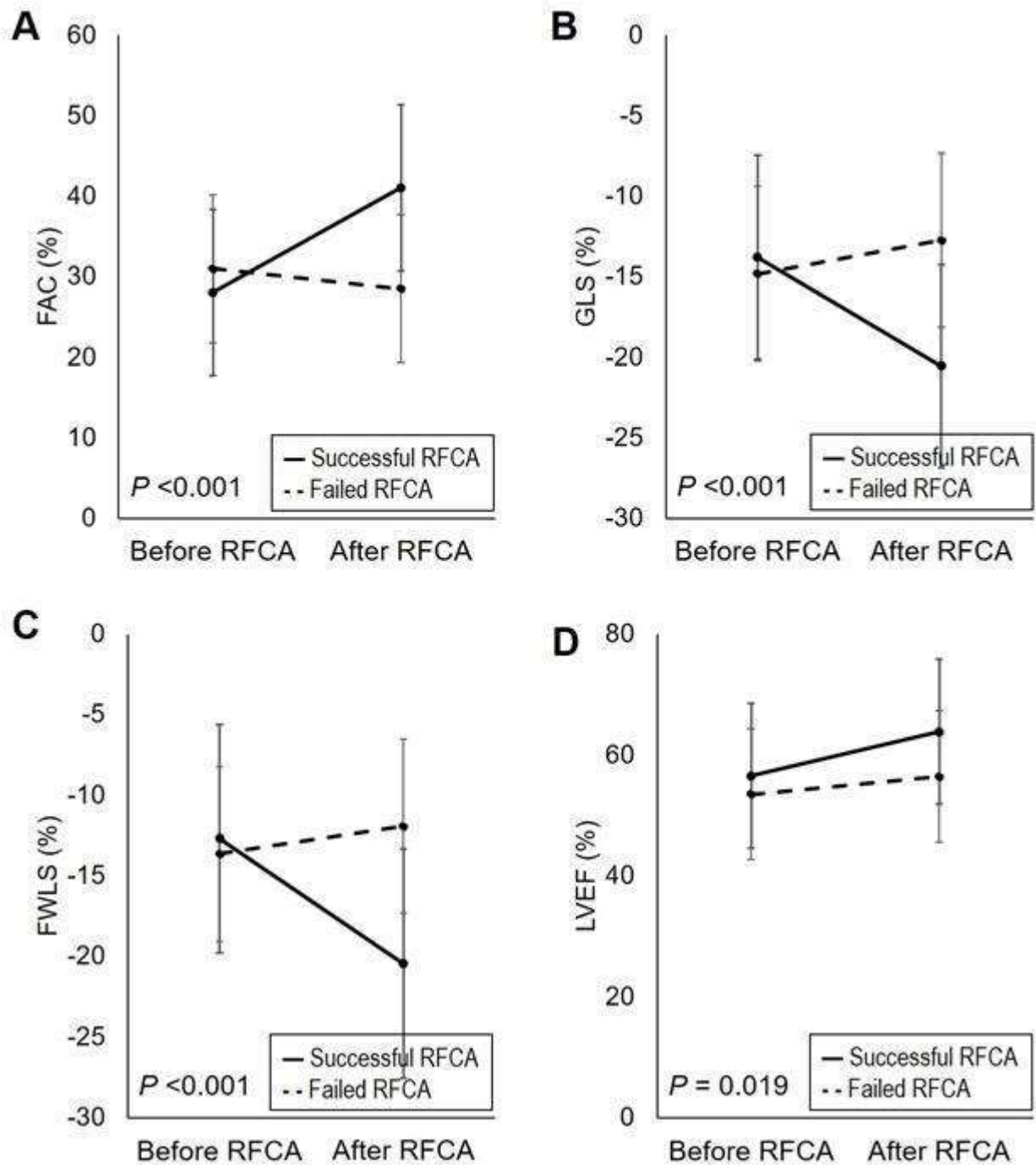
Background: The relationship between the presence of premature ventricular complexes (PVCs) and right ventricular (RV) dysfunction, and the effects of radiofrequency catheter ablation (RFCA) on RV function are unknown.

Methods: A total of 110 patients (age, 50.8 ± 14.4 years; 30 men) without structural heart disease who had undergone RFCA for RV outflow tract (RVOT) PVCs were retrospectively included. RV function was assessed using fractional area change (FAC) and global longitudinal strain (GLS) before and after RFCA. Clinical data were compared between the RV dysfunction ($n = 63$) and preserved RV function ($n = 47$) groups. The relationship between PVC burden and RV function was analyzed. Change in RV function before and after RFCA was compared between patients with successful and failed RFCA.

Results: PVC burden was significantly higher in the RV dysfunction group than in the preserved RV function group ($P < .001$). FAC and GLS were significantly worse in proportion to PVC burden ($P < .001$ and $P < .001$, respectively). The risk factor associated with RV dysfunction was PVC burden [odds ratio (95% confidence interval), 1.092 (1.052–1.134); $P < .001$]. Improvement in FAC ($13.0 \pm 8.7\%$ and $-2.5 \pm 5.6\%$, respectively; $P < .001$) and GLS ($-6.8 \pm 5.7\%$ and $2.1 \pm 4.2\%$, respectively; $P < .001$) was significant in the patients with successful RFCA, compared to the patients in whom RFCA failed.

Conclusions: Frequent RVOT PVCs are associated with RV dysfunction. RV dysfunction is reversible by successful RFCA.

SUPPORTING DOCUMENTS



Short-term and Long-term Effects of Noninvasive Cardiac Radioablation for Ventricular Tachycardia

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³Washington University, St Louis, United States

Objective: Noninvasive cardiac radioablation is reported to be effective and safe for the treatment of ventricular tachycardia (VT). This study aimed to analyze the acute and long-term effects of VT radioablation.

Methods: Patients with intractable VT or premature ventricular contraction (PVC)-induced cardiomyopathy were included in this study and treated using a single-fraction 25 Gy dose of cardiac radioablation. To quantitatively analyze the acute response after treatment, continuous electrocardiography monitoring was performed from 24-hour before to 48-hour after irradiation and at the 1-month follow-up. Long-term clinical safety and efficacy were assessed one year follow-up.

Results: From 2019 to 2020, six patients were treated with radioablation for ischemic VT (n=3), non-ischemic VT (n=2), or PVC-induced cardiomyopathy (n=1). In the short-term assessment, the total burden of ventricular beats decreased by 49% within 24-hour after radioablation and further decreased by 70% at 1-month. The VT component decreased earlier and more dramatically than the PVC component (decreased by 91% and 57% at 1-month, respectively). In the long-term assessment, five patients showed complete (n=3) or partial (n=2) remission of ventricular arrhythmias. One patient showed recurrence at 10-month, which was successfully suppressed with medical treatment. The post-treatment PVC coupling interval was prolonged (+38 msec at 1-month). Ischemic VT burden decreased more markedly than non-ischemic VT burden after radioablation.

Conclusion: In this prospective phase I/II study of 6 patients, without a comparison group, cardiac radioablation appeared to decrease intractable VT burden. A therapeutic effect was apparent within 1–2 days after treatment but was variable by etiology of cardiomyopathy

Characteristics of pulmonary sinus cusp reentrant VT in structurally normal heart

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OBJECTIVES

To identify characteristics of Supraventricular reentrant VT in structurally normal heart

MATERIALS AND METHODS

18 consecutive patients with idiopathic outflow tract VPC/VT were analyzed. RV and pulmonary cusp angiography were done to precisely localize pulmonary valve and pulmonary sinus cusp. Activation mapping and entrainment mapping was performed above and below the valve whenever possible.

RESULTS

In 16 patients' activation and pace mapping identified earliest activation site below the pulmonary valve and ablation there eliminated the VPCs. In 2 patients earliest activation site was below the pulmonary valve (55 ms and 46 ms earlier than QRS onset) but ablation there was failed. Pleomorphic QRS morphology was also identified in both of these patients. Mapping of supraventricular pulmonary sinus cusp with reverse U curve on ablation catheter was done, mid diastolic signals were noted and concealed entrainment was seen. Ablation there made the arrhythmia non inducible in both these patients. Pleomorphic QRS morphology and failure of ablation at sufficiently early site may give a clue to reentry at remote site

CONCLUSION

Pulmonary sinus cusp reentry can be identified and ablated in structurally normal hearts by reverse U curve in ablation catheter

SUPPORTING DOCUMENTS

Figure 1

VT induced showed pleomorphic QRS morphology

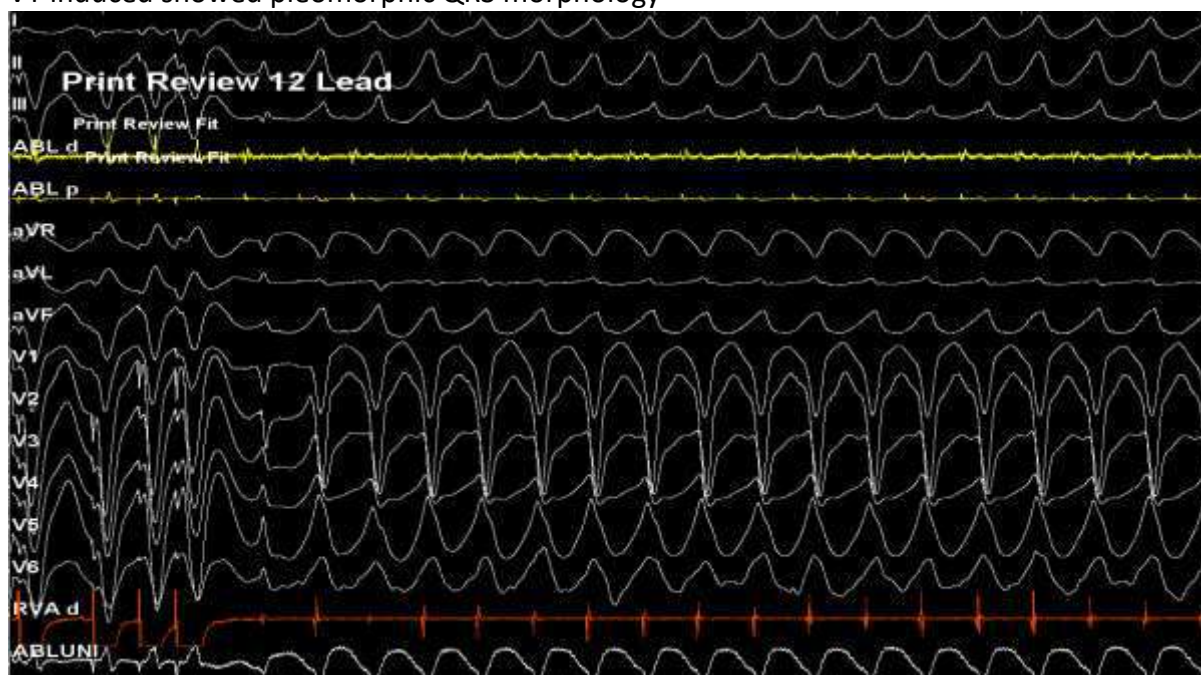


Figure 2

Concealed entrainment at supraventricular left pulmonary cusp



Figure 3
Reverse U curve at left pulmonary cusp



Does High Density Mapping Improve the Efficacy of Ablation of Papillary Muscle Arrhythmias?

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BACKGROUND and OBJECTIVE: The ablation of premature ventricular contractions (PVCs) originating from the papillary apparatus presents unique challenges related to complex anatomy with multiple papillary heads and chordae, with relatively higher rates of recurrence. The objective is to understand the impact of high density (HD) activation mapping on the efficacy of ablation procedures of PVCs originating from the papillary apparatus.

METHODS:

From 10/25/18 to 11/17/21, there were 39 consecutive ablations performed in 36 patients for PVCs originating from the papillary apparatus (29 posteromedial, 10 anterolateral) performed at a single center. A control group (15 cases) was compared against a study group (24 cases) with HD mapping. HD mapping was defined as using the Advisor HD Grid (20 cases) and Pentaray (4 cases) mapping catheters.

RESULTS:

The average age was 71 +/- 13 years, with 10 females (25.6%), LVEF of 48% +/- 12, and an average pre-procedure PVC burden of 25.5% +/- 12.6. HD mapping was associated with better procedural success at 3 months post-ablation when comparing study to control groups (78.8%, 14/18 vs 53.3%, 8/15; p = 0.005). There was no statistically significant difference in acute procedural success (91.3%, 21/23 vs 87.5%, 12/15; p = 0.08). There were no complications in either arm.

CONCLUSION:

HD mapping is safe to use in ablation of PVCs originating from the papillary apparatus and is associated with a better three-month ablation outcome when compared to traditional methods. This may be related to more accurate identification of the site of origin and lesion placement.

A Case of Recurrent Ventricular Tachycardia in Methamphetamine-associated and Ischemic Cardiomyopathy

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OBJECTIVES

We present a case of an elderly male with amphetamine use presenting with acute coronary syndrome and recurrent ventricular tachycardia who underwent successful revascularization and eventual implantable cardioverter-defibrillator placement.

RESULTS

A 66-year old male, hypertensive, smoker with a history of chronic amphetamine abuse presented to the emergency room with sudden dyspnea. Electrocardiogram showed anterior and inferior wall ST-elevation myocardial infarction for which he underwent coronary angiogram showing one vessel disease and percutaneous transluminal coronary angioplasty with stenting of left anterior descending artery. He eventually developed monomorphic ventricular tachycardia with right bundle branch block morphology necessitating electrical cardioversion and went into cardiogenic shock. Subsequent coronary angiogram showed patent stents. Urinary toxicology for methamphetamine was positive. Echocardiography showed dilated left ventricle with reduced systolic function (25%). He underwent intra-aortic balloon pump and temporary pacemaker insertion for overdrive pacing. He was eventually weaned off from mechanical ventilation, inotropic and mechanical circulatory support and discharged improved on guideline-directed medical therapy.

A month later, he presented at the ER for chest heaviness. ECG showed old anteroseptal wall infarct. CA showed patent stents. Myocardial perfusion scintigraphy showed scarred myocardium in the apex, apical and midventricular inferior segments. He had recurrence of monomorphic VT. He then underwent successful single lead ICD implantation and was sent home improved and stable.

CONCLUSION

Methamphetamine-associated cardiomyopathy leads to severe systolic function, left ventricular dilation, enhanced atherosclerotic plaque formation and susceptibility to cardiac arrhythmias. ICD implantation is valuable in preventing sudden death in patients with sustained ventricular tachycardia.

Intra Aortic Balloon Pump as Bridging Therapy in Acute Myocardial Infarction Complicated with Ventricular Storm

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OBJECTIVES

The objective is to report a case of a patient with acute anterior extensive STEMI complicated with incessant ventricular arrhythmia who is intolerant of antiarrhythmic drug during acute period.

MATERIALS AND METHODS

A 40-year-old male was referred from rural hospital with late onset acute anterior extensive STEMI complicated with cardiogenic shock. Previously he had an unstable ventricular tachycardia (VT) and converted with electrical cardioversion. He was referred with reduced left ventricular function and unstable hemodynamic.

The patient underwent urgent revascularization, however VT storm occurred, and electrical cardioversion was performed multiple times. More challenges occurred when he could not tolerate amiodarone as well as heart failure medication pillars even after hemodynamic improved. Catheter ablation strategy was also considered, however considering its efficacy and risk in this scenario a decision to optimize medical approach was justified.

A decision to use Intra Aortic Balloon Pump (IABP) as bridging therapy was made. After the IABP insertion, hemodynamic condition was improved, and the patient can tolerate heart failure and antiarrhythmic medication better. After 5 days, the IABP was removed, and no more significant arrhythmias found during follow up.

RESULTS

In this case, the use of IABP as bridging therapy to tolerate medication better by improving hemodynamic condition is justified with good clinical outcomes. The patient can tolerate medication better and arrhythmias were dissolved.

CONCLUSION

Management strategy for ventricular storm during acute myocardial infarction is limited. IABP is an alternative solution as bridging therapy to improve patient's tolerability in unstable hemodynamic condition.

SUPPORTING DOCUMENTS

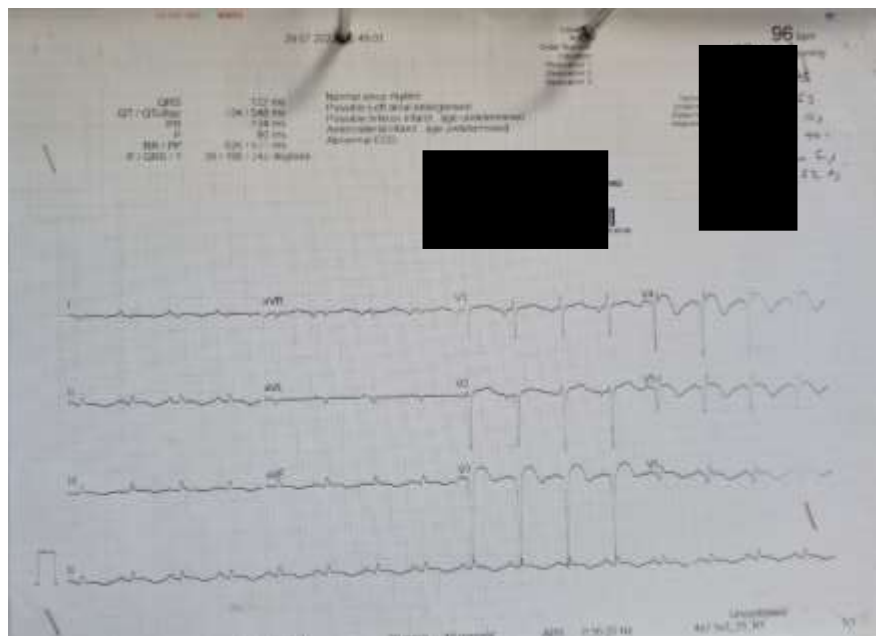


Figure 1. ECG on Admission shows ST elevation in V3-V6

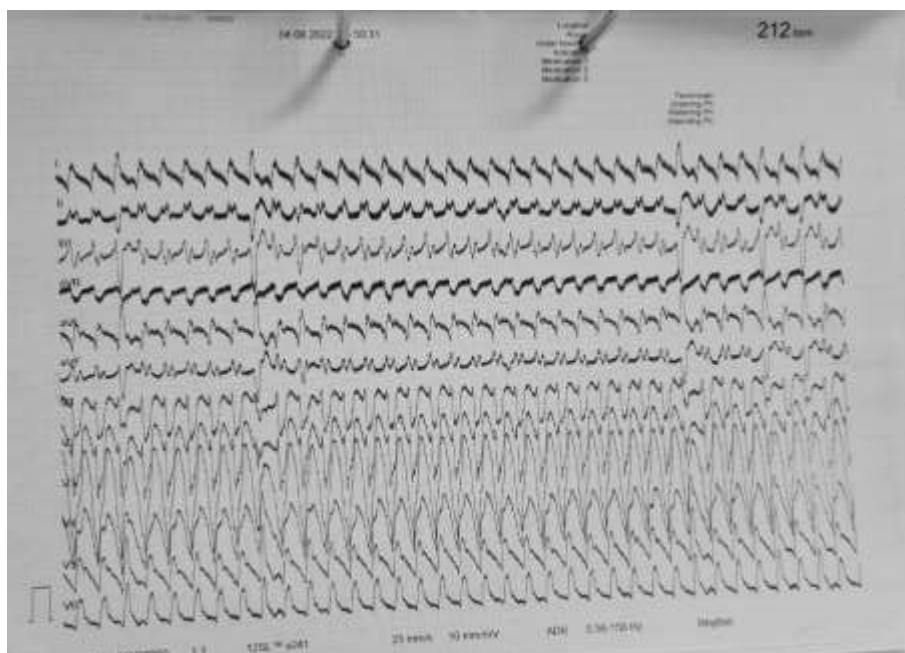


Figure 2. VT in ICU

Conduction Abnormality Associated with Abrupt Change in Paced-QRS Morphology in Scar-Mediated Ventricular Tachycardia

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Objectives:

An abrupt change in paced-QRS morphologies from poor to excellent match may be found at the critical isthmus of scar-mediated ventricular tachycardia (VT). We hypothesized that the abrupt change in pacemap morphology would be generated by conduction abnormality characterized as wavefront discontinuity in functional substrate mapping. The aim of this study was to investigate this hypothesis.

Material and Methods:

We retrospectively studied 15 patients (66±16 years, 13 male, 9 nonischemic) who underwent high-density substrate mapping and pace-mapping. Eighteen VTs whose critical sites were determined by direct termination during ablation (n=9) or pace-mapping findings (n=9) were assessed. The pacemap score between waveforms of VT and pace-mapping, stimulus to QRS interval (S-QRS), and conduction velocities along the presumed isthmus were evaluated.

Results:

Pace-mapping scores, which were obtained at two adjacent sites along the presumed isthmus, showed 94% (interquartile range [IQR] 88-97%) at the exit side and 45% (IQR 33-55%) at the adjacent entrance side. There was no significant difference in S-QRS interval at these sites (median 77 ms vs. 93 ms, p=0.30). Conduction velocity at the presumed isthmus was 0.11 m/sec (IQR 0.07-0.19 m/sec), which was significantly slow than that at areas of exit (0.43m/sec [IQR 0.18-0.83 m/sec]) and entrance (0.37 m/sec [IQR 0.24-0.69 m/sec]) (P<0.05 for both).

Conclusion:

Abrupt transition of pace-mapping morphologies appears to be observed across the area with a decent activation slowing and wavefront discontinuity in functional substrate mapping, which may facilitate targeted substrate ablation.

Quinine in place of Quinidine for Polymorphic VT Storm in Patients With Coronary Heart Disease

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Objectives:

To study whether Quinine is effective in place of Quinidine in patients with Coronary artery disease and polymorphic Ventricular Tachycardia (VT) storm without active Ischemia when they turn out refractory to usual agents. Quinidine is unavailable in many countries. Quinine is an optical isomer of Quinidine, and has similar effects on conduction time but doesn't prolong epicardial repolarization time or ventricular refractoriness.

Methods:

Quinine was administered in patients with Polymorphic VT storm triggered by short coupled PVCs, post-MI/ Revascularization beyond 48 hours, and without evidence of active ischemia. VT was refractory to at least beta-blocker, amiodarone, mexiletine, lidocaine, and Stellate ganglion blockade.

Results:

Total 4 patients who had Polymorphic VT storm triggered by short coupled PVCs, post-MI, and Revascularization beyond 48 hours were included in the study. All of them received four anti-arrhythmic drugs and had undergone stellate ganglion block. Quinine was added when all the above measures failed to suppress the electrical storm. All of them are male and had anterior wall myocardial infarction with a mean age of 52.75±4.27 years. Mean duration from post revascularization to onset of VT storm 72±33 hours. Mean time from onset of VT storm to initiation of quinine 24±4.8 hours and dose received 1275±150 mg/day. The mean time to attain electrical quiescence after initiation of quinine 67±6 hours. Three patients survived to discharge.

Conclusion:

Quinine is an effective alternative to Quinidine in Arrhythmic storm with recurrent polymorphic VT in patients with the coronary disease when other measures are failed.

Demographic characteristics and Treatment received

NO	Age (yrs)	Sex	Type of MI	Mode of revascularization	Territory involved	Time from revascularization MI whichever is last (hrs)	ECG					LV EF	Timing of Quinine initiation from VT storm	Time to Quiescence (hr)	Quinine dose (mg)	ICD Implant	RF Ablation	Discharge Status
							QRSd (ms)	QTc (ms)	PVC COUPLING INTERVAL (ms)	PVC MORPHOLOGY	PVC DURATION							
1	50	M	Anterior wall	CABG	LAD/RCA	120	80	450	320	Left posterior fascicle	110	29%	18hr	60	1200	YES	No	Alive
2	52	M	Anterior wall	PCI	LAD/RCA	52	70	433	300	Left posterior fascicle	120	24%	24hr	64	1200	YES	No	Alive
3	50	M	Antero-septal	CABG	LAD/LCx/RCA	48	90	462	280	Left posterior fascicle	120	23%	30hr	70	1200	YES	Yes	Alive
4	59	M	Antero-lateral	CABG	LAD/LCx	72	80	450	290	Left posterior fascicle	110	30%	24hr	74	1500	NO	No	Dead

Role of Percutaneous Stellate Ganglion Blockade in the treatment of Electrical Storm: Single Center Experience

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Objectives: To study the efficacy and outcomes of percutaneous stellate ganglion blockade (SGB) in the patients with drug-refractory electrical storm

Methods: The study included patients with a drug-refractory electrical storm. At least two anti-arrhythmic drugs(AAD) were given before SGB. Bupivacaine was injected in the vicinity of the stellate ganglion under Ultrasound guidance.

Results: A total of 73 procedures were performed on 52 patients (71% males, 60+6 years).82% (43/52) had ischemic heart disease. Nearly 69%(36/52) of patients were free from ventricular arrhythmias(VA) at 24 hours after GB and 53%(28/52) were arrhythmia free at 72 hours. Bilateral SGB was done in 16 patients who had failed left-sided SGB with a success rate of 37%. Heart failure and shock were documented in 65% and 57% respectively. Twenty Four (46%) patients were on both Intra-aortic balloon counterpulsation and inotrope support. All-cause mortality was 32% (17/52). Cardiovascular mortality was 28% (15/52). Septic shock in one patient and Ischemic brain stroke was the cause of death in the other patient. All patients who were arrhythmia free after 72 hours of SGB survived to discharge.VA recurrence, poor left ventricular ejection fraction, and failed stellate ganglion blockade were associated with increased mortality. Procedure-related complications like transient bradycardia(17%), hematoma(15%), hoarseness of voice(13%), persistent ptosis(6%), and monoparesis(6%) were noted, all of which were resolved within two weeks of post-procedure.

Conclusion: In patients with electrical storms SGB helps to stabilize them hemodynamically, and provides time for titration of the drugs. It acts as bridge therapy before radiofrequency ablation.

Impact of Interelectrode Spacing on Appearance of Functional Substrate Mapping in Scar-Related Ventricular Tachycardia

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Objective:

As the arrhythmogenic substrate of scar-related ventricular tachycardia (VT) often has three-dimensional nature, a detailed substrate mapping to assess conduction property on not only the surface of mapping chamber but also intramural myocardium is of importance to identify the ablation target. The objective of this study was to investigate the impact of interelectrode bipolar spacing on appearance of substrate map.

Material and Methods:

We retrospectively examined 9 patients (72±6 years, 8 males) who underwent ablation of scar-related VT. A high-density substrate mapping during sinus rhythm or ventricular paced rhythm was performed with a linear decapolar (1-mm electrode size and 2-8-2-mm interelectrode spacing) in all patients. The pattern of wavefront propagation in substrate mapping was compared between closely- and widely-spaced bipolar electrode maps (CEM and WEM [2-mm and 8-mm interelectrode spacing, respectively]).

Results:

Among 9 patients, 8 had substrate map depicting the area of activation slowing, wavefront discontinuity, and/or rotational activation pattern. Of these, one patient exhibited no difference between CEM and WEM. In two patients, wavefront propagation was identified in WEM at dense scar area but no obvious potential recorded in CEM. In five patients, WEM showed area with activation slowing that was generated by local fractionated continuous electrograms, where CEM showed wavefront discontinuity as characterized with less-fractionated split potentials.

Conclusion:

CEM that reduces a far-field effect in scar may demonstrate activation pattern at the mapping surface; however, WEM has a potential to serve as additional information to unveil intramural abnormal conduction at the area of interest.

Epicardial Access with CO₂ Insufflation: A Simplified Method Using Injection System Meant for Peripheral Intervention

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Background: Accidental right ventricular puncture is a common complication with “dry” percutaneous epicardial access. A method to reduce this is by creating a “safety buffer” between the pericardium and myocardium.

Objectives: We describe 4 patients who underwent VT ablation using pericardial carbon dioxide (CO₂) insufflation technique from March to July 2022. An automated CO₂ injection system meant for peripheral vascular intervention was used in 3 patients.

Methods: All patients were male (mean age: 52.5 +/- 17.8 years). Femoral venous access into the Coronary Sinus (CS) was obtained for 2 patients whereas right internal jugular vein was used in 1 patient. A decapolar catheter was inserted through a steerable sheath to cannulate the CS. The sheath was then advanced over the catheter which was removed prior to CS venogram. A coronary guidewire and microcatheter were used for intentional perforation of a distal CS branch. Epicardial access was confirmed with contrast injection. CO₂ was then injected into the pericardial space via a modified connecting tube from a dedicated injection system in 3 patients.

Results: Mean procedural time was 248.75 +/- 56.03 minutes. An average volume of 38.97 +/- 13.72cc of CO₂ was used. The illuminated epicardial space was accessed under fluoroscopy, and the initial guidewire exchanged to a deflectable sheath. The epicardial sheath was then connected to a negative pressure bottle for drainage, and the pericardial space was subsequently mapped. There was no procedural complication noted.

Conclusion: Insufflation of CO₂ into the pericardial space facilitates safe percutaneous epicardial access for VT ablation.

Ventricular Tachycardia Ablation in a Patient With Left Ventricular Assist Device

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OBJECTIVES

To understand the technical challenges in radiofrequency ablation (RFA) of ventricular tachycardia (VT) in a patient with left ventricular assist device (LVAD).

MATERIALS AND METHODS

A 28-year-old male presented with complaints of palpitations and was diagnosed with refractory VT (left bundle superior axis, cycle length 490 msec). He had previous history of mechanical prosthetic aortic valve replacement, severe left ventricular dysfunction and LVAD implantation (Heart Mate 3) one year before presentation. Antiarrhythmic medications at maximally tolerated doses and recurrent cardioversion could not revert the VT. In view of refractory VT and progressive right ventricular dysfunction, RFA was planned. On bridged heparin therapy, the ablation was done with Ensite/NavX guidance. To increase the left atrial pressure and maintain the left ventricle volume for ease of access and mobility of the catheters, the LVAD pump speed was reduced from 5000 RPM to 4000 RPM and the cardiac output was constantly monitored throughout procedure. The Transseptal access was obtained with fluoroscopy and transesophageal echocardiographic guidance, and entrainment and activation mapping were performed in the left ventricle. The earliest site of activation was on the septal aspect close to the LVAD inflow cannula and ablated successfully carefully avoiding catheter entrapment by use of fluoroscopy and recognition of contact artefacts.

RESULTS

The incessant VT (from arrhythmogenic substrate around the LVAD inflow cannula) was successfully ablated with no recurrence at 3 months of follow up.

CONCLUSION

Drug refractory, hemodynamically stable VT can be ablated in patients with LVADs with meticulous planning to avoid catheter entrapment.

EPICARDIAL VT ABLATION IN A PATIENT WITH DENSE PERICARDIAL ADHESIONS

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"Abstract submitted under supporting document"

INTRODUCTION:

Radiofrequency catheter ablation (RFCA) is the first-line therapy for treatment of drug refractory ventricular arrhythmias (VAs). Epicardial VT circuits may be ablate from the pericardial space or the coronary venous system.

CASE PRESENTATION:

A 35-year-old male with non-ischemic cardiomyopathy, with epicardial scar over lateral wall of left ventricle (cardiac MRI), presented with recalcitrant VT. PET imaging did not show any myocardial uptake. Previous Endocardial and epicardial mapping was unsuccessful and he was referred to our institution. Upfront subxiphoid pericardial access was obtained as the VT ECG revealed an epicardial origin. However, dense adhesions were encountered. We then engaged the coronary sinus (transfemoral medium curl, Agilis sheath, with 6F IMA catheter) and mapped the lateral tributaries where epicardial VT exit was suspected. Wire mapping (0.014" BMW wire) was performed as the target veins were too small to accommodate EP mapping catheters. Early electrograms were identified during clinical VT (activation mapping) and retrograde coronary venous ethanol ablation (RCVEA) was performed using a 1.25 x10mm OTW balloon with balloon occlusion (2 injections of 0.6 and 1ml absolute alcohol). No VT was induced after RCVEA.

CONCLUSION:

In the setting of pericardial adhesions, options include catheter-adhesiolysis or surgical dissection, both of which can have hemorrhagic complications. The coronary venous system offers excellent access to the LV myocardium, and catheter or wire mapping can be performed (based on vein size). We highlight the role of wire mapping and RCVEA in sites where traditional catheter access is challenging.

SUPPORTING DOCUMENTS

FIGURE A:

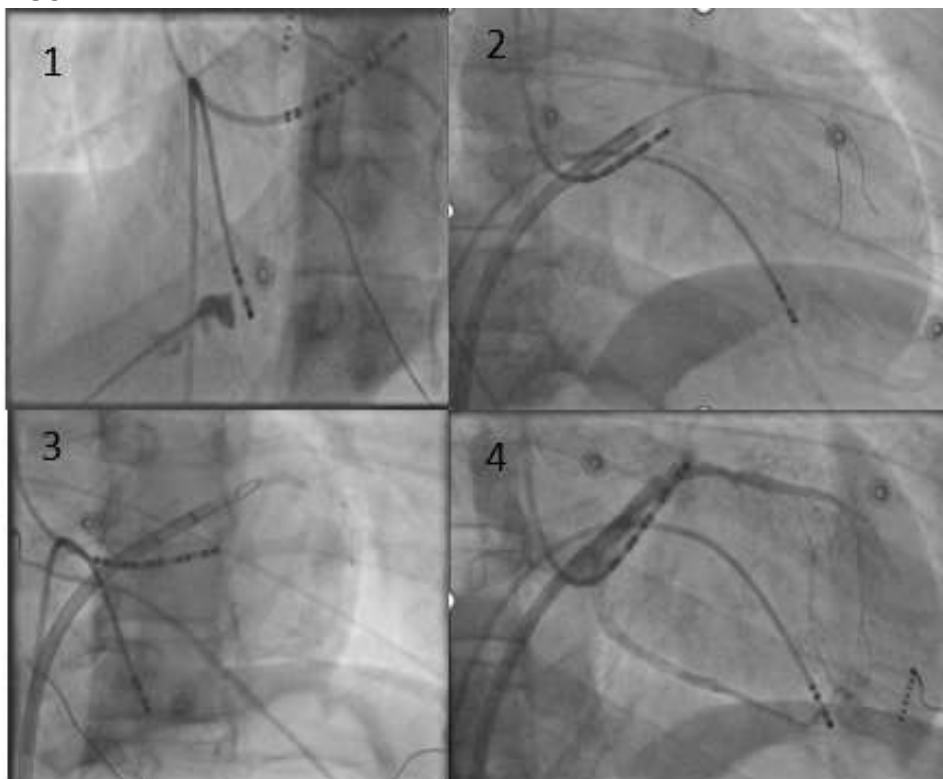


Figure A: The fluoroscopic images of the Alcohol ablation are shown. Image 1 Reveals the dense pericardial adhesions on attempted pericardial access. Image 2 shows the mapping of the target veins with the 0.014" BMW wires. Image 3 shows the alcohol instillation with balloon inflation in the target vein. Image 4 shows the final injection after alcohol ablation

FIGURE B:



FIGURE B: The Event ECG of the patient suggestive of an Epicardial scar VT .

Spiked-helmet Sign: A Prelude to Polymorphic Ventricular Tachycardia

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Objective: The Spiked-helmet sign is an electrocardiographic marker usually associated with critical illness and poor prognosis. Our aim is to shed some light on its pathogenesis and possible electrophysiologic consequences.

Case presentation: We present a case of an 80 year old woman with severe low flow low gradient aortic stenosis complicated by acute rapid atrial fibrillation and congestive heart failure. She was given intravenous amiodarone infusion for rhythm conversion. However, she developed frequent runs of non-sustained and sustained polymorphic ventricular tachycardia on cardiac monitor. Defibrillation at 200J biphasic was delivered successfully. A repeat twelve lead electrocardiogram showed sinus rhythm with spiked helmet sign, prolonged Qt interval and polymorphic ventricular tachycardia (Figure 1, 2). Intravenous infusion of magnesium sulphate, correction of electrolytes and withdrawal of amiodarone and other QT prolonging drugs brought regression of the spiked-helmet sign with no recurrence of polymorphic ventricular tachycardia (Fig. 3).

Conclusion: Our observation suggests that the spiked-helmet sign is a prelude to polymorphic ventricular tachycardia. Intravenous magnesium is an effective treatment to stabilize the cardiac membrane, while correction of electrolytes and removal of QT prolonging drugs reverses this electrocardiographic abnormality.

SUPPORTING DOCUMENTS



Figure 1. Intermittent runs of polymorphic ventricular tachycardia (black arrow) interspersed with periods of sinus rhythm with "Spiked-helmet" Sign (dashed arrow) and prolonged Qt interval of 0.48sec.



Figure 2. 12L ECG after IV magnesium infusion showed sinus tachycardia with Spiked-helmet Sign and a markedly prolonged Qtc interval of 0.69sec.



Figure 3. Repeat ECG prior to discharge showed resolution of the Spiked-helmet Sign with a Qtc interval of 0.36sec.

Repeated Stellate Ganglion Blockade for the Treatment of Electrical Storm in Patients with Nonischemic Cardiomyopathy

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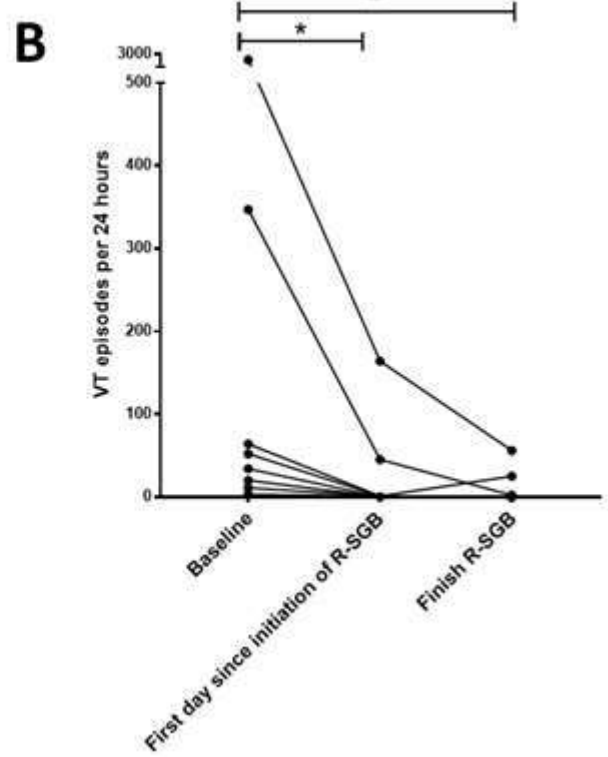
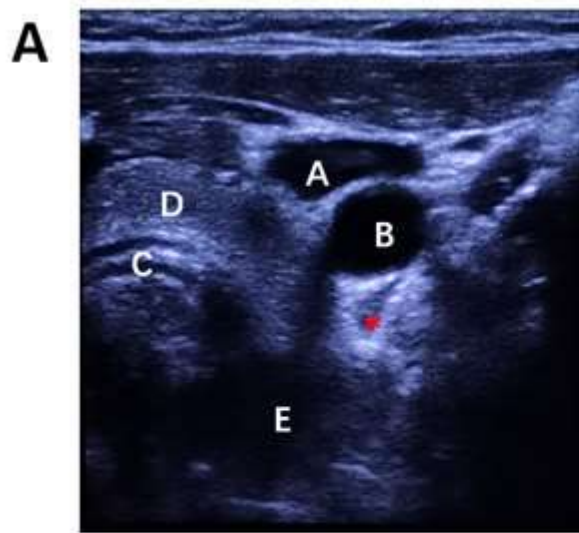
Objectives: This study sought to describe our institutional experience with providing repeated percutaneous stellate ganglion blockade (R-SGB) as a treatment for drug-refractory electrical storm in patients with nonischemic cardiomyopathy (NICM).

Materials and Methods: This study included 8 consecutive patients who had drug-refractory electrical storm and underwent R-SGB between June 1, 2021, and January 31, 2022. Lidocaine (10ml, 1%) was injected in the vicinity of the left stellate ganglion under the guidance of ultrasound, once per day for 7 days. Data were collected for patient clinical characteristics, immediate and long-term outcomes, and procedure related complications.

Results: Totally, 5 patients with dilated cardiomyopathy, 2 patients with arrhythmogenic right ventricular cardiomyopathy and 1 patient with hypertrophic cardiomyopathy were enrolled. Clinical characteristics included age, 51.5 ± 13.6 years; men, 100%; and left ventricular ejection fraction, $37.8 \pm 6.6\%$. After the treatment of R-SGB, 75% of patients were free of electrical storm. 24h Holter monitoring showed a significant reduction in ventricular tachycardia (VT) episodes from 43 [13.25, 276.25] to 1 [0.25, 34.00] first day following R-SGB ($P < 0.05$) and 0.5 [0.00, 19.25] after whole R-SGB process. There were no procedure-related major complications. The mean follow-up was 4.8 ± 1.1 months, and the median time of recurrent VT was 2 months.

Conclusion: Minimally invasive R-SGB was a safe and effective method to attenuate electrical storm in patients with NICM.

SUPPORTING DOCUMENTS



Electrocardiographic characteristics of idiopathic ventricular arrhythmias difficult to eliminate by catheter ablation from RVOT endocardium

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(Objective) QRS morphology of left bundle branch block (LBBB) and inferior axis pattern might indicate ventricular arrhythmias (VAs) originating from right ventricular outflow tract (RVOT). However, some cases were difficult to ablate VAs from RVOT endocardium and required additional catheter ablation (ABL) measures. The aim of this study was to evaluate electrocardiographic (ECG) to distinguish VAs difficult to eliminate by ABL from RVOT endocardium.

(Materials and Methods) Thirty-one consecutive patients (age 47 ± 14 years, 12male) who underwent CA of VAs was enrolled in this study. VAs of all patients had LBBB and inferior axis. In 25 cases VAs were eliminated by ablation from RVOT endocardium (S-group). However, VAs of 6 cases were not (F-group).

(Results) ECG analysis revealed QS pattern in lead I (100% vs 8% ; $p < 0.0001$), larger R-wave ratio (III/II) (1.19 ± 0.11 vs 0.90 ± 0.16 ; $p < 0.001$) and Q-wave ratio (aVL/aVR) (1.62 ± 0.53 vs 0.83 ± 0.41 ; $p < 0.001$) were significant in F-group rather than S-group respectively. Activation interval between ABL site of RVOT endocardium and QRS onset of VAs was no significant difference between two groups. In 6 patients of F-group, VAs of one patient was eliminated by re-do ABL from RVOT endocardium, one required ABL from distal coronary vein, two patients required long-duration (≥ 180 sec) radiofrequency ABL from RVOT endocardium, one required bipolar ABL and two patients did not undergo re-do ABL because of their mild symptoms.

(Conclusion)

These ECG findings could be useful to predict VAs difficult to eliminate by ABL from RVOT endocardium and the need for additional measures to treat these VAs.

An Unusual Cause of Bidirectional Ventricular Tachycardia: Andersen-Tawil Syndrome

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Background: Bidirectional Ventricular Tachycardia (VT) is an unusual rhythm. Its differential diagnoses are limited, but important. Here we introduce a case of asymptomatic bidirectional VT with dysmorphism. The diagnosis was confirmed genetically.

Case: A 14-year-old girl was referred by Student Health Service for asymptomatic irregular heartbeat. 12-lead ECG showed frequent ventricular ectopy with alternating axis, with a normal corrected QT interval of 432ms. Holter showed 9.2% ventricular ectopy with non-sustained runs of bidirectional VT. Longest run consisted of 16 beats at a heart rate of 130 per minute. Physical examination showed micrognathia and clinodactyly. She also reported episodes of weakness following prolonged rest. A provisional diagnosis of Andersen-Tawil Syndrome (ATS) was made and was confirmed by genetic testing with a targeted gene panel. A heterozygous pathogenic variant NM_000891.3(KCNJ2):c.244C>T p.(Arg82Trp) was identified in the KCNJ2 gene.

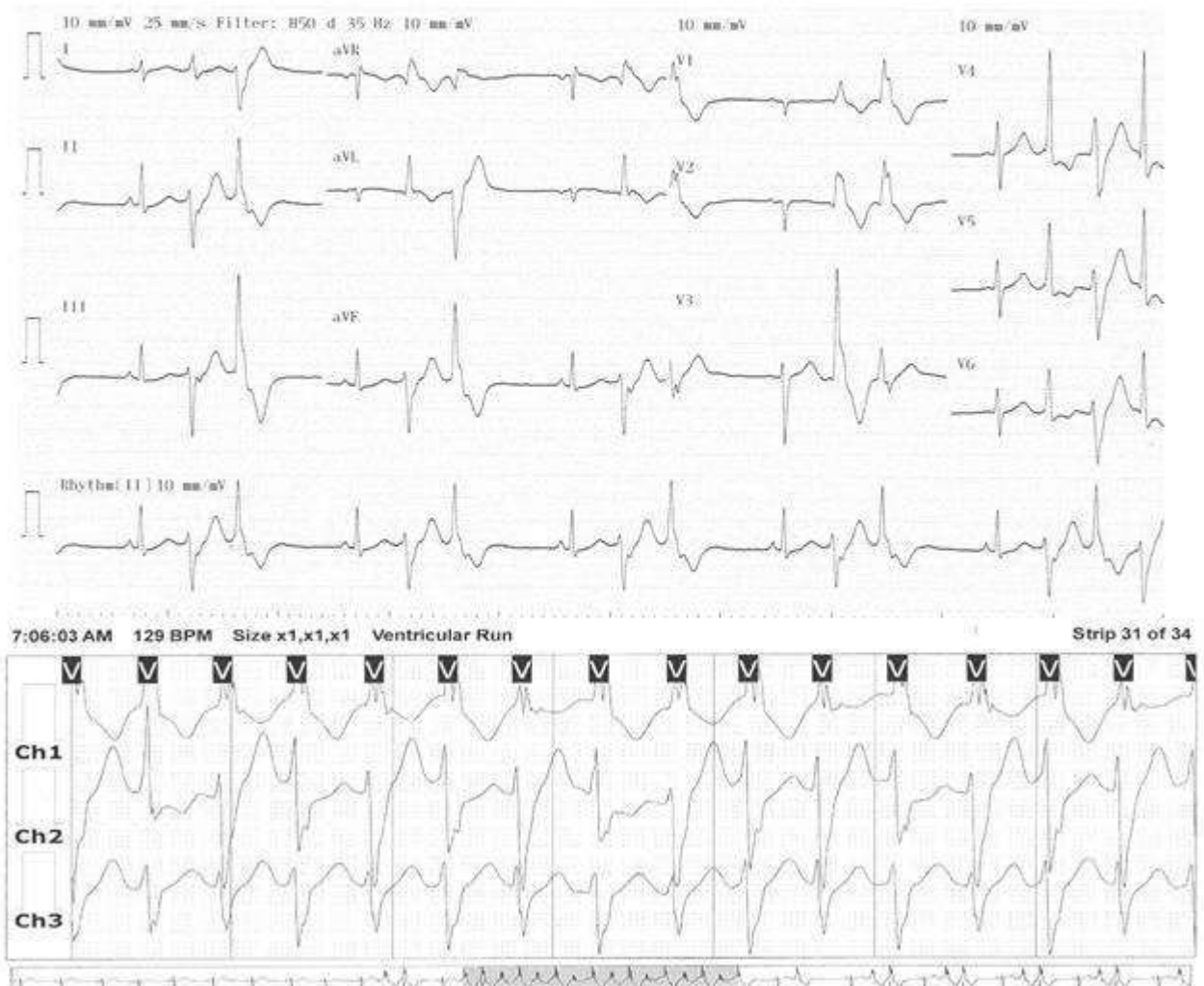
Decision making: ATS is an important channelopathy as a differential diagnosis of bidirectional VT, apart from catecholaminergic polymorphic VT. Recognition of the dysmorphic features and the history of periodic paralysis helped raise suspicion for ATS. Flecainide was effective in reducing the amount of ventricular ectopy in this case.

Conclusion: Detailed history taking and physical examination are crucial in the diagnosis of ATS, which carries a risk of life-threatening arrhythmic event and has important genetic implication. Cascade screening is recommended.

SUPPORTING DOCUMENTS

ECG: Frequent ventricular ectopy with alternating axis. Ventricular rate 96 per minute. Normal QTc of 432ms

Holter: 16-beat run of non-sustained bidirectional ventricular tachycardia seen in channel 2



Diagnostic validation of smart wearable device embedded with single-lead electrocardiogram for arrhythmia detection

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Objective: In this study, we hypothesized that the information obtained with smartphone operated single lead ECG can be used to accurately detect AF and common ectopic beats.

Research Design and Methods: Between 2020 Jun and 2021 Apr, 656 subjects (431 males and 225 females) aged from 19 to 93 years (median 65 years) who participated in the Mobile Health [mHealth] Technology for Improved Screening, Patient Involvement and Optimizing Integrated Care in Atrial Fibrillation [MAFA II] Study were enrolled in this study. The validity of smartphone-embedded single lead ECG as an tool for the detection of arrhythmias including AF and ectopic beats was compared with simultaneously performed 12 lead ECG assessed by cardiologists as the reference standard.

Results: The results show that the screening results of arrhythmia screening module are highly consistent with those ECG based interpretations. Detailed results are as bellows:

three-class classification

For sinus rhythm subjects, recall: 97.6%, precision: 96.5%, F1 score: 97.0%;

For atrial fibrillation subjects, recall: 96.7%, precision: 96.9%, F1 score: 96.8%;

For extrasystole subjects, recall: 92.8%, precision: 94.2%, F1 score: 93.5%;

Macro F1 score: 95.8%.

Four-class classification

For sinus rhythm subjects, recall: 97.6%, precision: 96.5%, F1 score: 97.0%;

For atrial fibrillation subjects, recall: 96.7%, precision: 96.9%, F1 score: 96.8%;

For premature atrial contraction subjects, recall: 90.5%, precision: 89.4%, F1 score: 89.9%;

For premature ventricular contraction subjects, recall: 86.1%, precision: 89.6%, F1 score: 87.8%;

Macro F1 score: 92.9%.

Conclusion: The test results are highly consistent with the clinical ECG detection results, which is effective for arrhythmia screening.

Electrical Isolation of Abnormal Substrate: A New Endpoint of Ablation in Arrhythmogenic Right Ventricular Cardiomyopathy

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Objectives: Benefits of abnormal substrate isolation are uncertain during catheter ablation of ventricular tachycardia (VT) in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC). This observational study aims to explore the feasibility and efficacy of abnormal substrate isolation in ARVC patients with VT.

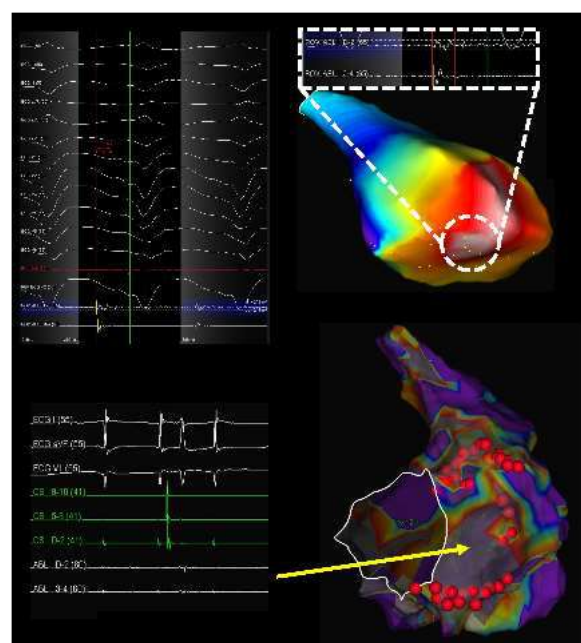
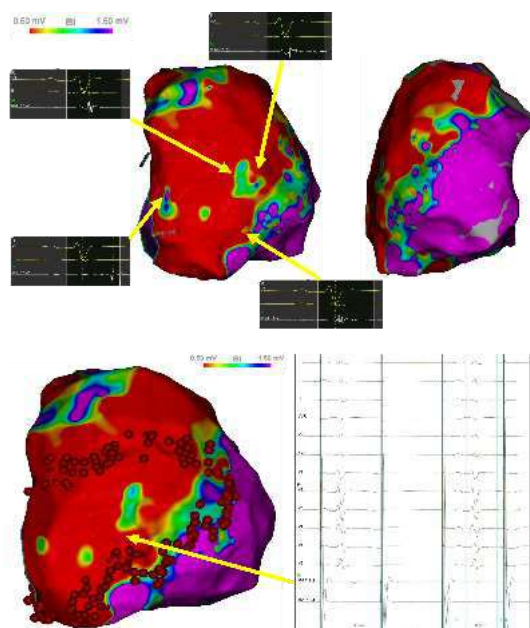
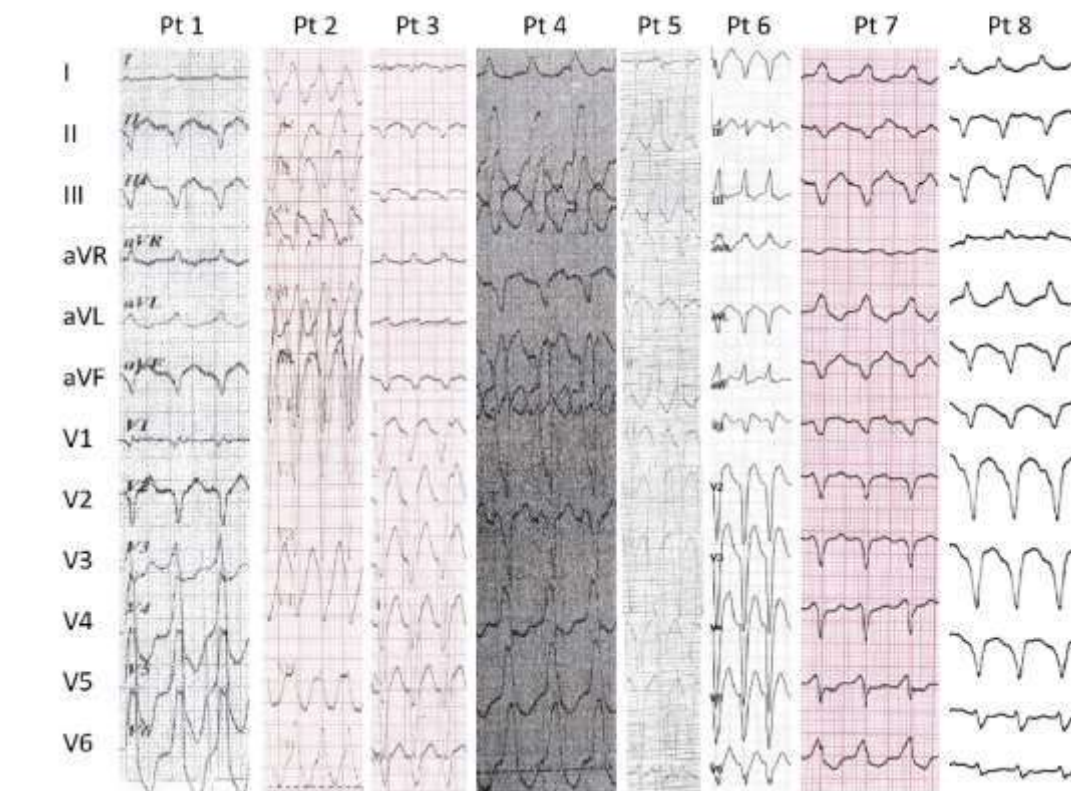
Materials and Methods: Eight consecutive ARVC patients with VT who underwent catheter ablation and achieved the endpoint of electric isolation of abnormal substrates were included. Induced VTs which were localized by activation, entrainment and pace mapping were eliminated. Detailed voltage mapping was performed during sinus rhythm, and area with fractionated or late potentials were further homogenized. A circumferential linear lesion was deployed along the low-voltage area border zone and electric isolation was achieved.

Results: All eight patients had extensive endocardial low-voltage area (114.2 ± 90.8 cm², $49.8 \pm 32.1\%$) and dense scar (61.1 ± 42.7 cm², $25.5 \pm 15.2\%$). Stable hemodynamical VTs were induced in 6/8 patients and finally eliminated. Electrical isolation of abnormal substrate was achieved in 5/8 (62.5%) patients via endocardial approach and 3/8 (37.5%) patients via a combination of endocardial and epicardial approach, resulted in isolated potential (6/8, 75%) or non-capture (2/8, 25%) during high output pacing inside the encircled area. During a median follow-up of 43 months (range 24-53), 7/8 (85.7%) patients remained free of sustained VT.

Conclusions: Electrical isolation of abnormal substrate is feasible and effective in VT patients with ARVC. Substrate isolation can be achieved by endocardial approach in a majority of VT patients with late stage ARVC, and associated with excellent rhythm control.

SUPPORTING DOCUMENTS

Keywords: ventricular tachycardia; arrhythmogenic right ventricular cardiomyopathy; catheter ablation; electrical isolation.





15th Asia Pacific
Heart Rhythm Society

PERSPECTIVE IS POWER



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**Advances in AF Ablation: RF Transseptal, Next
Generation Cryoballoons, and Pulsed Field Ablation**

Saturday • 19th November 2022 • 12:00 PM – 1:00 PM
Track 4 • Level 3

Chair: Datuk Dr Azlan Hussin • *Malaysia*

- RF-Based Transseptal Access • Dr Atul Verma • *Canada*
- Cryoablation • Dr Nick Jackson • *Australia*
- Pulsed Field Ablation • Dr Jim Hansen • *Denmark*

CRM
INNOVATION
THEATRE

Subcutaneous ICD Real World Experience

Saturday • 19th November 2022 • 9:30 AM – 10:10 AM
Track 4 • Level 3

Chair: Asst Prof Tan Vern Hsen • *Singapore*

- Characterization of the PRAETORIAN score in Asian patients to evaluate implant position and predict defibrillation success • Dr Yuji Ishida • *Japan*
- Complications in the TVICD compared to the SICD – a secondary analysis of the PRAETORIAN trial • Dr Reinoud Knops • *Netherlands*

Early Experience with a Novel Omnipolar Mapping Technology in the Asia Pacific Region

Dr. Shinji Kaneko¹, Dr. Yuji Shimatani², Dr. Koji Yasumoto³, Dr. Yasuyuki Egami³, Dr. Yoshio Yamaguchi⁴, Dr. Kohei Ukita³, Dr. Han Lim⁵, **Mr Peter Gora**⁶, Dr. Mikio Kakishita²

¹*Toyota Kosei Hospital, Toyota, Japan*, ²*Higashi Takarazuka Sato Hospital, Hyogo, Japan*, ³*Osaka Rosai Hospital, Sakai, Japan*, ⁴*Fukui Cardiovascular Center, Department of Cardiology, Fukui, Japan*, ⁵*Epworth Hospital, Melbourne, Australia*, ⁶*Abbott, Minneapolis, United States*

Objectives: EnSite Omnipolar Technology (OT) was recently introduced on the EnSite X EP system in the Asia Pacific region. This technology enables EGMs to be analyzed in 360 degrees, eliminating artifact introduced by the orientation of a recording bipole relative to the activation wavefront. This analysis sought to evaluate utilization and associated mapping settings for this novel technology.

Materials and Methods: Procedural data was collected in cases performed in the Asia Pacific region utilizing the EnSite X mapping system. Procedural characteristics recorded included indication for mapping and ablation, OT utilization and settings, and navigation mode utilization.

Results: Procedural data was prospectively collected in 448 cases from 37 operators at centers in Japan, Australia, and Hong Kong. Indication for mapping and ablation included AF (81.0%), SVT (11.4%), and VT (7.6%). Overall navigation mode selection was VoXel 62.7% of cases; NavX in 37.3%. Considering only those cases utilizing OT, VoXel mode selected for 90.0%. Utilization rate of OT was higher in complex cases (31.4% SVT; 37.0% PAF; 49.5% PersAF; 73.5% VT). The most commonly utilized OT certainty settings were 0.5 (61.4%) and the nominal setting of 0.3 (30.7%).

Conclusion: The initial experience with OT included utilization across a variety of arrhythmias, trending higher in more complex cases which may suggest that the new clinical functionality introduced by this technology aids in substrate characterization and identification of ablation targets during challenging cases. Future study may focus on the impact that this technology has on long-term outcomes.

Chinese Experience with a Novel Grid-Style Mapping Catheter in Atrial Fibrillation Ablation

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¹Sir Run Run Shaw Hospital Zhejiang University School of Medicine, Hangzhou, China, ²Beijing Anzhen Hospital, Beijing, China, ³Guangdong Province Hospital of Traditional Chinese Medical, The Second Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangdong, China, ⁴West China Hospital of Sichuan University, Chengdu, China, ⁵Beijing Royal Integrative Medicine Hospital, Beijing, China, ⁶Abbott, Minneapolis, United States, ⁷Tongji Medical College of HUST, Wuhan, China

Objectives: To characterize and examine the clinical utilization of a high-density grid-style catheter (HD Grid) in atrial fibrillation (AF) ablation procedures in the Chinese population.

Materials and Methods: Self-reported procedural data were prospectively collected in cases utilizing HD Grid during the initial phases of commercialization in China. Procedural characteristics and workflow were recorded and analyzed.

Results: Procedural data was collected in 335 AF cases from 26 operators at 14 centers in China. Among the 335 cases, only 13 were repeat procedures. The primary indication was paroxysmal (n=218, 65.1%) and persistent AF (n=117, 34.9%); conscious sedation/monitored anesthesia care was used in 321 cases (95.8%). The use of a steerable sheath with the HD Grid was documented in 125 cases (37.3%). An average of 10,843±11,203 and 4,317±6,181 points were collected and used; use of the AutoMap module was documented in 238 (71.0%). Pulmonary vein (PV) isolation lesion delivery was most commonly guided by lesion index (LSI) (n=317, 94.6%), with target value of 4.5-5.0 (n=298, 89.0%) for the anterior/roof PV segment and 4.0-4.5 for the posterior/inferior PV segment (n=247, 73.7%). The average procedure and fluoroscopy times were 153.0±52.1 and 13.5±8.8 minutes, respectively. No mapping catheter-related serious complication was reported.

Conclusion: While procedural characteristics differed depending on ablation strategy and operator preference, the HD Grid can be used in catheter ablation for both de novo and redo AF procedures in the Chinese population without compromising patient safety or ablation workflow

Grid-mapping Catheters Versus Pentaray Catheters for Left Atrial Mapping on Ensite Precision Mapping System

Dr Soichiro Usumoto¹, Dr. Jumpei Saito¹

¹*Showa University Yokohama Northern Hospital, Yokohama, Japan*

Objective: Areas displaying reduced bipolar voltage are defined as low-voltage areas (LVAs). In this study, we compared grid mapping catheter (GMC) with PentaRay catheter (PC) for LA voltage mapping on Ensite Precision mapping system.

Methods: Twenty-six consecutive patients with LVAs and border zone within the LA were enrolled. After achieving PVI, voltage mapping under high right atrial pacing for 600msec was performed twice using each catheter type (GMC first, PC next). Furthermore, LVA was defined as a region with a bipolar voltage of <0.50, and border zone was defined as a region with a bipolar voltage of <1.0, or <1.5 mV.

Results: Compared with PC, using GMC, voltage mapping contained more mapping points (20242 [15859, 26013] vs 5589 [4088, 7649] ; $P < .0001$), and more mapping points per minute (1428 [1275, 1803] vs 558 [372, 783] ; $P < .0001$). In addition, LVA and border zone size using GMC was significantly less than that reported using PC: <1.0 mV (5.9 cm² [2.9, 20.2] vs. 13.9 cm² [6.3, 24.1] , $P = 0.018$) and <1.5mV voltage cutoff (10.6 cm² [6.6, 27.2] vs. 21.6 cm² [12.6, 35.0] , $P = 0.005$).

Conclusion: Bipolar voltage amplitude estimated by GMC was significantly larger than that estimated by PC on Ensite Precision mapping system. GMC may be able to find highly selective identification of LVAs with lower prevalence and smaller LVA and border zone size.

Zero-flouroscopy Ablation of Premature Ventricular Contraction Originating From Moderator Band in a Pregnant Woman

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¹*Hospital Serdang, Kajang, Malaysia*

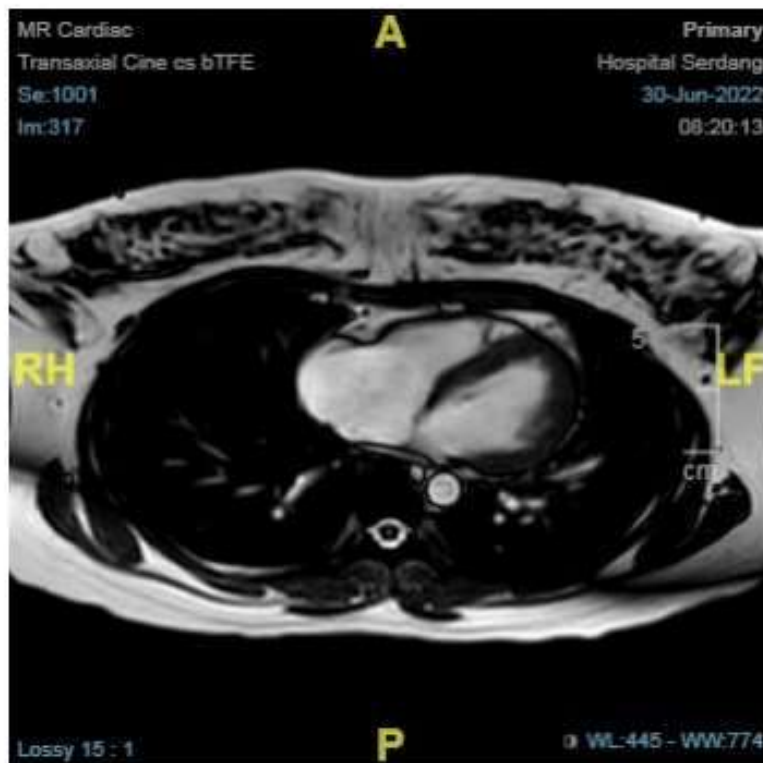
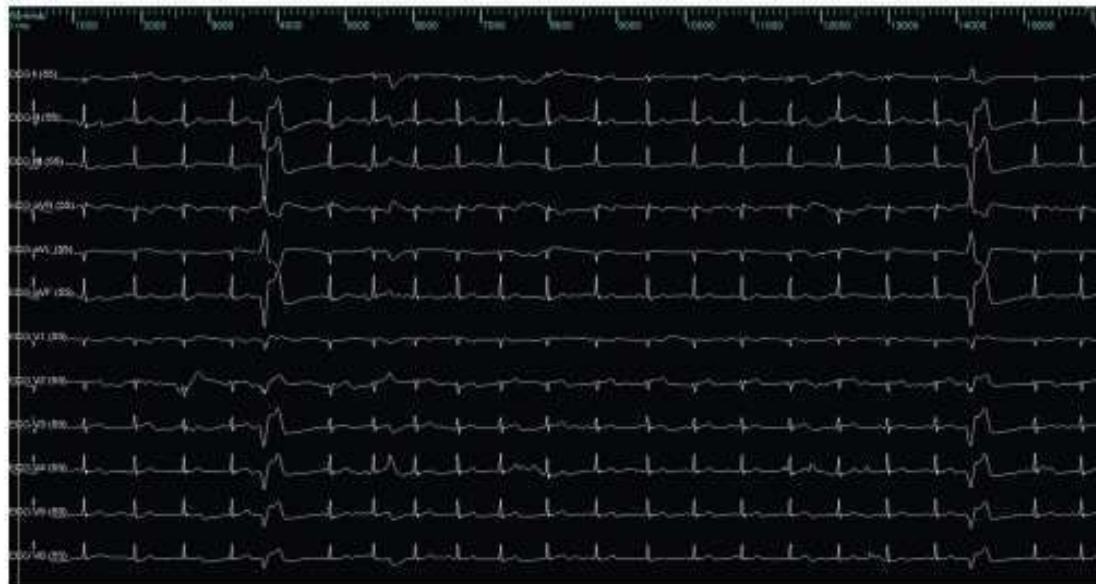
Objectives: An increased incidence of premature ventricular contractions (PVCs) is observed during pregnancy and may be a potential trigger for cardiac arrhythmias (1) We report a case of a pregnant lady who presented with syncope and Moderator band PVCs.

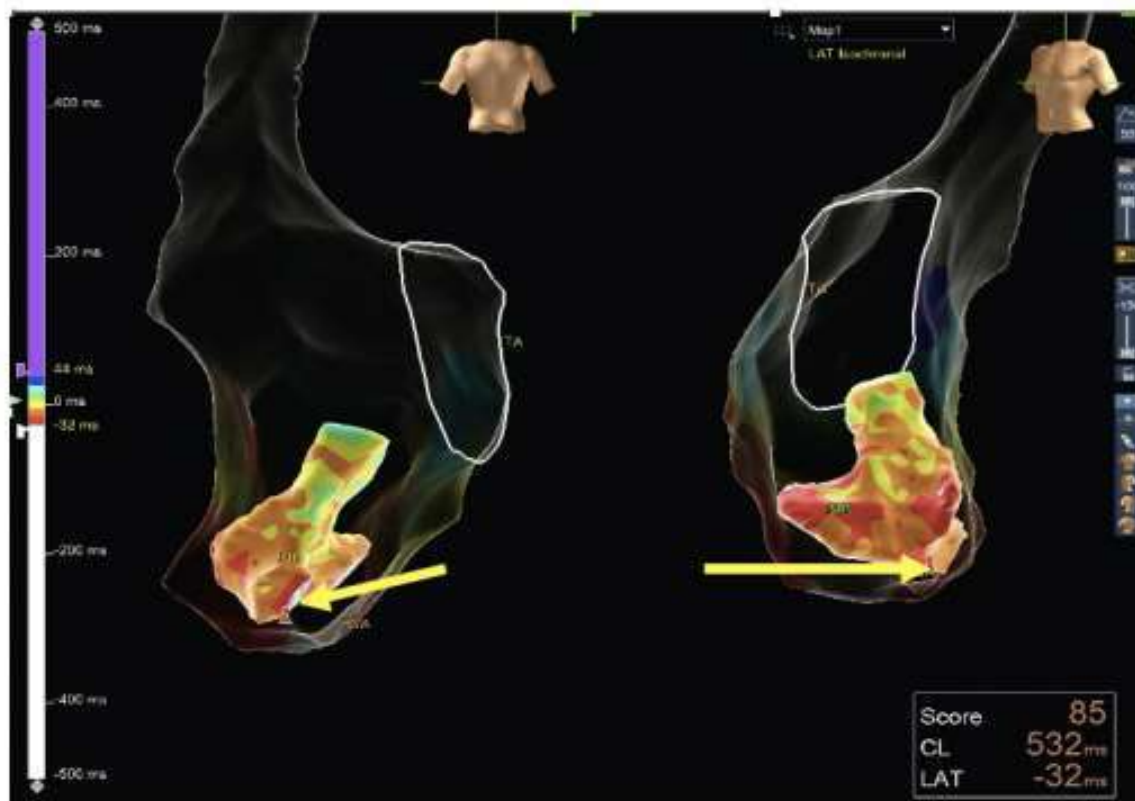
Material and methods: A 29 year-old nurse at 17weeks of gestation presented to us with an episode of syncope preceded with sustained palpitations. A 12-lead electrocardiogram was performed which revealed frequent unifocal PVCs of Left bundle branch block with negative concordance and leftward superior axis. Subsequent investigations includes a normal brain computed tomography, normal transthoracic echocardiography, PVC burden of 1.5% on 24 hour HOLTER and presence of moderator band (MB) on Cardiac Magnetic Resonance Imaging. In view of the association of moderator band PVCs with sudden cardiac death, we discussed with the patient for a potentially curative ablative therapy.

Results: The electrophysiology procedure was performed with zero-fluoroscopy, guided by intracardiac echocardiography and three-dimensional electroanatomical mapping system. PVCs of similar morphology were mapped and localised to the lateral and septal insertion site of the MB with earliest activation by 31ms. Radiofrequency energy was delivered to both sites which resulted in acceleration and termination of the PVCs. Procedure was completed with no complications.

Conclusion: PVCs arising from the MB are uncommon and have been described to be a potential source of VT/VF triggers which may result in sudden cardiac death (2) Successful ablation may be achieved in a pregnant patient with zero-fluoroscopy approach to ensure safety for both the mother and fetus.

SUPPORTING DOCUMENTS





HD-grid for Mapping Improvement of Right Posterolateral Accessory Pathway

Mr Irnizarifka Irnizarifka¹, MD, PhD Sunu Budhi Raharjo¹, MD, PhD Dicky Armein Hanafy¹, MD Dony Yugo Hermanto¹, MD Alice Inda Supit¹, Prof, MD, PhD Yoga Yuniadi¹

¹*National Cardiovascular Centre Harapan Kita, Jakarta, Indonesia*

Background: The right posterolateral (RPL) area is a thought-provoking anatomic zone since its stabilization of mapping catheter became a challenge. Accessory pathways (AP) located in this area pose a relatively difficult task for electrophysiologists, especially in patient with significant tricuspid regurgitation (TR). Despite maneuver with long sheath was already well established, the use of HD-grid believed to add precision of intracardiac AP localization.

Case Illustration: A 39-years-old man with manifest right-sided WPW and palpitation of documented aberrant AVRT was scheduled for conventional ablation. He had history of MV repair and currently has severe TR with decrease RV function. Conventional irrigated radio-frequency-ablation (RFA) catheter mapping with SL-O long-sheath support was challengingly not be able to get accurate site of the AP. This was not unexpected since severe TR tends to undulate the catheter. Hence, HD-grid catheter was used in order to yield meticulous mapping at RPL. Despite there was no antegrade fused AV EGM, right ventricular apical (RVA) pacing evinced retrograde fused VA at RPL (HD-grid at B1-C1). Delta wave disappeared and VA separated after 5 seconds of RFA (45 Celsius, 40 Watt, 120 seconds) delivered to this area during RVA pacing. After 20 minutes of evaluation, neither delta wave nor inducible tachyarrhythmia were evidenced.

Conclusion: HD-grid catheter could potentially be a secret armament to aid stabilization and thus get meticulous conventional mapping of RPL AP through its stiff shaft and soft-deflectable grid. To the best of our knowledge, this HD-grid guided conventional mapping technique is the first to be reported.

The Effect of Catheter Ablation of Typical Atrial Flutter on atrial remodelling and ventricular Function

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¹Canberra Heart Rhythm Centre, Garran, Australia, ²Australian National University, Canberra, Australia, ³The Canberra Hospital, Garran, Australia

Objective(s): Cavo-tricuspid isthmus (CTI) dependent atrial flutter (AFL) is one of the most common atrial arrhythmias involving the right atrium (RA). Radiofrequency catheter ablation has been widely used as a curative therapy of choice. Patients with AFL often have dilated RA and reduced function. However, there is limited data on the effect of this intervention on cardiac size and function.

Methods: A prospective study was conducted on 89 patients who underwent CTI dependent ablation for clinical typical AFL at a single institution between 2017-2021. Echocardiographic data was analysed at baseline prior to ablation, and within 1-year post-ablation follow-up. Follow-up echocardiographic data was available for 75 patients.

Results: Of the 89 patients, 79 had typical counter-clockwise flutter. Other 10 had scar dependent or atypical RA flutter. The mean age was 69.2 ± 8.1 years old with 19% female. The average left ventricular (LV) ejection fraction (EF) significantly improved on follow-up echo (43 ± 11 to $52 \pm 2\%$, $p=0.002$). 21 (23%) patients had an increased EF of 20% or more. The prevalence of moderate to severe tricuspid regurgitation (TR) was 18% ($n=16$) at baseline and 5% ($n=5$) at follow-up with no significant difference ($p=0.047$). Echocardiography also showed improvement of RA size in 51% and left atrial (LA) size in 43.2% of the patients.

Conclusions: Patients who underwent CTI dependent AFL ablation showed an improvement in cardiac size and function at 12-month follow-up evaluation. These findings suggest that restoration of sinus rhythm from atrial flutter is associated with improvement in TR severity, RA size, LA size, and LVEF.

Pre-clinical Assessment of Safety and Acute Efficacy of Pulsed-Field Ablation: PULSE-DOSE Study

Dr Suraya Hani Kamsani¹, Prof Prashanthan Sanders¹, Mr Darius Chapman², Mr Twins Yiu³, Mr Milanjot Assi³, Mr Stephen Walsh³, Mr Ian Fong³, Dr Mehrdad Emami¹

¹*Centre for Heart Rhythm Disorders, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*, ²*Flinders University, Adelaide, Australia*, ³*CathRx, Rydalmere, Australia*

Background: Pulsed-field ablation (PFA) is a novel ablative technology that delivers high voltage short duration electrical pulses to induce cell apoptosis. Data on the effect of delivering different electrical pulse parameters in pre-clinical settings is limited.

Objectives: We assessed the safety and acute efficacy of PFA for pulmonary vein isolation (PVI) in healthy swine.

Materials and Methods: A total of 13 swine (weight 37.25 +/- 3.73kg) were evaluated. A prototype bipolar biphasic PFA generator system was designed to allow programming of various squared waved biphasic bipolar PFA parameters to the catheter. Three different voltages were studied: 4 animals in the 1,800V (low voltage) group, 4 in the 2,300V (intermediate voltage) group and 5 in the 2,800V (high voltage) group. Electro-anatomical maps were created with a 3D mapping system and pulmonary venous (PV) potentials were recorded at baseline. These veins were isolated using a variable loop multielectrode PFA catheter. Entrance and exit blocks were evaluated post-ablation. Phrenic nerve viability was assessed after a single PFA application to the superior vena cava/right atrium junction.

Results: 22 out of 23 PVs (96%) were successfully isolated in 13 swine, with a mean of 8.3 +/- 1.8 applications per vein. The only PV that was not isolated was a superior branch which was ablated with 8 applications of 2,300V. None of the animals sustained phrenic nerve injury and no acute procedural complication was noted.

Conclusion: In this preclinical study, PFA appears to be safe and efficacious for PVI across low, intermediate and high voltages.

Cavotricuspid Isthmus Line Ablation in Porcine Models Using Pulsed-Field Ablation

Dr Suraya Hani Kamsani¹, Dr Mehrdad Emami¹, Mr Darius Chapman², Mr Twins Yiu³, Mr Milanjot Assi³, Mr Stephen Walsh³, Mr Ian Fong³, Prof Prashanthan Sanders¹

¹*Centre for Heart Rhythm Disorders, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*, ²*Flinders University, Adelaide, Australia*, ³*CathRx, Rydalmere, Australia*

Background: Cavotricuspid isthmus (CTI)- dependent atrial flutter commonly co-exist with atrial fibrillation. Pulsed-field ablation is an emerging ablative modality used in pulmonary vein isolation however data in CTI ablation is limited.

Objectives: The aim of this study is to evaluate the feasibility and durability of CTI line ablation using PFA technology.

Materials and methods: 13 healthy swine underwent a CTI line ablation and followed up after 12 weeks. An integrated prototype PFA system was used to deliver biphasic bipolar PFA waveforms of different voltages to a linear catheter. Three different voltages were examined: 1,800V (low), 2,300V (intermediate) and 2,800V (high). Baseline and follow-up data including voltage maps, post-ablation conduction blocks and complications were recorded.

Results: At index procedure, 12 out of 13 CTI lines (92.3%) demonstrated bidirectional conduction block with a mean of 8.7 +/- 2.1 applications per line. The only CTI line that was not adequately ablated was in the low voltage (1,800V) group with 11 applications. Voltage map revealed the presence of an extensive myocardial sleeve in this animal model. 11 out of 13 swine survived to complete the follow-up procedure. Re-map at 12-week showed bidirectional conduction block in 10 out of 11 CTI lines (91%). There was only 1 CTI reconnection which was previously ablated with the lowest PFA dose (6 applications of 1,800V). No PFA-related complication was observed in all the animals.

Conclusion: This study showed that PFA is a promising ablative modality for use in CTI line ablation specifically with intermediate and high voltage deliveries.

Case Report: Step-by-Step to Start Ablation by Radiofrequency Without Fluoroscopy

Dr Mam Chandara¹

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Exposure to radiation during catheter ablation procedures poses a risk to the health of both the patient and electrophysiology laboratory staffs. Recently, the feasibility and effectiveness of zero-fluoroscopy ablation have been reported. However, studies on the outcomes of zero-fluoroscopy ablation in Cambodia remain limited. The beginning to do ablation by radiofrequency without fluoroscopy with the simple case by using electro-anatomic mapping remote support at New World Heart Clinic, Cambodia. A case report of frequent ventricular arrhythmia without structural heart disease at Right Ventricular Outflow Tract was mapped and eliminated by Radiofrequency ablation without using fluoroscopy.

Key Words: Cardiac arrhythmia, Ablation by Radiofrequency, Electro-anatomic mapping Remote, Zero-Fluoroscopy.

A Single-center Experience for Catheter Ablation of Premature Ventricular Complexes

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¹*Hospital Sultanah Bahiyah/ Ministry Of Health, Alor Setar, Malaysia*

Objectives: This study reports the demographics, origin, and success rate of our single-center catheter ablation of premature ventricular complexes (PVCs) using a 3D system.

Materials and Methods: This retrospective study included patients who underwent PVC ablation in Hospital Sultanah Bahiyah from March 2016 to March 2022, evaluating patient demographics, PVC burden, success rate (defined as the resolution of symptoms and PVC from 12 leads ECG), and clinical outcome.

Results: There is a total of 122 PVC ablations were done. There are 8 patients with non-inducible PVC and 5 patients (4%) with intraprocedural complications (highest being pericardial effusion 2.4%). All catheter ablation was successful on the first attempt (80%) except for 3 patients requiring 2 procedures and 2 patients requiring 3 procedures. There are 7 patients (6 from RVOT, 1 from parahisian origin) whose ablation failed on one attempt and turned down a repeat procedure, and 1 patient (suspected mural origin) who failed despite two attempts. 67% of the cohort are females, with a success rate of 84% (74% in males) and an average age of 49 years old (IQR Q1 36, IQR Q3 58). The average PVC burden is 21%. The most common origin of PVC is RVOT (65%), highest in the posteroseptal region (27%). Notably, the success rate was improved (95.4%) in 2021 and 2022.

Conclusion: RVOT PVC is the most common site of PVC. Catheter ablation for PVC is safe and effective. With increasing experience, we believe that the success rate will improve with a lower complication rate.

Using Waveform Similarity Vector Field to Visualize the Activation Wave Propagation in Persistent Atrial Fibrillation

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Background: Atrial fibrillation's dynamical characteristics have been quantified/described through many measurements. Most algorithms, however, only record the momentary activity of regional regions, and it is not clear how complex waves propagate within patients' atriums.

Objective: The purpose of this study is to propose a vector field method to display the overall propagation activities. AF drivers are identified by ensembling the atrium's asynchronous mapping sets.

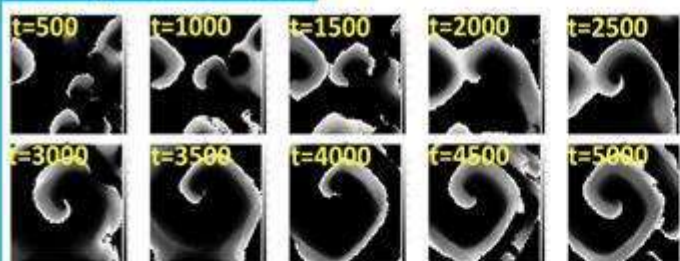
Materials and Methods: We applied a cellular automaton technique to simulate the electrical wave propagation of the meandering rotor (5000 ms) and used a simulated 20-electrode high-density catheter, Pentaray, to record the EGMs (1000 ms). The EGMs of each asynchronous mapping set was analyzed with the Waveform Similarity Vector Field (WSVF) algorithm. The vector in each grid of WSVF maps was derived from the addition of SI vectors of the four adjacent electrodes. By comparing the waveform morphology of local activation waves, SI vectors for bipolar pairs were estimated.

Results: In the computer simulation, waveform propagation patterns in WSVF map were identified within the region with maximal rotational force and divergence force. The size and average vector force of the critical areas detected by the asynchronous WSVF map showed significant contrast between the center and periphery rotors ($P < 0.001$).

Conclusion: Our results from the WSVF mapping indicated that waveform propagation was consistent in the stable region, which could be used to identify the drivers during AF. WSVF maps reconstructed from the high-density asynchronous mapping were feasible for rotor detection.

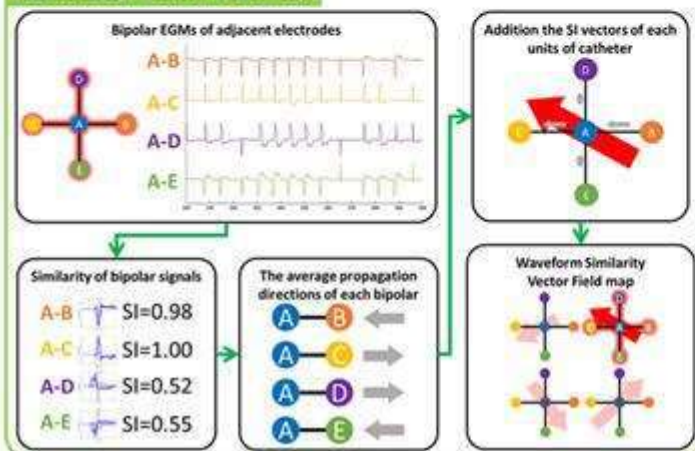
SUPPORTING DOCUMENTS

Method (I) - Simulation model

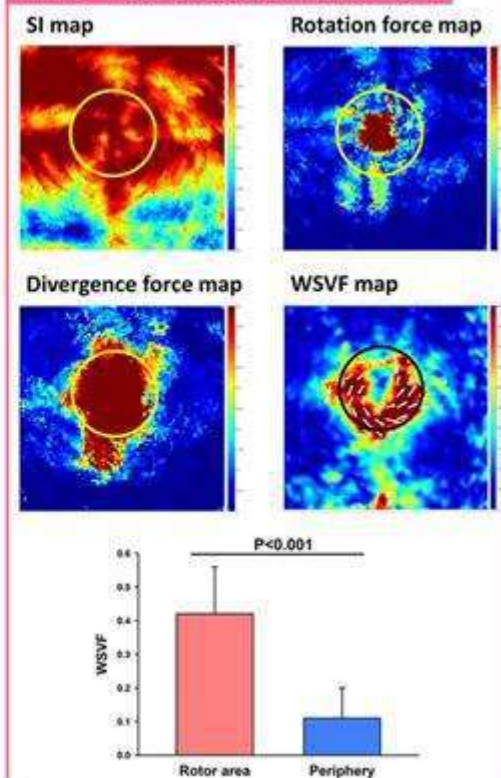


The snapshot of wavefront propagation of the rotor simulation model.

Method (II) - Vector Field map



Results - Practical test of simulation model



IDIOPATHIC POSTERIOR FASCICLE LEFT VENTRICULAR TACHYCARDIA: A CASE REPORT

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¹*Department Of Cardiology And Vascular Medicine, Faculty Of Medicine, Universitas Airlangga/Dr. Soetomo General Hospital, Surabaya, Indonesia*

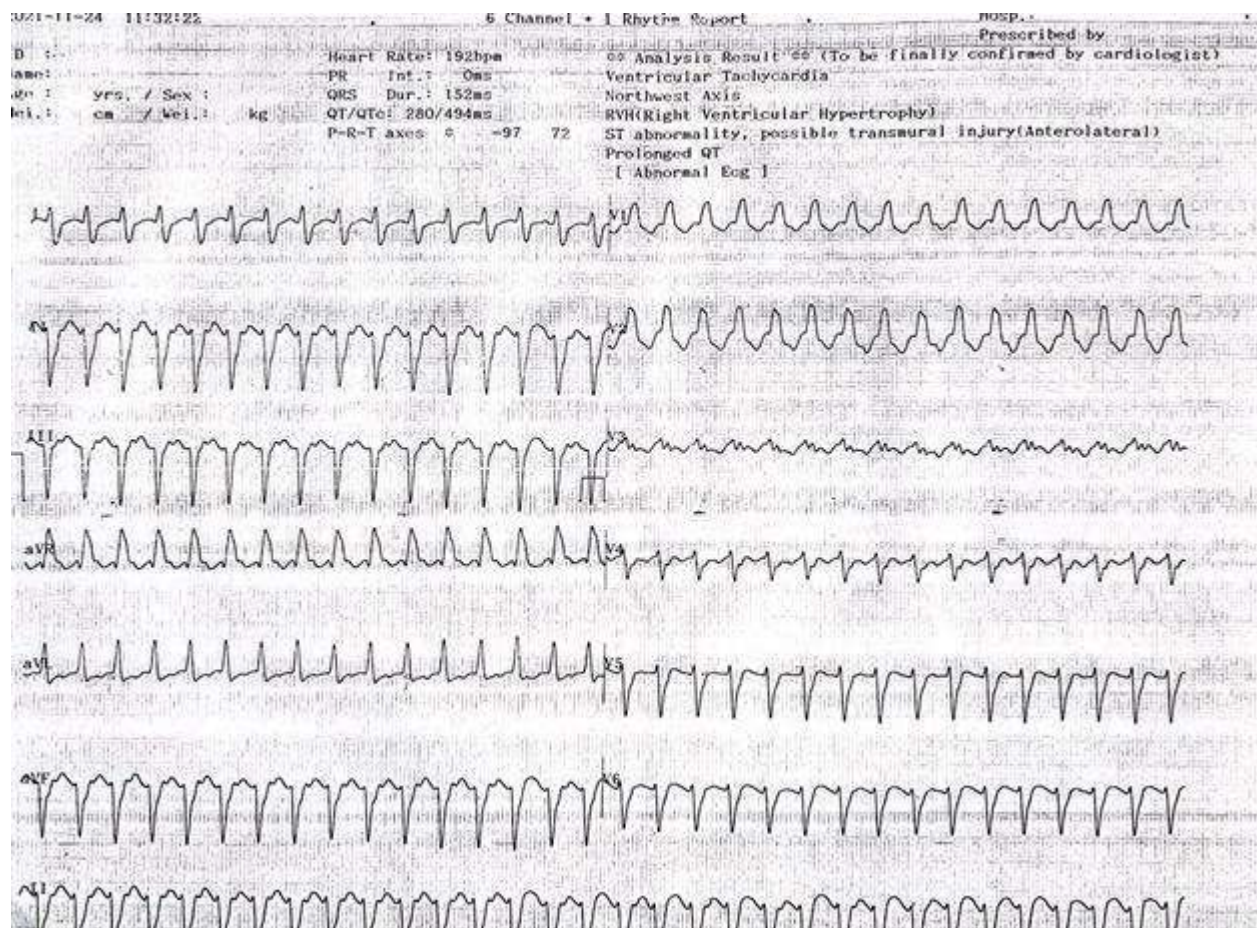
Objectives: Idiopathic Left Ventricular Tachycardia (ILVT) is one of the idiopathic Ventricular Tachycardia (VT) manifestations, with right bundle branch block and left axis deviation electrocardiogram morphology. The mechanism of ILVT is thought to be due to the localized closed reentry in the posterior fascicle.

Materials and Methods: We present an ILVT case of a 15-year-old man with complaints of palpitations while running.

Results: A 15-year-old man was admitted to the emergency department with complaints of palpitations while running. The ECG showed a feature suggestive of ILVT. Vagal maneuvers, adenosine, and intravenous metoprolol were ineffective in terminating the arrhythmia. Conversion of heart rhythm to sinus was achieved after intravenous administration of verapamil. Electrophysiological studies with entrainment demonstrated a macro-reentry mechanism in the posterior fasciculus when a multipolar ablation catheter was placed at the apex of the LV septum, with the orthodromic appearance of Purkinje potential P1 and retrograde diastolic potential P2. Radiofrequency ablation was targeted at the position where PP1 appeared earliest. In addition, there was also a 52 ms Atrial-His bundle (AH) jump, which indicated the presence of Dual AV Node Physiology. Ablation was performed on the apical third of the septum, shifting toward the basal site until successful ablation was achieved to avoid accidental injury to the left bundle branch or His bundles. Successful ablation was indicated by the inability to induce VT.

Conclusion: The first-line treatment for ILVT is the radiofrequency ablation that targets the P1 or early P2 potential to eliminate this type of VT.

SUPPORTING DOCUMENTS



Sex differences in predictors of recurrence after catheter ablation in patients with persistent atrial fibrillation

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¹*Yonsei University College Of Medicine, South Korea*

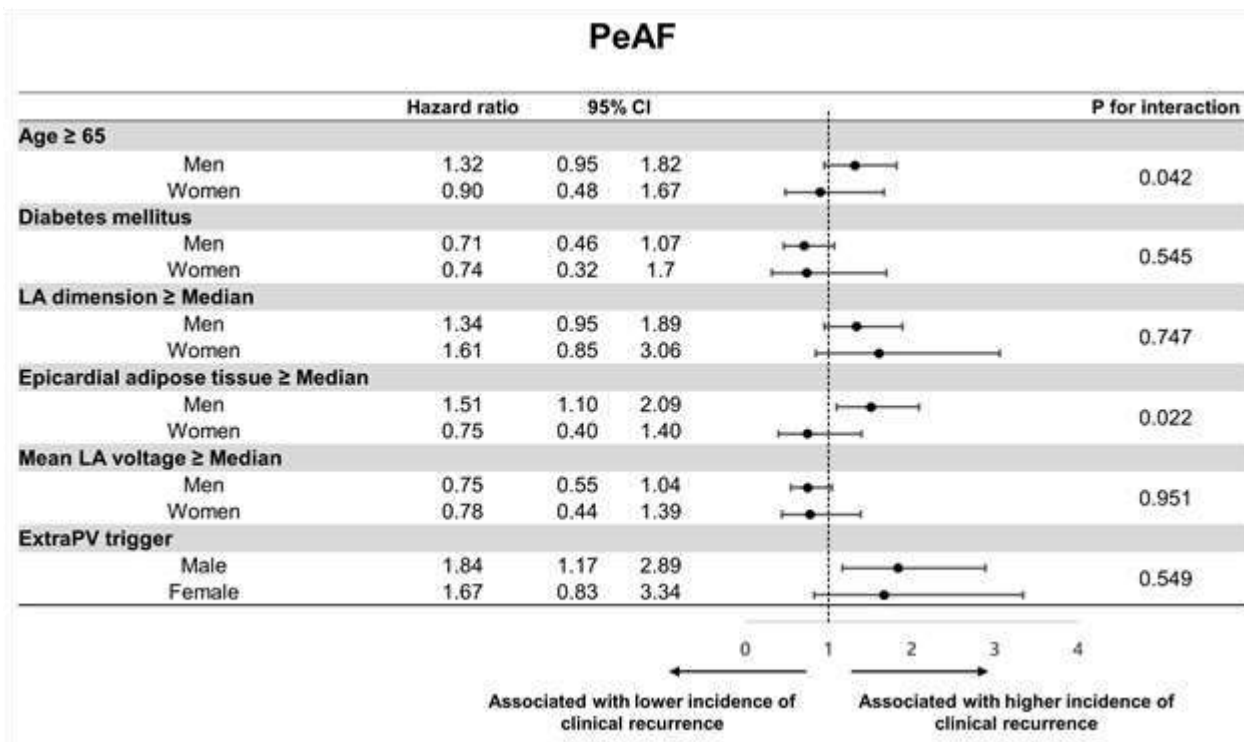
Background: Atrial fibrillation (AF) is a progressive disease, and patients with persistent AF (PeAF) have consistent long-term recurrences after AF catheter ablation (AFCA). We explored the possible sex-related differences in the recurrence predictors in patients with PeAF who had a recurrence within 3 years after AFCA.

Methods: Among 3985 consecutive patients who underwent a de novo AFCA and protocol-based rhythm follow-up, we evaluated the predictors of an AF clinical recurrence within 3 years (CR-3yr) of the AFCA in 1387 patients with PeAF (men: 78.4%, 59.5±10.5 years old), in relation to the sex of the patients.

Results: The left atrial (LA) dimension (hazard ratio [HR] 1.04 [1.02–1.06], p=0.001) and LA voltage (HR 0.71 [0.58–0.87], p=0.001) were independently associated with a CR-3yr of the AFCA of PeAF. Among 1088 men, the LA dimension (HR 1.04 [1.01–1.07], p=0.006), an epicardial adipose tissue (EAT) volume ≥ the median (HR 1.37 [1.04–1.80], p=0.025), and LA voltage (HR 0.64 [0.51–0.80], p<0.001) were independent predictors of a CR-3yr. In 299 women, diabetes was independently associated with a CR-3yr (HR 0.48 [0.25–0.93]), p=0.03). There were significant interactions between the sex and effects of the age (P for interaction=0.042) and EAT (P for interaction=0.022) on the CR-3yr. In contrast, there were no significant sex differences in the CR-3yr risk factors in patients with paroxysmal AF.

Conclusions: A large EAT volume was associated with a higher CR-3yr, especially in males after PeAF ablation. The absence of diabetes in women was independently associated with AF recurrence after PeAF ablation.

SUPPORTING DOCUMENTS



Acute Results from the Persistent Atrial Fibrillation Asia Pacific Observational Study

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¹*National University Hospital, Singapore*, ²*Asan Medical Centre, Seoul, South Korea*, ³*Kaohsiung Chang Gung Memorial Hospital, Kaohsiung City, Taiwan*, ⁴*Prince of Wales Hospital, Hong Kong, China*, ⁵*Phramongkutklao Hospital, Bangkok, Thailand*, ⁶*Taipei Veterans General Hospital (VGH), Taipei City, Taiwan*, ⁷*Severance Hospital, Yonsei University Health System, Seoul, South Korea*, ⁸*National Heart Centre Singapore*, ⁹*Sejong Hospital, Sejong City, South Korea*

Objective: The Persistent Atrial Fibrillation (PerAF) Asia Pacific (APAC) Observational study aimed to collect safety and effectiveness data for the TactiCath™ Contact Force Ablation Catheter, Sensor Enabled™ (TactiCath SE) in subjects with PerAF in the Asian population.

Materials and Methods: The PerAF APAC study (NCT04244396) investigated the TactiCath SE catheter for the treatment of PerAF in Asian subjects. Acute data is reported on regarding procedure characteristics, procedural success, and safety. This is an ongoing study collecting data 15 months post-procedure.

Results: 81 PerAF subjects were enrolled at 9 APAC centers (mean age 61 years; 74.1% male). All subjects had pulmonary veins (PV) ablated with wide area circumferential ablation (WACA) alone (67.9%), WACA with lines (24.7%), or individual PV isolation (6.2%) strategies. Non-PV targets were ablated in a majority of subjects (76.5%; 62/81), mostly to treat typical atrial flutter (62.9%, 39/62). The average procedure time was 204 ± 66.2 minutes (first venous puncture to groin sheath pulled or patient left the lab) with an average PV radiofrequency (RF) time of 40.8 ± 23.6 minutes and non-PV RF time of 15.2 ± 13.0 minutes. 98.8% (80/81) subjects reported successful PVI and 92.6% (75/81) used entrance block to verify isolation. 3.7% (3/81) of subjects experienced a primary safety event (2 cardiac tamponade/perforation, 1 stroke) related to the procedure and/or study device within 7 days of the procedure.

Conclusion: In conclusion, these data demonstrate continued safety and acute efficacy of the TactiCath SE catheter when used to treat PerAF in the APAC patient population.

Ablation Adjacent To The Gaps Between Low-power Long-duration And High-power Short-duration During Pulmonary Vein Isolation

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Objectives: We aimed to investigate gap lesions under different RFA settings and identify the predictor values for gap formation.

Materials and Methods: AF patients who received RFA under lower-power long-duration (LPLD) (power control <45W) or HPSD (power control $\geq$ 45W) settings were analyzed. Ablation lesion data were collected by the CARTO version 7 system (Biosense Webster, Inc). The parameters of lesions adjacent to the gaps were collected and compared to those of the remaining lesions. Gap lesions under different energy settings were investigated.

Results: In total, 52 AF patients (35 men, mean age 63.71 ± 10.82 years; 31 PAF and 21 PeAF) received RFA under LPLD (N=12) or HPSD (N=40) settings were analyzed. The incidence of gap lesions was similar between the LPLD and HPSD patients (1.81 ± 0.93 vs. 2.41 ± 0.80 , $p=0.35$). In total, 144 gap lesions were identified. The gap lesions either at the anterior or posterior LA wall had a significantly lower impedance drop than successful lesions (Table 1, 2), and the above findings were consistent in LPLD and HPSD. There were no significant differences in impedance drop between gap lesions between LPLD and HPSD (Table 3). After multivariable analysis, impedance drop was the only predictor of gap formation during HPSD ablation.

Conclusion: Despite the different lesion characteristics between LPLD and HPSD, the lesions adjacent to the gap were similar. Moreover, irrespective of energy setting, the impedance drop serves as the most important parameter to predict gap formation.

SUPPORTING DOCUMENTS

Table 1. Lesion Characteristics of the LA Anterior and Posterior Wall Under LPLD Setting.

	LA Anterior Wall			LA Posterior Wall		
	Success Lesion (N=332)	Gap Lesion (N=23)	P	Success Lesion (N=303)	Gap Lesion (N=10)	P
Duration (sec)	22.09±8.07	22.26±11.32	0.926	20.41±6.44	16.84±10.09	0.094
Median Energy (watt)	37.28±3.88	36.98±4.64	0.050	34.32±3.99	36.00±4.59	0.194
Impedance Drop (Ω)	13.06±7.96	3.96±2.10	0.000	13.87±7.64	3.70±2.67	0.000
Mean Force (gram)	11.48±6.39	9.70±6.68	0.201	10.67±5.80	10.00±6.39	0.735
Force Drop (gram)	23.95±14.72	22.48±17.52	0.648	26.97±16.06	33.9±20.21	0.191

Table 2. Lesion Characteristics of the LA Anterior and Posterior Wall Under HPSD Setting.

	LA Anterior Wall			LA Posterior Wall		
	Success Lesion (N=1077)	Gap Lesion (N=78)	P	Success Lesion (N=1025)	Gap Lesion (N=33)	P
Duration (sec)	15.29±5.49	16.94±4.58	0.061	12.91±3.90	12.07±2.63	0.087
Median Energy (watt)	49.37±1.72	49.36±2.33	0.957	48.23±2.45	48.79±2.18	0.198
Impedance Drop (Ω)	14.22±5.64	4.10±4.97	0.000	13.79±5.85	2.30±1.40	0.000
Mean Force (gram)	10.80±5.58	10.21±4.26	0.353	10.52±4.60	10.12±5.29	0.629
Force Drop (gram)	18.27±11.21	16.54±7.83	0.174	21.35±12.79	20.12±7.25	0.580

Table 3. Gap Lesion Characteristics Under Different Energy Settings.

	LPLD (N=23)	HPSD (N=78)	P
Duration (sec)	21.36±7.69	14.15±4.99	0.000
Median Energy (watt)	35.88±4.24	48.78±2.38	0.000
Impedance Drop (Ω)	13.09±7.99	13.54±6.13	0.114
Mean Force (gram)	25.40±15.69	19.65±11.8	0.000
Force Drop (gram)	11.09±6.31	10.67±5.09	0.071

Pulmonary Vein Isolation Using Left Atrial 3D Images Created With a New CARTOSOUND® Fam Module

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¹*Osaka National Hospital, Osaka-city, Japan*

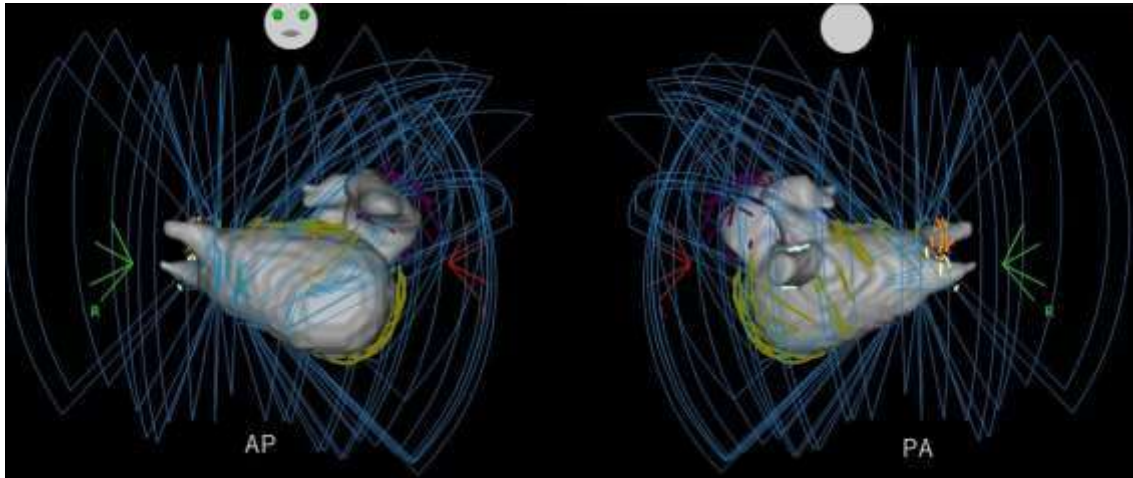
Objective: Fast Anatomical Mapping (FAM), which is a module that creates geometry from trajectories of catheters, is one of the methods to obtain 3-dimensional anatomical information of the left atrium (LA) and pulmonary veins (PV) during catheter ablation for atrial fibrillation using the CARTO® system. CARTOSOUND® FAM, a new method to create 3-dimensional geometry of the LA and PV based on intracardiac echo images, is under development and is being validated at our institution.

Materials and Methods: Before PV isolation, 2-dimensional images of the LA and PV were obtained by SOUNDSATR® catheter from the right atrium and right ventricular outflow tract. Using these images, the CARTOSOUND® FAM module automatically created contours and constructed a 3-dimensional geometry of the LA and PV.

Result: A geometry of the LA and PV was successfully created (Figure). We performed CARTOMERGE® between the geometries of the LA and PV created by the CARTOSOUND® FAM and cardiac CT. PVs were successfully isolated based on the images of the CARTOMERGE® using CARTOSOUND® FAM without any complications.

Conclusion: We report a case in which PV isolation was performed using 3D images created by the CARTOSOUND® FAM system. Though some improvements may be required, it can be a promising option to create geometries of the LA and PV for PVI in the future.

SUPPORTING DOCUMENTS



The Effectiveness and Safety of Lesion Size Index-guided Cavotricuspid Isthmus Linear Ablation.

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¹*Kitasato University School of Medicine, Sagamihara, Japan*

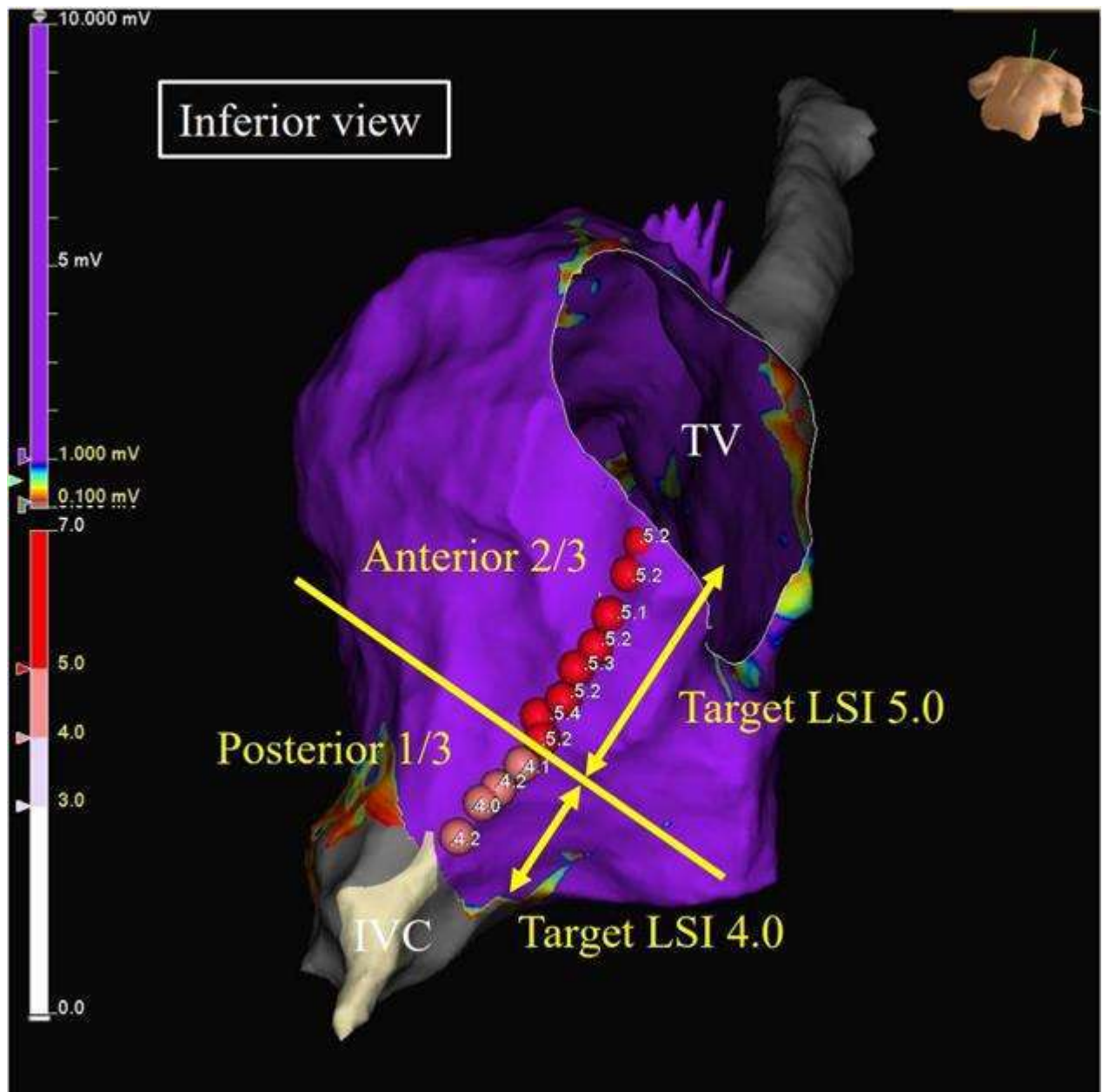
Objective: The lesion size index (LSI) predicts radiofrequency (RF) ablation lesion size and is an established parameter for pulmonary vein isolation. However, the effectiveness and safety of LSI for cavotricuspid isthmus (CTI) linear ablation remain unclear. We investigated the efficacy and safety of LSI guided-CTI linear ablation.

Materials and Methods: This single-center retrospective study included 50 patients (67 ± 10 years, 68% male) who underwent de novo CTI linear ablation between July 2020 and December 2020. The LSI target was set at 5.0 and 4.0 for the anterior $\frac{2}{3}$ and posterior $\frac{1}{3}$ segments, respectively. Acute procedural parameters of ablation were evaluated.

Results: Acute bidirectional CTI block was achieved in all patients with an RF application time of 4.0 min [3.1–5.0 min], RF application number of 15 ± 7 , and length of CTI of 36.9 ± 9.3 mm. First-pass bidirectional conduction block of the CTI was achieved in 39/50 (78%) patients. No major complications were observed during or after the procedure. The contact force (CF) per application was significantly lower in the gap tag group than in the no-gap tag group (7 g [7–8 g] vs. 10 g [7–12 g], $P = .0284$).

Conclusion: LSI-guided CTI linear ablation is an effective and safe treatment approach. CF affects gap formation, even when the target LSI is the same.

SUPPORTING DOCUMENTS



Assessment of Optimal Thresholds for Ventricular Scar Substrate Characterization

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¹Essex Cardiothoracic Centre, Basildon, United Kingdom, ²Barts Heart Centre, London, United Kingdom, ³Onassis Cardiac Surgery Center, Athens, Greece, ⁴Sussex Cardiac Centre, Brighton, United Kingdom, ⁵Brighton & Sussex University Hospitals NHS Trust, Brighton, United Kingdom

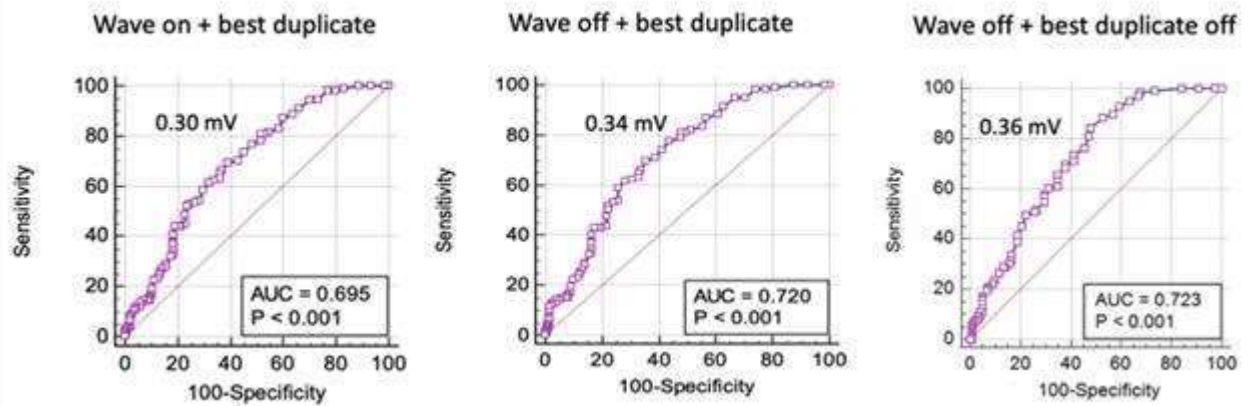
Objectives: We aimed to assess the optimal voltage cut-offs for ventricular scar substrate characterization using the HD Grid multipolar mapping catheter compared to standard linear collection.

Methods: A multicentre study of thirty patients undergoing VT ablation was conducted. Substrate mapping was performed using the high density HD-grid multipolar mapping catheter. Pre-procedure contrast-enhanced imaging data were analysed using ADAS software (Galgo medical). Data points were collected in regions of scar during (1) HD wave mapping with best duplicate algorithm on (Waveon), (2) Mapping with HD wave off and best duplicate on (Waveoff) and (3) with conventional bipolar mapping (Alloff).

Results: The median bipolar voltage for regions of dense CMR scar using (Waveon) HD wave solution and best duplicate algorithm was 0.27mV (IQR 0.14 – 0.46). The median voltage with (Waveoff) HD wave off was 0.29mV (0.15 – 0.45). The median voltage with (Alloff) HD wave off and best duplicate off was 0.32mV (0.19 – 0.5). ROC analysis using AUC suggested the optimal cut-off for endocardial dense scar using (Waveon) HD wave mapping and best duplicate algorithm was 0.30mV (sensitivity: 69.6%, specificity: 60.74%), (Waveoff) cut-off with the best duplicate and without the HD wave mapping was 0.34mV (sensitivity: 69.78%, specificity: 64.46%) and (Alloff) without wave mapping or best duplication was 0.36mV (sensitivity: 84%, specificity: 52%).

Conclusion: Ventricular substrate characterization with newer mapping technology using narrow electrode spacing and smaller electrode size suggests that traditional voltage cut-offs may need revision for delineation of scar characteristics.

SUPPORTING DOCUMENTS



Atrial Substrate Mapping in Atrial Fibrillation Ablation With Omnipolar Technology

Proffesor José Luis Merino¹, Doctor Sergio Castrejon¹, Doctor Marcel Martínez-Cossiani¹, Doctor Leonardo Ciulli¹, Doctor Michela Casella², Doctor Quintino Parisi², Doctor Laura Cipolletta², Proffesor Antonio Dello Russo²

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Objective: Left atrial (LA) mapping is a critical component of atrial fibrillation catheter ablation (AF-CA), but carries some limitations, including the sensitivity of signal amplitude to conduction direction. The HDGrid mapping catheter allowed introduction of Omnipolar Technology (OT) which provides information on voltage, conduction velocity, and activation direction, irrespective of catheter orientation. The aim is to assess the feasibility and reliability of OT maps of the LA as compared to bipolar LA maps, among patients undergoing AF-CA for substrate characterization.

Methods: We included 34 patients mean age 63.5 ± 7.5 years, undergoing for paroxysmal AF-CA with prospective (n=9) and retrospective (n=25) evaluation; the LA was mapped with HDGrid. Low-voltage areas (LVA; region with voltage values < 0.5 mV) were compared between OT maps and bipolar maps. Continuous variables were checked for normality with Shapiro-Wilk test, and statistical comparisons were made with paired t or Wilcoxon matched paired tests.

Results: The mean procedural times measured 253.5 ± 21.5 min. OT mapping acquired a significantly greater number of points than bipolar mapping (OT: 10258 (20194 ± 7452); bipolar: 7592 (13531 ± 4640); mean difference 2666, $p=0.000002$). LVAs were significantly smaller with OT than with bipolar mapping (OT: 53,795 ($110,84 \pm 30,9$) cm^2 ; bipolar: 57,269 ($119,61 \pm 34,2$) cm^2 ; mean difference 3,474 cm^2 , $p=0.000009$).

Conclusion: OT allows rapid acquisition of greater number of points during AF-CA as compared to standard bipolar, and better delineation of areas of clinical interest. The smaller LVAs may indicate that substrate characterization was significantly improved using OT, and may have application in persistent AF substrate characterization.

Renal Outcomes in Asian Patients With NVAf Receiving Rivaroxaban Versus Warfarin: a Nationwide Cohort Study

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Objectives: We aimed to determine the effect of rivaroxaban versus warfarin on adverse renal outcomes in Asian patients with NVAf.

Materials and Methods: Patients with NVAf who initiated warfarin or rivaroxaban between 1 January 2014–31 December 2017 were identified using Korean nationwide claims data, partly linked to laboratory results. Baseline characteristics of the two groups were balanced using IPTW. The primary outcome was incident ESRD, defined as the need for maintenance dialysis or kidney transplantation. Exploratory outcomes were eGFR <15 ml/min/1.73 m² at follow-up, starting dialysis or undergoing kidney transplantation, ≥30% decline in eGFR, doubling of serum creatinine level, AKI, or a composite of the five outcomes. The groups were compared using Cox proportional hazards regression.

Results: 30,933 warfarin and 17,013 rivaroxaban users were identified (51% received rivaroxaban 15 mg once daily). The mean age was 70 years and the mean CHA₂DS₂-VASc score was 3.9 in both groups. During a median follow-up of 0.93 years (IQR 0.23-2.10), weighted incidence rates of ESRD for warfarin and rivaroxaban were 0.83 and 0.32 per 100 person-years, respectively. Rivaroxaban was associated with a lower risk of ESRD versus warfarin (HR 0.398, 95% CI 0.300-0.499, p<0.001), which was consistent in patients with pre-existing CKD or eGFR ≤60 ml/min/1.73 m². Rivaroxaban demonstrated a lower risk of the composite of the five exploratory renal outcomes versus warfarin (HR 0.798, 95% CI 0.713-0.892, p<0.001).

Conclusion: Rivaroxaban was associated with lower risks of adverse renal outcomes versus warfarin in Korean patients with NVAf.

The Association of Age and Sex With TTR in Atrial Fibrillation Patient on Warfarin

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Objectives: To assess association of age and sex with Time in Therapeutic Range (TTR) in patients treated with warfarin for atrial fibrillation in a tertiary hospital in Indonesia

Materials and Methods: We randomly picked 70 patients with atrial fibrillation on warfarin to see their TTR. TTR was calculated from the last 10 INR value of each patient. Age, sex and comorbidities was then noted as these factors had been identified before to play role in SAME-TTR score. (1)

Results: Overall, only 5.71% patients have good TTR, all of which were between 61-70 years old. Age < 60 yo (p= 0.724), female sex (p= 0.436), hypertension (p= 0.095), vascular disease (p= 0.593), and LV dysfunction (p= 0.600) did not associate with poor TTR]. Interestingly, our diabetes patients tend to have less poor TTR (33,3 %) compared to non-diabetes (61,8 %) (p=0.049).

Conclusion: Age and sex did not associate with poor TTR in our patients. Whereas those with diabetes associate with better TTR, this might partly due to their discipline in dietary habits and taking medicine.

SUPPORTING DOCUMENTS

REFERENCE

- 1) Apostolakis S, Sullivan RM, Olshansky B, Lip GYH. Factors affecting quality of anticoagulation control among patients with atrial fibrillation on warfarin: The SAME-TT2 R2 score. Chest. 2013;144(5):1555–63.

Table 1. Crosstabulation of Characteristics and TTR

		TTR Category		Asymp. Sig. (2-sided)
		Poor	Not Poor	
Age	<60	18	13	.724
	≥60	21	18	
Gender	Female	20	13	.436
	Male	19	18	
LV Dysfunction	Yes	31	23	.600
	No	8	8	
Hypertension	Yes	20	22	.095
	No	19	9	
Diabetes	Yes	5	10	.049
	No	34	21	
Vascular Disease	Yes	11	7	.593
	No	28	24	

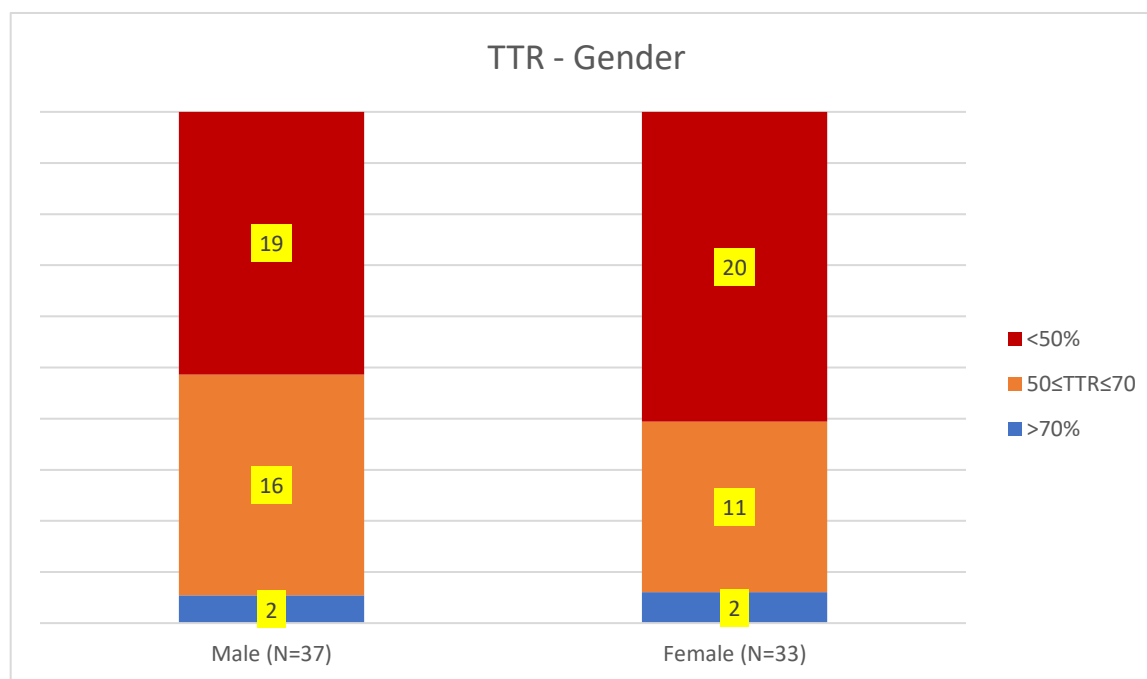


Figure 1. Gender and TTR Distribution

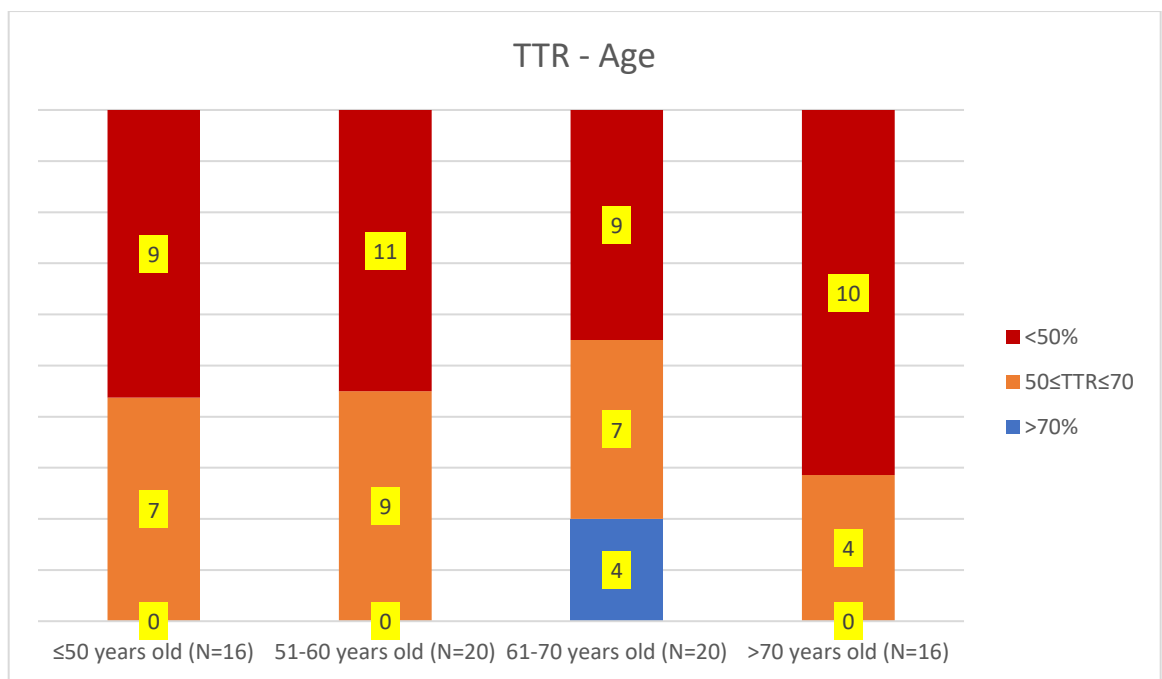


Figure 2. Age and TTR Distribution

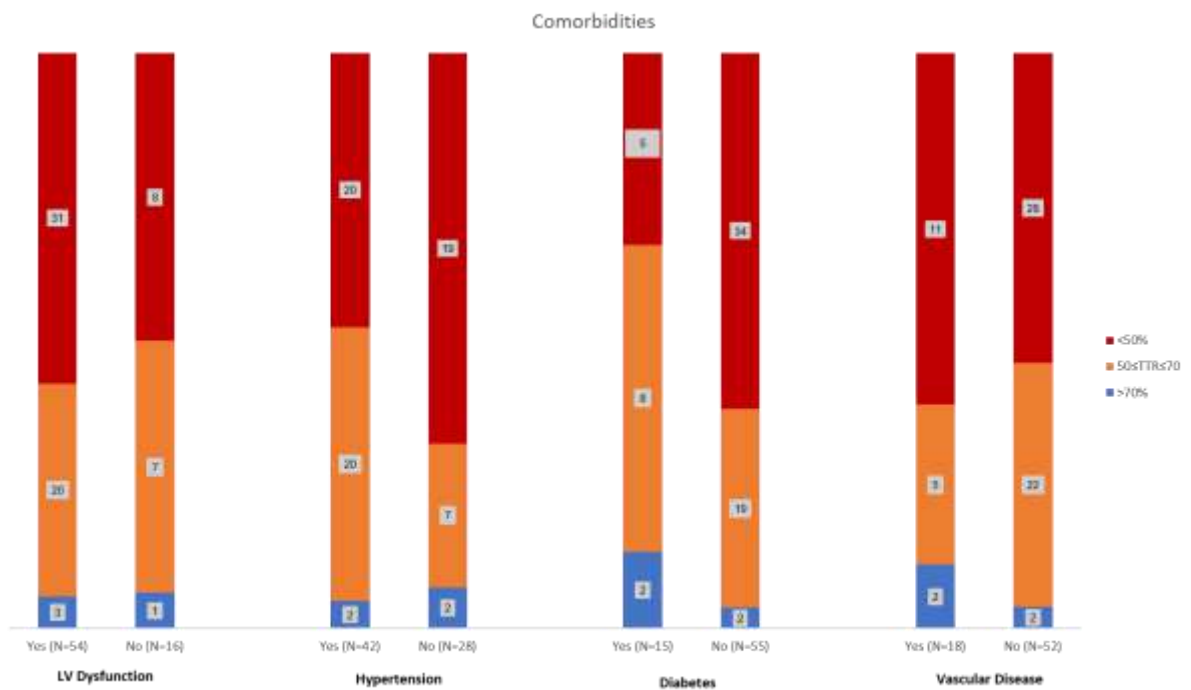


Figure 3. Comorbidities and TTR Distribution

Gender Differences in the Use of Oral Anticoagulants in Patients With Atrial Fibrillation

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¹*Taipei Veterans General Hospital, Taipei, Taiwan*

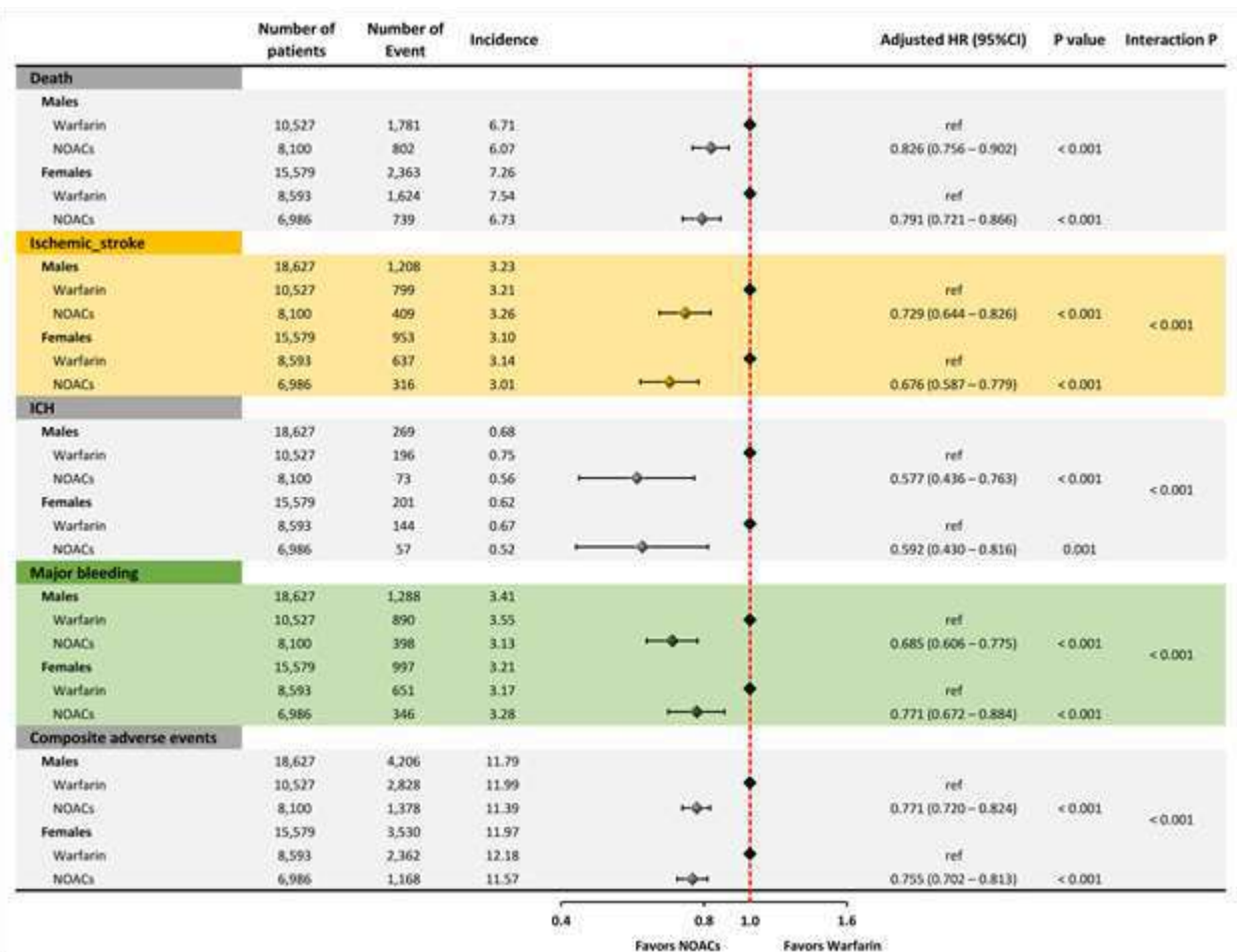
Objective: It is not known how sex affects the use of oral anticoagulants (OAC) and prognosis.

Materials and Methods: From year 2012 to 2016, 141,941 patients with AF were identified from a nationwide cohort, and 34,206 patients taking OAC constituted our study population. The end points include death, ischemic stroke, ICH, major bleeding, and composite adverse events.

Results: Female AF patients were older, had higher CHA2DS2-VASc and HAS-BLED scores. The CHA2DS2-VASc score of female patients remained higher than male patients after excluding the point of gender. NOAC use was more common in females while there were no significant differences regarding warfarin use between genders. There was no significant differences of characteristics of NOAC users between sexes compared to warfarin users. NOACs were associated with lower risks of all end points compared to warfarin in both sexes. The benefit of NOACs in reducing risks of mortality, ischemic stroke, and composite adverse events was more prominent in females than in males. Meanwhile, NOACs related risk reduction of ICH and major bleeding was more obvious in males. (death: aHR 0.826 for male, 0.791 for female; ischemic stroke: aHR 0.729 in males, 0.676 in females; ICH: aHR .0577 for males, 0.592 for females; major bleeding: aHR 0.727 for males, 0.685 for females; composite adverse events: aHR 0.771 for males, 0.755 for females; all interaction $P < 0.001$).

Conclusion: OAC was associated with a lower risk of clinical end points than warfarin, but the benefit of risk reduction regarding different end points varied between males and females.

SUPPORTING DOCUMENTS



Impact of Atrial Fibrillation on Prognosis in AMI With Reduced, Mildly Reduced, or Preserved LVEF

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¹*Chungbuk National University Hospital, Cheongju, South Korea*

Objectives: We aimed to compare the all-cause mortality rate and mode of death in acute myocardial infarction (AMI) patients with atrial fibrillation (AF) and in those without AF according to the left ventricular ejection fraction (LVEF) subtype.

Materials and Methods: Among 13,104 AMI patients from the Korea Acute Myocardial Infarction Registry-National Institute of Health (KAMIR-NIH) registry, 12,166 male patients surviving during hospitalization (age 64 ± 13 , 74%) were classified by the LVEF subtype (Group 1, <LVEF 40%; Group 2, LVEF 40-50%; Group 3, LVEF $\geq 50\%$). We investigated the adverse impact of AF on all-cause, cardiac, and non-cardiac mortality rate for 2-years follow-up period in patients with AMI.

Results: The crude all-cause and cardiac mortality rates were significantly higher in AF patients than in non-AF patients across all LVEF subtypes. The adjusted risk of AF for the all-cause and cardiac mortality rates was significantly higher in patients with LVEF $\geq 40\%$ than in those with <LVEF 40% (hazard ratio for all-cause mortality: 1.03 (95% CI 0.72-1.47, $p=.86$) in group I; 1.54 (95% CI 1.06-2.22, $p=.02$) in group II; 1.61 (95% CI 1.10-2.37, $p=.02$) in group III, hazard ratio of cardiac mortality: 1.06 (95% CI 0.69-1.62, $p=.79$) in group I; 2.11 (95% CI 1.35-3.28, $p=.001$) in group II; and 2.55 (95% CI 1.61-4.02, $p<.001$) in group III. AF did not impact non-cardiac mortality rates in all subtypes of LVEF.

Conclusion: AF complicating AMI was associated with increased all-cause and cardiac mortality in patients with LVEF $\geq 40\%$, but not with non-cardiac mortality, in all LVEF subtypes.

Association Between SGLT-2 Inhibitors and Risk of AF in Type 2 Diabetes: Nationwide Cohort Study

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Objectives: Accumulating evidence shows that sodium-glucose co-transporter-2 (SGLT-2) inhibitors reduce cardiovascular outcomes. However, this favorable effect is unclear for newly atrial fibrillation development compared to other anti-diabetic drugs. We investigated the association of SGLT-2 inhibitor for newly AF development compared to dipeptidyl peptidase-4 (DPP-4) inhibitors in patients with type 2 diabetes.

Materials and Methods: Using the Korean National Health Insurance Service database, among 2,160,911 type 2 diabetes patients between 1 May 2016 and 31 December 2018, we studied 44,557 patients with SGLT-2 inhibitors and 470,358 patients with DPP-4 inhibitors. Propensity score-matching was used to correct for differences between the groups.

Results: During a median follow-up of 1.3 years, compared with patients with DPP-4 inhibitors, patients with SGLT-2 inhibitors have not shown lower incidence and risk of AF (2.7 and 3.3 per 1000 person-years; hazard ratio 0.79, 95% confidence interval 0.62-1.01; p=0.058) in overall treatment analysis. In intention-to-treat analysis, these results were consistent (3.4 and 3.9 per 1000 person-years; hazard ratio 0.87, 95% confidence interval 0.72-1.05; p=0.149). In subgroup analysis, SGLT-2 inhibitors were associated with lower risks of AF in female compared to male patients.

Conclusion: In this nationwide cohort of type 2 diabetes patients treated with SGLT-2 inhibitors or DPP-4 inhibitors, SGLT-2 inhibitors were not associated with protection against newly AF development except for female patients after adjusting for clinical confounders.

A Case of Reentrant Atrial Tachycardia Associated With Epicardial Intercaval Bundle

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¹Midori Hospital, Kobe, Japan, ²Akashi Medical Center, Akashi, Japan, ³Itami City Hospital, Itami, Japan

Introduction: The anterior wall area of the right pulmonary vein is connected to the posterior wall of the right atrium with a complex intercaval bundles (IB) on the epicardial side. It has been reported that this region may be involved in proarrhythmia. A 72-year-old female was referred to our hospital for shortness of breath during exertion in June 2018. She had a persistent atrial fibrillation. The first ablation (extensive encircling pulmonary vein isolation and posterior wall isolation) was performed in February 2019. After that, persistent atrial tachycardia recurred, and second session was performed.

Method: The 4PV isolation and roof-line in the previous session were completed. When the left and right atrium were mapped by HDGC, the earliest excitatory site of AT showed a centrifugal pattern in the anterior lower part of RIPV. The PPI was consistent at the same site, but the tachycardia circuit drawn with 3D mapping system did not satisfy the tachycardia cycle length. Since the area of early activation site was relatively wide, the epicardial side may be involved. And the circuit is estimated by considering the IB, it was suggested that reentrant tachycardia circuit may occur due to epicardial bridge conduction.

Result: Ablation was successful by cauterizing the endocardial side of the left atrial septal attachment site of IB.

Conclusion: In recent years, a ridge-related-AT involving the epicardial marshall bundle in the left pulmonary vein region has been reported. This case may be a right ridge-related-AT involving the epicardial IB in the right pulmonary vein region.

Epicardial Connections after a Conventional Pulmonary Vein Antrum Isolation in Patients with Atrial Fibrillation

Mr Eiji Nyuta¹, Dr Masao Takemoto¹, Mr Togo Sakai¹, Dr Yoshibumi Antoku¹, Dr Shintaro Umemoto¹, Dr Masaki Fujiwara¹, Ms Kaoru Takegami¹, Dr Tomohiro Takiguchi¹, Mrs Miyuki Nakahara¹, Dr Tokushi Koga¹, Dr Takuya Tsuchihashi,¹

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Objectives: The existence of epicardial connection(s) (ECs) between the pulmonary veins (PVs) and atrium may hinder establishing a complete PV antrum isolation (AI) (PVAI) in patients with atrial fibrillation (AF). Thus, the purpose of this study was to determine the incidence and location of ECs inside the conventional PVAI lines.

Materials and Methods: Three hundred consecutive patients with non-valvular AF were evaluated. The ECs were defined as the existence of RPs (remaining potentials), which were located at a distance exceeding at least 5 mm from complete conventional PVAI lines.

Results: This study revealed that 1) the prevalence of patients with ECs and number of ECs per patient between the PVs and atrium became significantly greater, respectively, in accordance with the progression of paroxysmal to long-lasting AF and left atrial enlargement, 2) some ECs were located at sites far distal to the PVAI lines, 3) 25% of ECs could be detected only by high-density mapping catheters, but not by conventional circular mapping catheters, 4) a BNP level of 176.6 pg/ml and LAV of 129.0 ml may be important predictors of the presence of ECs, and 5) the rate of conduction of ECs from the right PVs was dominantly to the atrium and His-bundle, and that from the left PVs to the coronary sinus was most dominant.

Conclusion: The PVAI may not be completed by only a conventional PVAI, and additional EC ablation inside the PVAI lines detected using high-density mapping may be able to achieve a more complete PVAI.

Effect of Heart Rate Control on Clinical Course of Non-ischaemic Cardiomyopathy With Atrial Fibrillation

Dr Kwai-Kuen Irene Chung¹

¹*TTSH, Singapore*

Background: The optimal rate control strategy in patients with AF and heart failure (HF) remains unknown.

Methods: 447 patients with heart failure and reduced left ventricular ejection fraction (LVEF <40%) due to non-ischemic cardiomyopathy (NICMP), with mean LVEF at follow up were categorised into two groups, improved LVEF ≥40% (group 1) or LVEF remain <40% (group 2). Continuous variables were compared by Student t tests and categorical variables compared by use of the Fisher exact test. Composite endpoints include ventricular arrhythmias (VA), cardiovascular death (CVD), death and hospitalisations for heart failure. Statistical significant difference was denoted as $p < 0.05$.

Results: 172 patients with AF. Mean age and LVEF of AF vs sinus rhythm patients were 69.64 ± 11.67 years vs 58.99 ± 14.11 years and 25.78 ± 8.60 % vs 21.19 ± 8.00 % respectively ($p = 0.001$). Patients with diabetes mellitus 33%, hypertension 84%. Patients taking ivabradine 10%, b-blocker 91%, Angiotensin inhibitors/Angiotensin Receptor Blocker 71%, Sacubitril/ Valsartan 19%, spironolactone 42%, SGLT-2 inhibitor 5%. Mean follow-up duration of 6.18 ± 4.16 years. 49% patients LVEF improved to >40%. The mean LVEF of group 1 and 2 were 50.07 ± 7.30 % and 26.45 ± 8.80 % respectively ($p < 0.001$). The heart rate were 72.09 ± 13.19 and 82.04 ± 20.44 beats/min respectively ($p < 0.001$). Group 2 have significantly higher CVD ($p = 0.03$), death ($p = 0.017$), VA ($p = 0.012$), hospitalisations for heart failure ($p < 0.001$) and composite endpoints ($p < 0.001$).

Conclusions: This study suggests more optimal heart rate control in patients with NICMP and AF improve clinical endpoints.

Arrhythmic Risks Post Acute Myocardial Infarction (MI) in the Modern Era

Dr Kwai-Kuen Irene Chung¹

¹*Ttsh, Singapore*

Current data on arrhythmic risks after acute MI in the modern era of early revascularization in the Asian population are limited.

Objective: To investigate the incidence of arrhythmias after acute ST elevation MI in a contemporary cohort of Chinese patients in the era of early revascularization.

Method: 394 patients admitted with ST elevation MI who under emergency revascularization, 88 % male, mean age of men and women 68.07 ± 13.13 and 58.66 ± 12.42 respectively, mean follow up of 577 ± 118 days. Pain to needle time (onset of chest pain to primary angioplasty) 4.88 ± 4.60 hours. 130 patients had left ventricular ejection fraction (LVEF) $\leq 35\%$, mean LVEF $29.74 \pm 5.95\%$ improved to $39.85 \pm 10.13\%$ ($p < 0.001$) after 6 months.

Results: 12 deaths, 8 non arrhythmic cause, 1 cardiac arrest due to ventricular fibrillation and 3 of unknown cause. Risk of arrhythmic death/death of unknown cause and atrial fibrillation is 0.64% vs 2.4% per year respectively. 14 patients developed atrial fibrillation, 11 and 3 in men and women respectively ($p = 0.433$). 7 occurred at day 1, 5 at day 2 and 2 at day 3 post MI.

Conclusion: The arrhythmic risks after acute myocardial infarction in the modern era of early revascularization in the Asian population is lower than previously reported. AF is the commonest arrhythmia and 86% occurred within 48 hours post MI may be due to ischaemia and inflammation. Women presented 10 years later than men and there is no significant difference in the incidence of AF.

An Unusual Treatment to Reduce Atrial Fibrillation Burden

Dr Kwai-Kuen Irene Chung¹

¹*Ttsh, Singapore*

A 94 years old woman diagnosed with paroxysmal atrial fibrillation (AF), diabetic mellitus, chronic kidney disease, hypertension, giant cell arteritis (GCA) and hypothyroidism was presented with one day history of chest pain and palpitation. Her ECG showed AF with ventricular rate of 130 bpm. She went to sinus pause of 8 seconds probably due to high vagal tone during passing motions and subsequently underwent dual chamber pacemaker (PPM) implantation. She was readmitted 3 days post PPM implant with palpitation and fever 37.9C. ECG showed AF with ventricular rate 126 bpm. This was complicated by acute decompensated heart failure requiring intravenous diuretic. Her AF was incessant despite IV amiodarone and b-blocker. Extensive infectious workup was negative and there was no sign of inflammation at her PPM site. CRP was elevated 65 mg/L and continued to increase despite escalation of antibiotic but procalcitonin was 0.08 ug/L. Repeat echocardiogram showed normal left ventricular ejection fraction with a small pericardial effusion noted and myocardial perfusion scan showed normal perfusion. It was thought that an acute inflammatory response following implantation of PPM precipitated the AF with a background of GCA and hence patient was treated with increased dosage of prednisolone of 20mg. Patient reverted to sinus rhythm within 24 hour and remained so at 8 months follow up.

This case illustrates the temporal relationship of systemic inflammation to AF burden and highlights the need for anti-inflammatory pharmacological intervention to reduce AF burden and improve haemodynamic of patient.

SUPPORTING DOCUMENTS



Temporal relationship between CRP (mg/L) and AF burden(per 24 hours)

Predictor of the Recurrence Over 3 Years After Cryoballoon Ablation for Paroxysmal Atrial Fibrillation

Dr Akira Sato¹, Dr Masayo Minegishi¹, Dr Shin Meguro¹, Dr Kentaro Nakata¹, Dr Gaku Narita¹, Dr Yuhei Isonaga¹, Dr Shunichi Kato¹, Dr Toshikazu Kono¹, Dr Hiroaki Ohya¹, Dr Takamitsu Takagi¹, Dr Yasuaki Hada¹, Dr Miki Kanoh¹, Dr Yukihiro Inamura¹, Dr Tsunehiro Yamato¹, Dr Ken Negi¹, Dr Osamu Inaba¹, Dr Yutaka Matsumura¹

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Background: Recently, the catheter ablation for paroxysmal atrial fibrillation is improving safety and efficacy. Especially cryoballoon ablation is easier and faster than radiofrequency ablation, therefore spread rapidly. However, the long-term outcome of cryoballoon ablation for paroxysmal atrial fibrillation is unknown. We investigated the predictors of the recurrence over 3 years of cryoballoon ablation for paroxysmal atrial fibrillation.

Subjects/Methods: We investigated 495 patients (the mean age 64.4 ± 10.7 y.o., male 350, the mean observation 1507.1 ± 342.2 days) that had undergone the first session of cryoballoon ablation for paroxysmal atrial fibrillation without recurrence of atrial fibrillation for 3 years from 2014 to 2018.

Results: Between 3 and 8 years after catheter ablation, 86 patients had atrial fibrillation recurrence and 409 patients had no recurrence. That independent predictors were female gender (39.5%/27.1%, 95% CI 1.16-3.25, OR 1.94, $p=0.0116$), atrial fibrillation under no anti-arrhythmic drugs in admission (34.9%/16.2%, 95% CI 1.67-4.98, OR 2.89, $p=0.000144$).

Conclusion: We need to give attention to atrial fibrillation recurrence over 3 years after catheter ablation in patients that characterized female gender, atrial fibrillation in admission:

Effect of blood pressure on the prevalence of atrial fibrillation in DM ESRD

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Background: Atrial fibrillation (AF) prevalence is increasing as elderly population increases. Even after eliminating impact of aging, chronic kidney disease, diabetes and hypertension are known risk factors of AF occurrence. Since multi-morbidity exists in chronic kidney disease patients, it is difficult to determine impact of hypertension solely. Besides, little is known about impact of hypertension to predict AF in diabetic end stage renal disease (ESRD). To evaluate sole effect of hypertension in ESRD, we aimed to evaluate the effect of differential blood pressure control status on developing AF among diabetic ESRD population.

Methods: From 2,717,072 individuals with diabetes who underwent health examinations during 2009–2012 from the database of the Korean national health insurance service, total 13,859 individuals with diabetic ESRD without prior history of AF were included for the analysis. Based on blood pressure level and previous hypertension medication history, we subdivided as five blood pressure categories.

Among five levels of blood pressure status, new onset hypertension (HR 1.609 [1.045-2.477]), controlled hypertension (HR 1.792 [1.295-2.482]), and uncontrolled hypertension (HR 2.291 [1.651-3.18]) showed higher risk of AF orderly. Impact of hypertension was mainly due to diastolic hypertension and increased pulse pressure.

Conclusion: In diabetic ESRD patients, overt hypertension and history of hypertension impacts on AF. The effect of hypertension in this population is mainly due to diastolic hypertension and increased pulse pressure.

SUPPORTING DOCUMENTS

Table1. Predefined five levels of blood pressure status^o

5 Levels of ^o Blood pressure status ^o	Blood Pressure ^o	Antihypertensive medication ^o	Label ^o
1 ^o	SBP<120 and DBP<80 ^o	No ^o	normal ^o
2 ^o	120≤SBP<140 and 80≤DBP<90 ^o	No ^o	Pre- hypertension ^o
3 ^o	SBP≥140 or DBP≥90 ^o	No ^o	new onset ^o
4 ^o	SBP<140 and DBP<90 ^o	Yes ^o	controlled ^o
5 ^o	SBP≥140 or DBP≥90 ^o	Yes ^o	uncontrolled ^o

Long-term Patient and Health Service Outcomes in Atrial Fibrillation: A Systematic Review

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Atrial fibrillation (AF) is a prevalent problem worldwide and a common cause of hospitalisation, poor quality of life and associated with increased mortality. Previous studies have largely focused on short term outcome effects of these treatments. This systematic review aims to determine the effect of ablation compared to antiarrhythmic drugs for AF on long-term patient and health service outcomes of mortality, hospitalisation, and quality of life.

Studies were included if they were published in the past ten years, in English, and reported long-term outcomes of more than 12 months comparing ablation and antiarrhythmic drugs for treating AF. The details of the search were recorded according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses report (PRISMA). Risk-of-Bias tool for randomized trials (Rob2) and Risk-of-Bias in Non-randomized Studies of Interventions (ROBINS-1) were used for assessing the risk of bias.

A total of 2,224 records were identified. Finally, 12 papers were included in the analysis. Eight studies reported mortality indicating ablation was superior, two studies reported hospitalisation with opposing outcomes, and five quality of life studies indicating ablation was a better treatment. In studies assessing long-term outcomes, beyond 12 months, following ablation or rhythm control drugs for atrial fibrillation, most found a lower risk of death and greater improvement in quality of life in the ablation group.

Association of Bundle Branch Block With Recurrence of Atrial Fibrillation After Catheter Ablation

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Association of bundle branch block with recurrence of atrial fibrillation after catheter ablation

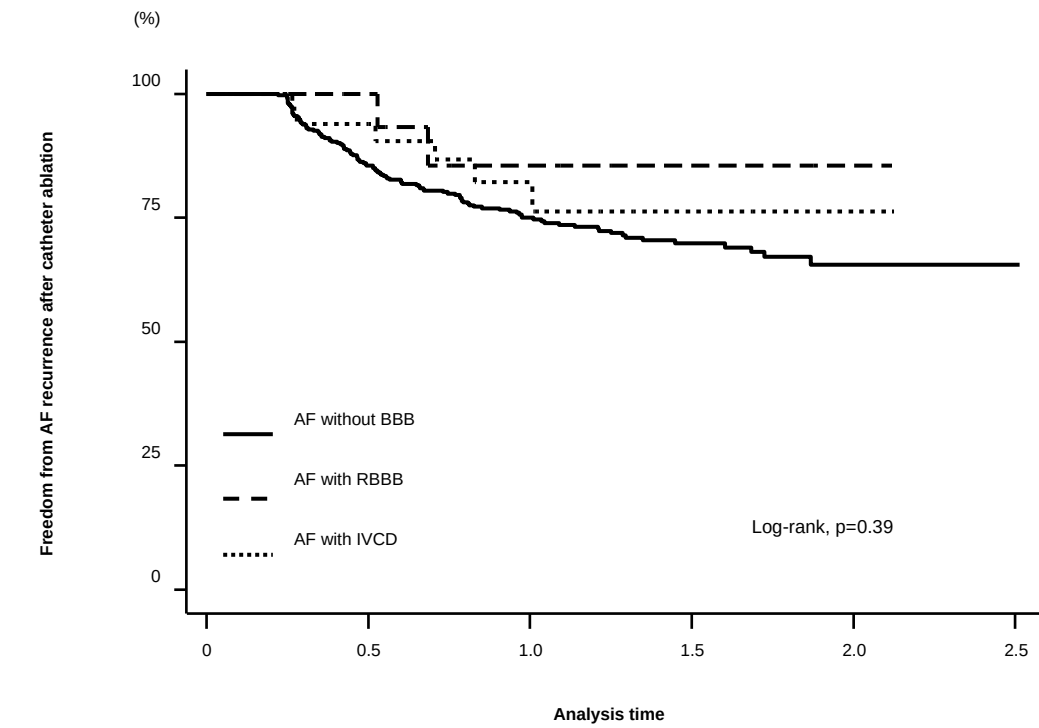
Objective: The association between bundle branch block (BBB) and recurrence of atrial fibrillation (AF) after catheter ablation is unclear. The aim of this study was to determine whether AF combined with BBB is associated with AF recurrence after catheter ablation.

Materials and Methods: A total of 477 consecutive AF patients who underwent catheter ablation were included. The AF patients were divided into three groups according to BBB: AF without BBB (n=427), AF with RBBB (n=16), and AF with intraventricular conduction disturbance (AF with IVCD) (n=34).

Results: Of the 477 AF patients (mean age 57 years, 81% men, median CHA2DS2-VASc score of 1), 16 (3.4%) patients had RBBB and 34 (7.1%) patients had IVCD. During a mean follow-up of 15.2 ± 6.7 months, 119 patients (24.9%) had recurrence of AF. Of these, 111 (26%) patients were in the AF without BBB group, with two (12.5%) and six (17.6%) patients in the RBBB and IVCD groups, respectively. The Kaplan-Meier estimate of the rate of recurrent AF was not significantly different among the three groups ($p=0.39$). Multivariable analysis showed that persistent AF (HR 1.7, 95% CI 1.15-2.50, $p=0.007$), chronic kidney disease (HR 2.94, 95% CI 1.20-7.17, $p=0.01$), and left atrial diameter (HR 1.04, 95% CI 1.009-1.082, $p=0.01$) were significantly associated with AF recurrence.

Conclusion: AF with BBB was not significantly associated with recurrence of AF after catheter ablation in middle aged patients with low risk cardiovascular profile.

SUPPORTING DOCUMENTS



Number at risk

427	330	219	110	32	1
16	15	8	3	1	0
34	28	14	2	1	0

High-Frequency, Low-Tidal-Volume Mechanical Ventilation During Radiofrequency Ablation of Atrial Fibrillation: A Single Center Experience

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Pulmonary vein isolation (PVI) is a radiofrequency catheter ablation technique commonly used to treat atrial fibrillation (AF). Recent studies have shown that a high-frequency, low-tidal-volume mechanical ventilation strategy (HFLTV) may improve catheter stability and the overall efficiency of the ablation procedure. We hypothesized that PVI with HFLTV had higher first-pass isolation than PVI with standard mechanical ventilation.

We prospectively collected demographic and procedural data for patients who underwent PVI for the treatment of AF at the Queen's Medical Center in Honolulu, HI between July 2019 and July 2022. The HFLTV protocol was defined by using mechanical ventilation with a respiratory rate of 30 breaths/min and a tidal volume of 200 mL only during the ablation part of the PVI procedure. The primary outcome was first-pass isolation, achieved if both veins on one side of the left atrium were isolated after the first ablation lesion set. Statistical analysis was performed using logistic regression.

A total of 127 patients were included in the study (39 HFLTV group; 88 control group). HFLTV strategy was associated with higher first-pass isolation (OR 2.15 [1.11 – 4.16]; $p = 0.023$). The primary outcome is primarily driven by significantly higher first-pass isolation of the left pulmonary vein bundle (OR 5.03 [1.42 – 17.81]; $p = 0.012$).

HFLTV strategy was associated with a statistically significantly higher chance of achieving first-pass isolation for PVI. From our experience, HFLTV is a feasible and safe technique to perform during PVI.

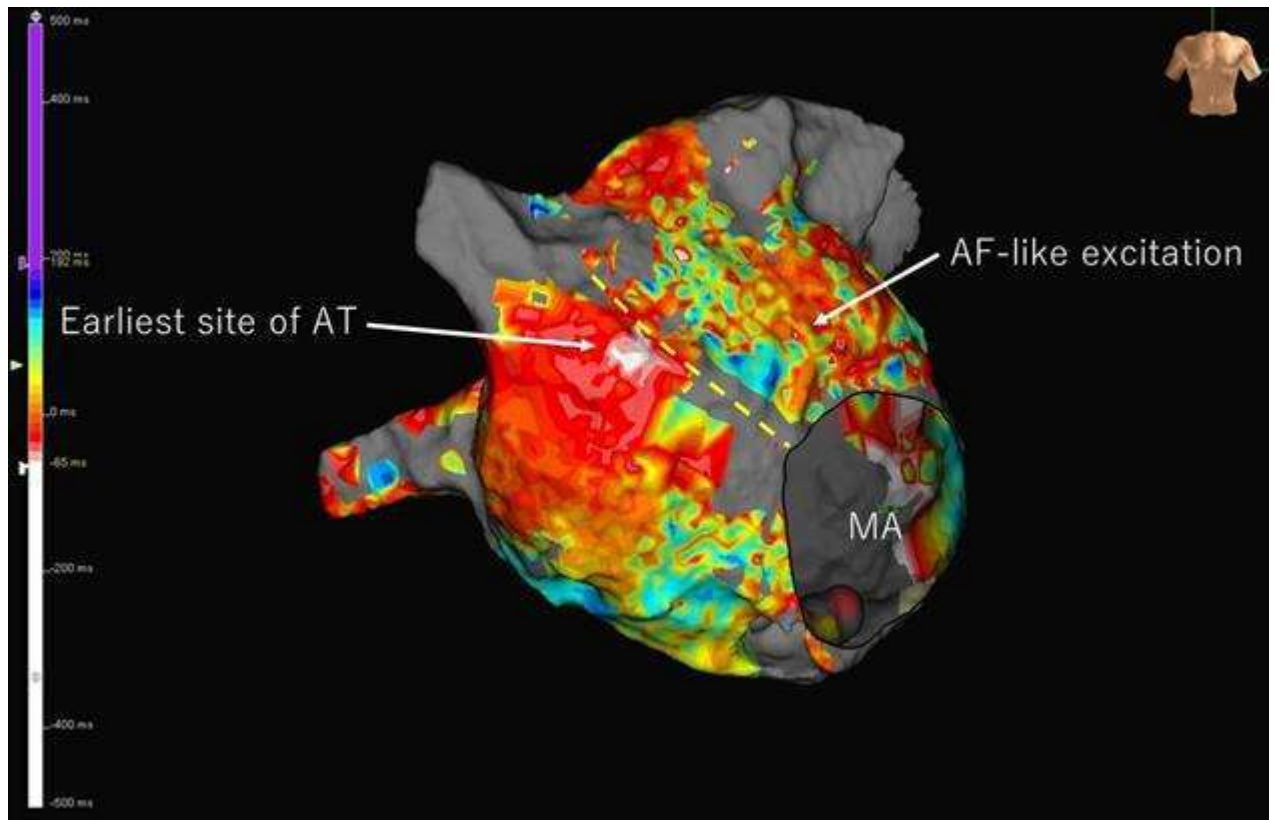
Irregular Atrial Tachycardia After the Maze Procedure

Dr Sou Takenaka¹, Dr Ayano Enzan¹, Dr Akihiko Ueno¹, Dr Soihiro Ogura¹, Dr Daisuke Iida¹, Dr Nobuhiro Hara¹, Dr Masahiro Yamauchi¹, Dr Motohiro Nakao¹, Dr Tomonobu Okuno¹, Dr Masayoshi Sakakibara¹

¹*Department Of Cardiology, Ims Katsushika Heart Center, Tokyo, Japan*

A 76-year-old male presented to our clinic with a chief complaint of shortness of breath on exertion. Seven years ago, he was admitted to another institute for heart failure due to atrial fibrillation (AF). At that time, a thrombus was found in the left atrial appendage. He took a left atrial appendage resection and a left atrial maze procedure were performed. Six years ago, biventricular pacing was performed for sick sinus syndrome with low left ventricular function, and 5 years ago, radiofrequency ablation was performed for recurrent AF. However, the atrial fibrillation had recurred. The ECG showed AF and ventricular pacing. The ultrasonic echocardiography finding was 40% of left ventricular ejection fraction, and enlargement of the left atrium (LA) and ventricle. When electrode catheters were inserted into the atria, the right atrium showed irregular and slow excitation. Three-dimensional mapping revealed that excitation in the region closer to the septum of the LA was synchronous with the right atrium, and irregular and relatively slow. The origin of this slow excitation was located at the anterior wall of LA, arising from the electrically isolated line during the maze procedure. The lateral site of this line also exhibited AF-like excitation. After radiofrequency ablation of the earliest site of this slow excitation, he was restored to atrial pacing rhythm. But that lateral site also continued AF-like excitation. There was no recurrence after ablation, and the shortness of breath on exertion improved. We report a case of unique atrial conduction after maze procedure.

SUPPORTING DOCUMENTS



Distributions of GAP and Dormant Conduction Site of AI-guided Box Isolation in Persistent AF Patients

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¹*Department Of Cardiology Toranomon Hospital, Tokyo, Japan*

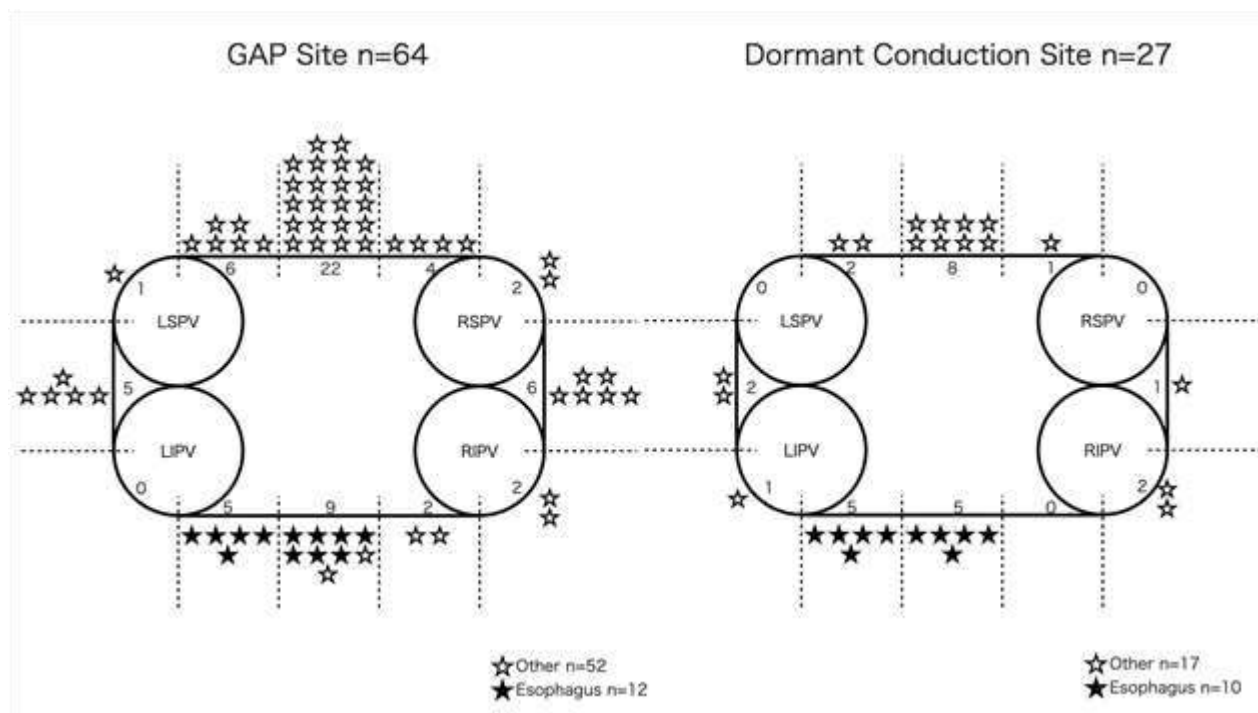
Objectives: For the catheter ablation of persistent atrial fibrillation (AF), the clinical benefit of box has been reported. However, electrical conduction gap (GAP) and dormant conduction (DC) can be unwantedly produced. We aimed to clarify the distributions of GAP and DC site.

Methods: One hundred dive consecutive patients AF underwent ablation index (AI)-guided single ring box isolation (BOX). AI-guided BOX was performed target values with 550, inter-lesion distance of ≤ 6 mm and RF energy was delivered with 35 W everywhere except the bottom line near the esophagus. In the absence of first-pass isolation, the residual and reconnected GAP were mapped, touch-up ablation was delivered. After achievement of BOX, adenosine was given. In case of reconnection, the site of DC was treated with touch-up ablation.

Results: Their mean age was 59.7 ± 9.4 . The median duration of AF was 16 months. Acute Box was achieved in all cases, however, 64 GAP in 44 patients were observed after initial encirclement. (Fig) And, 27 DC in 22 patients were observed. (Fig) The mean duration of follow up was 2.3 ± 1.3 years. 1 year freedom from any atrial tachyarrhythmia ≥ 30 s without AAD was 88.4%. There was no relation between recurrence and GAP or DC.

Conclusion: AI-guided BOX may have some limitation in making a first-pass isolation especially at the center portion of roof line and the bottom line near the esophagus due to their anatomical features. For improving ratio of a first-pass isolation of Box, new technologies or tools may be needed.

SUPPORTING DOCUMENTS



Association of Catheter Ablation and Different Types of Dementia in Atrial Fibrillation during Long-term Follow-up

Dr Guan-Yi Li¹, Mrs Yun-Yu Chen^{1,2,3}, Professor Yenn-Jiang Lin^{1,2}, Dr Fa-Po Chung^{1,2}, Professor Yu-Cheng Hsieh^{2,4}, Professor Kuo-Liong Chien³, Professor Shih-Ann Chen^{1,2,4}

¹Heart Rhythm Center, Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, ²Cardiovascular Research Center, School of Medicine, National Yang-Ming University National Yang Ming Chiao Tung University, Taipei, Taiwan, ³Institute of Epidemiology and Preventive Medicine College of Public Health, National Taiwan University, Taipei, Taiwan, ⁴Cardiovascular Center, Taichung Veterans General Hospital, Taichung, Taiwan

Objectives: Epidemiologic characteristics of new-onset dementia in patients with AF were investigated, as well as the effect of catheter ablation on different types of dementia.

Materials and Methods: AF patients were identified using Taiwan's National Health Insurance Research Database (2013-2014) and new-onset of dementia events were followed till 2019. The ages of controls and AF patients were matched at baseline. We studied 68387 patients with AF (> 18 y/o) without a prior history of dementia. Non-AF controls with the same age groups were matched to AF patients without prior AF diagnoses in 2013-2014. A competing risk model was used to investigate three subtypes of dementia.

Results: During follow-up, 8704 new-onset dementia events occurred. Subtypes of dementia in AF patients were reported: 73% attributed to Alzheimer's disease, 16% attributed to vascular dementia, and 11% attributed to other/mixed dementia. The crude incidence of dementia in AF patients was higher than in non-AF controls (total dementia: 18.9 vs 23.2, Alzheimer's disease: 15.3 vs 16.8, vascular dementia: 2.08 vs. 3.88, and other/mixed dementia: 2.01 vs. 2.59 [per 1000 person-years]; all $P < 0.001$). In AF patients receiving ablation, the total dementia risk decreased significantly (HR: 0.74, 95% CI: 0.58-0.94) after multi-variable adjustment, but only for the subtypes of Alzheimer's disease (HR: 0.79, 95% CI: 0.60-0.98)

Conclusion: AF patients have a higher risk of developing all types of dementia, including Alzheimer's disease, vascular dementia, or a mix type of dementia. Alzheimer's disease was less likely to occur in patients with AF who received ablation, but not vascular dementia.

SUPPORTING DOCUMENTS

Study flow chart

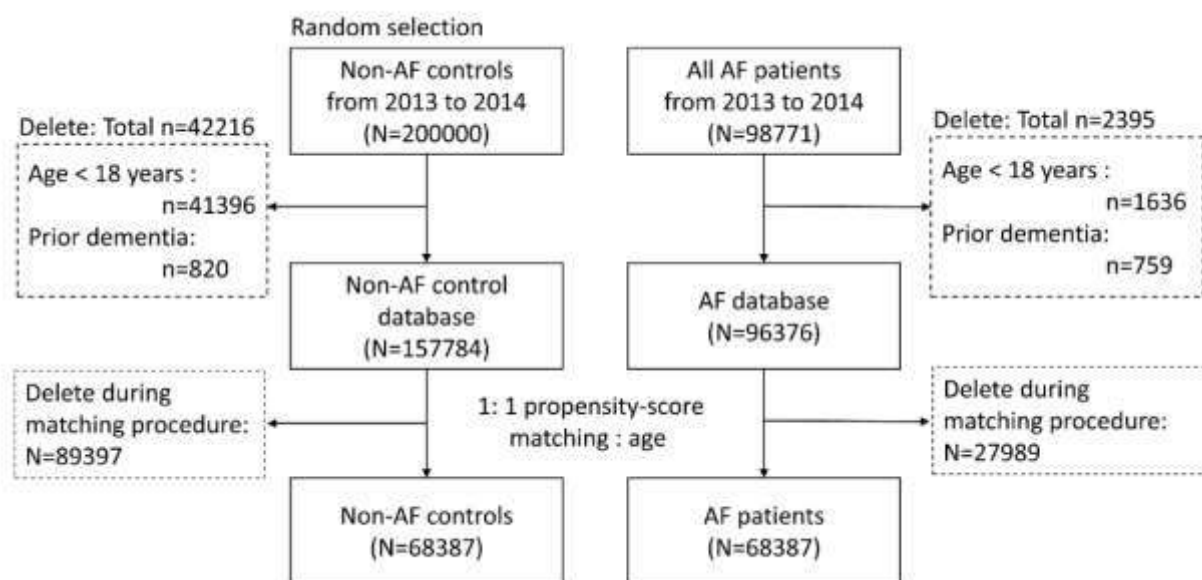
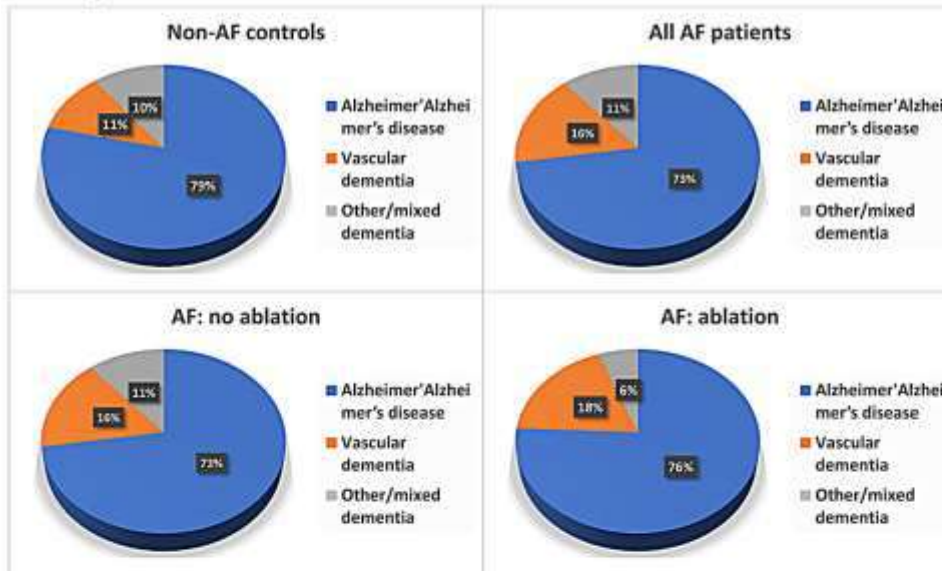
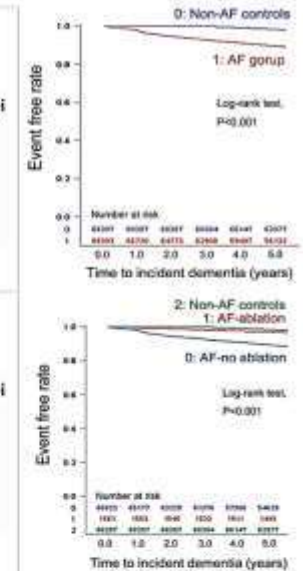


Figure: characterization of the dementia types in AF patient

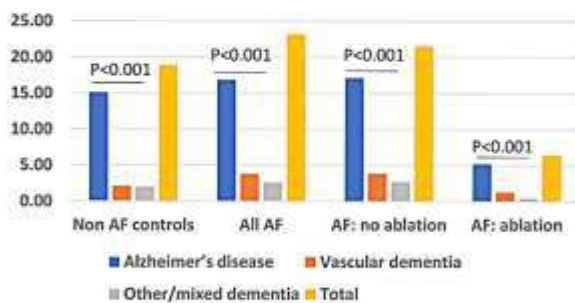
Subtypes of dementia



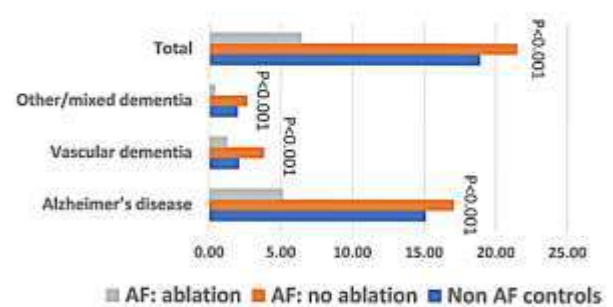
Time to total dementia



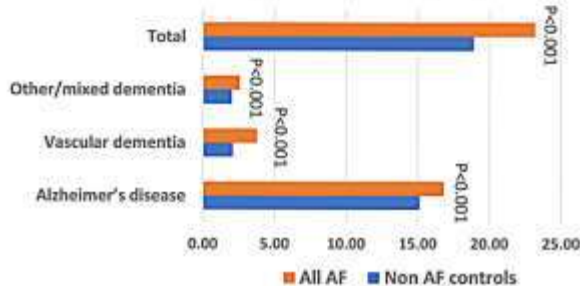
Incidence Rate (per 1000 person-years)



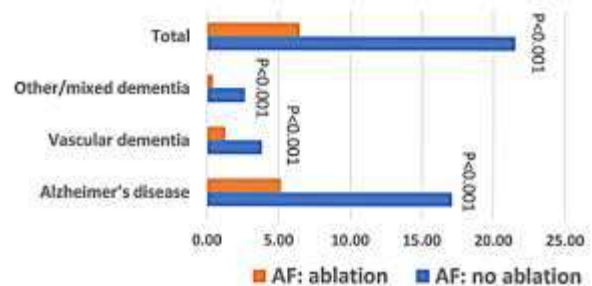
Incidence Rate (per 1000 person-years)



Incidence Rate (per 1000 person-years)



Incidence Rate (per 1000 person-years)



Effect of SGLT-2 Inhibitors on Adverse Outcomes in patients with AF and DM

Dr Bo Kyung Jeon¹, Dr Yeji Kim¹, Dr Moo-Nyun Jin¹, Dr Dong Hyeok Kim¹, Dr Min-ho Kim¹, Dr Junbeom Park¹
¹*Ewha Woman's University Medical Center, Yangcheon-gu, South Korea*

Objectives: Sodium-glucose cotransporter 2 (SGLT-2) inhibitors, one of the commonly used medications for diabetes mellitus (DM), are well known to have beneficial for heart failure (HF). Atrial fibrillation (AF) and HF have similar pathophysiological features and similar risk factors including DM. In this study, we hypothesized that SGLT-2 inhibitors would be effective on the prognosis of AF with DM.

Materials and Methods: This is a retrospective study using the common data model (CDM) database, converted using the patients' clinical information in several tertiary hospitals in South Korea. 300 patients who were first prescribed oral diabetic medication before or within 60 days of diagnosis of AF were enrolled from 2001 to 2020. Major adverse cardiac and cerebrovascular events (MACCE) were regarded as the primary endpoint. Student t-test and Cox regression analysis were used for statistical analysis.

Results: A significant difference was not seen between the incidence of MACCE, hospitalization rate and all-cause mortality between the two groups. Using multivariable cox-regression analysis, the use of SGLT-2 inhibitors was not significantly associated with higher MACCE incidence and hospitalization rate before and after adjusting for potential confounders. However, upon comparing hospitalization periods using student t-test, lower all-cause hospitalization periods with borderline significance ($p = 0.091$) were seen in the SGLT-2 inhibitor group.

Conclusion: Thus, to conclude, no significant difference was seen between the SGLT-2 inhibitor administration and control groups in terms of MACCE incidence, hospitalization, and all-cause mortality. However, the hospitalization period was shorter in the SGLT-2 inhibitor administration group with borderline significance.

SUPPORTING DOCUMENTS

	SGLT-2 inhibitor	Other medications	p value
Incidence (MACCE)	139 (54.30)	21 (47.73)	0.513
Incidence (ischemic heart disease)	11 (25.00)	52 (20.31)	0.548
Incidence (stroke)	15 (34.09)	104 (40.63)	0.505
Hospitalization rate (total)	22 (50.00)	143 (55.86)	0.514
Hospitalization rate (MACCE)	9 (20.45)	60 (23.44)	0.846
Hospitalization rate (ischemic heart disease)	4 (9.09)	22 (8.59)	1.000
Hospitalization rate (stroke)	6 (13.64)	43 (16.80)	0.825
Mortality (total)	0 (0.00)	7 (2.73)	0.599

*Values are presented as n (%); SGLT-2, sodium-glucose co-transporter inhibitor 2; MACCE, major adverse cardiac and cerebrovascular events

Table 1. Incidence, hospitalization rate, and mortality of SGLT-2 inhibitor administration and control group

	Unadjusted HR (95 % CI)	p value	Adjusted HR** (95 % CI)	p value
Incidence (MACCE)	0.891 (0.563 – 1.412)	0.624	1.015 (0.590 – 1.748)	0.955
Incidence (ischemic heart disease)	1.346 (0.700 – 2.591)	0.373	1.065 (0.473 – 2.398)	0.879
Incidence (stroke)	0.846 (0.492 – 1.456)	0.546	1.073 (0.554 – 2.079)	0.836
Hospitalization rate (total)	0.957 (0.608 – 1.506)	0.849	1.212 (0.705 – 2.083)	0.487

*SGLT-2, sodium-glucose co-transporter inhibitor 2; MACCE, major adverse cardiac and cerebrovascular events

**Age, sex, hypertension, cardiovascular disease, heart failure, cerebrovascular disease, and the use of antiplatelet, anticoagulant, statin, antiarrhythmic agent, angiotensin-converting enzyme inhibitor, angiotensin II receptor blocker, beta blocker, calcium channel blocker and diuretics were regarded as confounding variable and adjusted.

Table 2. Multivariable Cox-regression analysis table, comparing incidence of MACCE and hospitalization rate

	SGLT-2 inhibitor	Other medications	p value
Hospitalization period (total)	4.78 ± 6.27	7.38 ± 10.01	0.091
Hospitalization period (MACCE)	6.60 ± 6.45	10.95 ± 13.94	0.101
Hospitalization period (cardiovascular)	8.00 ± 8.72	8.29 ± 10.48	0.954
Hospitalization period (stroke)	7.33 ± 6.12	12.97 ± 15.98	0.106

*Values are presented as mean ± SD; SGLT-2, sodium-glucose co-transporter inhibitor 2; MACCE, major adverse cardiac and cerebrovascular events

Table 3. Average hospitalization period between SGLT-2 inhibitor administration and control group

The Clinical Relevance of Underweight on Treatment Outcome of Catheter Ablation for Atrial Fibrillation

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Objectives: Underweight is known to relate to complications and recurrence of atrial arrhythmia in patients undergoing catheter ablation (CA) for atrial fibrillation (AF). However, little is known about the clinical implication of underweight on patients' quality of life (QoL) among AF patients. We investigated the association between underweight and QoL improvement after CA for AF.

Materials and Methods: Using a prospective, multicenter Japanese registry, we analyzed 1,127 patients with AF who underwent CA within 12 months after registration. Patients were categorized into four groups based on body mass index (BMI): underweight (BMI<18.5), normal (18.5≤BMI<25), overweight (25≤BMI<30), and obesity (30≤BMI). Patients' QoL was assessed and compared at registration (baseline) and 1-year after registration by using the Atrial Fibrillation Effect on Quality-of-Life (AFEQT) questionnaire.

Results: Patients with underweight were more likely to be older, female, had smaller left atrial size, and had a greater proportion of paroxysmal AF. There were no significant differences in AFEQT overall summary (AFEQT-OS) scores at baseline among the four groups. Compared to baseline, AFEQT-OS scores improved significantly at 1-year follow-up in each group. Mean changes of AFEQT-OS scores in four groups were 9.73±20.37, 14.05±16.48, 14.25±15.12, and 12.89±18.79, respectively. After adjustment, underweight was independently associated with poor improvement of AFEQT-OS score 1-year after registration (adjusted difference -4.32 points, 95% CI, -8.52 to -0.11 points; P=0.044).

Conclusion: In contemporary Japanese clinical practice, underweight was associated with poor improvement of QoL after CA for AF. Careful assessment and tailored treatment strategy may be required for underweight AF patients.

Association of Coronary Artery Calcium Score with Recurrence After Catheter Ablation for Persistent Atrial Fibrillation

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Objectives: Cardiac computed tomography (CT) is often performed before catheter ablation (CA) for atrial fibrillation (AF) for preoperative treatment planning and thrombus evaluation. Although the coronary artery calcium score (CACS) is known to be associated with the risk of developing AF, there are few data on the association of CACS with recurrence of AF after CA. The purpose of this study was to investigate the association of CACS with AF recurrence after CA for persistent AF.

Materials and Methods: We included 153 consecutive patients who underwent initial pulmonary vein isolation and left atrial posterior wall isolation for persistent AF at our institution from January 2018 to December 2021, and analyzed 105 patients who underwent coronary CT. We divided the patients into two groups according to the Agatston score: CACS > 100 (N=35) and CACS ≤ 100 (N=70), and compared them with respect to recurrence of atrial arrhythmias after CA.

Results: Patients with CACS>100 had higher prevalence of diabetes mellitus (37% vs 11%, p=0.004) and dyslipidemia (66% vs 24%, P<0.0001) and higher left atrial volume (87±30 vs 75±25 ml, p=0.045). Mean observation time was 19 months. The chronic recurrence rate 3 months after CA was significantly higher in the CACS>100 group (26% vs 5%, p=0.0013). On multivariate analysis, diabetes mellitus and CACS>100 (OR: 10.2; CI: 1.73 to 60.3, p = 0.01) were factors associated with AF recurrence.

Conclusion: In patients with persistent AF undergoing CA, CACS may be associated with risk of chronic phase AF recurrence.

Esophageal Injury After Radiofrequency Catheter Ablation or Cryoballoon Ablation in Atrial Fibrillation

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Aims: Esophageal lesion (EL) is one of the complications after catheter ablation of atrial fibrillation (AF). However, the comparison of EL between radiofrequency catheter ablation (RFCA) and cryoballoon ablation (CBA) is not well known. Hence, we aimed to investigate the association with EL after catheter ablation.

Methods: Consecutive patients with AF who underwent RFCA or CBA, including pulmonary vein isolation, were studied. We compared clinical outcomes between patients with EL and those without EL.

Results: Among 584 patients (mean age 62.8 ± 11.2 years, 68.6% men), 30 (5.14%) had EL after RFCA (25/504, 4.96%) or CBA (5/80, 6.25%). When patients with EL were classified by Kansas City Classification, Class I was 17 (68%) and 3 (60%) in RFCA and CBA, respectively. Patients with EL had significantly reduced ejection fraction (EF) (48.9 ± 8.7 vs. 52.8 ± 6.8 , $p=0.023$) and lower body mass index (BMI) (24.5 ± 3.9 vs. 25.9 ± 3.4 , $p=0.030$) compared to patients without EL. EL after RFCA had more history of diabetes, previous stroke, and congestive heart failure compared to CBA. Multivariate analysis using logistic regression showed a lower BMI (odds ratio (OR) 0.82, 95% confidence interval (CI) 0.71-0.93, $p=0.003$) and a reduced EF (OR 2.29, 95% CI 1.08-4.86, $p=0.031$) were significantly associated with EL.

Conclusion: This study showed that the incidence of EL after catheter ablation was low and the degree of EL was mostly mild. A reduced EF and lower BMI were significantly associated with an increased risk of EL after RFCA or CBA, suggesting that post-ablation EGD may be useful for detecting early EL.

SUPPORTING DOCUMENTS

Table. Logistic regression between with esophageal injury and without esophageal injury.

	Univariable		Multivariable	
	OR (95% CI)	P value	OR (95% CI)	P value
Paroxysmal atrial fibrillation	2.08 (0.82-5.31)	0.118		
TEE before RFCA	1.55 (0.63-3.82)	0.337		
Roof line	1.58 (0.35-7.08)	0.548		
Posterior line	1.04 (0.24-4.58)	0.960		
SVC	0.64 (0.15-2.80)	0.555		
Lt PV additional ablation	2.21 (0.99-4.97)	0.049	2.32 (1.01-5.35)	0.048
Male	0.13 (0.59-3.05)	0.483		
Congestive heart failure	1.39 (0.60-3.22)	0.441		
Hypertension	0.90 (0.40-2.02)	0.792		
Diabetes mellitus	1.10 (0.40-3.00)	0.859		
Stroke/TIA	1.71 (0.56-5.20)	0.338		
Vascular disease	2.00 (0.44-9.06)	0.362		
Body weight (kg)	0.99 (0.96-1.01)	0.247		
Height (cm)	1.02 (0.98-1.06)	0.349		
BMI (kg/m ²)	0.85 (0.75-0.97)	0.017	0.82 (0.71-0.93)	0.003
Age >60 (years)	1.12 (0.48-2.58)	0.793		
CHADS-Vasc ≥2	1.03 (0.43-2.43)	0.953		
LA size ≥40(mm)	2.35 (0.79-6.96)	0.114		
LVEF <50 (%)	2.97 (1.32-6.68)	0.006	2.98 (1.28-6.94)	0.011
E/e'	0.94 (0.84-1.07)	0.352		
Pulmonary artery pressure (mmHg)	1.03 (0.98-1.08)	0.301		
LVEDD (mm)	1.07 (0.99-1.15)	0.110		
LA volume ≥ 100 (ml)	1.60 (0.63-4.09)	0.320		

Feasibility and Safety of “zero-fluoro” Repeat Pulmonary Vein Isolation Procedures After Initial Cryoballoon Ablation

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Objective: We aimed to demonstrate the feasibility and safety of zero-fluoro approach for the repeat AF procedures after initial cryoballoon ablation.

Methods: We have performed a retrospective study on patients that have undergone repeat PVI procedures in our institution since we started the zero-fluoro program in 2020. All patients received CB ablation for the initial procedure. Procedures were performed under conscious sedation with the help of intracardiac echo and 3D mapping system, without the use of fluoroscopy. Right-sided femoral vein was used for two introducers. Single transseptal puncture was performed guided by ICE. Steerable sheath was used and high-density voltage map of LA was created to evaluate the PV reconnections. Contact-sensing RF ablation catheters were used to reisolate the reconnected veins and in the case of no reconnections, posterior wall isolation was performed.

Results: We have analyzed in total 30 patients (76% male, 59.9±9.3 years old), 55% of which suffered from paroxysmal AF. The mean LVEF was 61.8±7.5% and mean LA diameter was 42.0±6.4 mm. In two(6.7%) patients RF energy was required to cross the intraatrial septum. The mean procedure time was 101.3±27.0 min and the mean RF time was 878 sec±436 sec. The mean of 1.24±0.87 veins were reconnected per patient and 23.3% of patients did not have PV reconnections. In all patients successful PV/PW isolation was performed confirmed by entry and exit block. No periprocedural complications were observed.

Conclusion: In our small cohort of patients, zero-fluoro approach for repeat PVI procedures ablation proved to be feasible and safe.

The Morphology of Left Atrial Roof Might Influence Recurrence After Atrial Fibrillation Ablation

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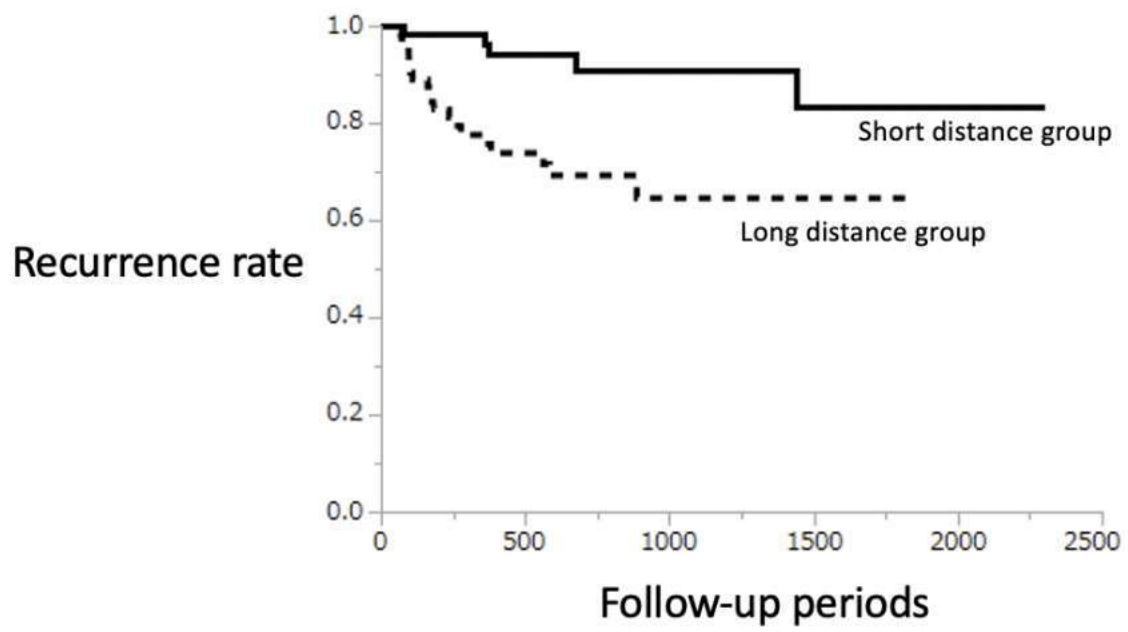
The morphology of the left atrium (LA) would not only vary among individuals depending on the severity of the atrial fibrillation, but also could influence the difficulties of the procedures of the ablation. The shape of the left atrial (LA) roof might affect the outcome of the atrial fibrillation (AF) ablation.

Methods: We enrolled 632 patients to whom we performed initial box pulmonary vein (PV) isolation (BoxPVI) for various severities of AF, and 101 patients for redo procedures after BoxPVI. We measured the distance and the angle between superior PVs in order to evaluate the shape of the LA, and analyzed the parameters associated with the recurrence of AF during follow-up periods of 679.0 (307.0-1195.0) days.

Results: The distance and the angle of the LA roof varied among different severities of AF and redo cases. The redo cases showed longer distance and more acute angle than those of other cases, and also showed the worst prognosis in the Kaplan-Meier curves($p=0.0021$).

Conclusions: The recurrence after the second BoxPVI would depend upon the shape of LA roof, suggesting that we had better consider beyond BoxPVI procedures in redo cases of AF ablation if their shape of the LA roof showed such characteristics.

SUPPORTING DOCUMENTS



The Association of Poor Outcomes in Patients With Newly Diagnosed Atrial Fibrillation After Stroke (AFDAS)

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Objectives: The purpose of this study is to evaluate the adverse effect of atrial fibrillation diagnosis after stroke (AFDAS) on the outcome of stroke patients.

Materials and Methods: A total of 3336 consecutive patients with ischemic stroke between 2016 and 2018 were retrospectively enrolled from our stroke registry database. All patients were classified into one of the four groups based on the past medical recordings and admission 12-lead electrocardiography (ECG)/Holter findings: normal sinus rhythm (NSR), paroxysmal atrial fibrillation (PAF), persistent atrial fibrillation (PeAF), and AFDAS. The severity of the stroke was evaluated by the National Institutes of Health Stroke Scale (NIHSS), and we also estimated the risk of recurrent thromboembolic stroke in all patients by the CHA2DS2VASc score. All patients were followed at admission, discharge, 1, 3, 6 and 12 months after ictus.

Results: The admission NIHSS was statistically higher in AFDAS (13.3 ± 10.0) than in the other three groups (10.2 ± 8.2 , 10.1 ± 9.7 , 8.1 ± 9.5 for PeAF, PAF, and NSR, respectively, all p values < 0.05). The CHA2DS2VASc of AFDAS was lower than the scores of PeAF (2.90 ± 1.33 vs. 3.28 ± 1.47 , $p = 0.01$) and higher than that of NSR (2.90 ± 1.33 vs. 2.17 ± 1.54 , $p < 0.01$). All-cause mortality was significantly high in AFDAS patients compared with NSR patients (24.0% vs. 14.9%, $p < 0.01$). In addition, among patients with CHA2DS2VASc > 4 , AFDAS resulted in a lower survival probability than PAF (Log Rank p value < 0.05 , by the Kaplan-Meier analysis).

Conclusion: AFDAS had a potentially adverse effect on patients with ischemic strokes. Further investigation of the underlying pathophysiology beneath AFDAS is warranted.

Impact of Cerebral Microbleeds on Decreased Cognitive Function in Atrial Fibrillation Patients

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Objectives: We aimed to investigate the association of cerebral microbleeds with cognitive function in atrial fibrillation (AF) patients.

Materials and Methods: We collected 38 non-AF controls and 36 AF patients prospectively from multicenter in Taiwan. Participants were followed every six months. At baseline, all participants received brain magnetic resonance imaging (MRI) to check for cerebral microbleeds. During baseline and follow-up visits, cognitive function was assessed. To account for the effects of repeated measurements and different enrollment sites, generalized estimating equations were used.

Results: After multivariable adjustment, AF (β : -0.74, 95% CI: -1.26- -0.22; Table 1) was associated with decreased cognitive function (MoCA) in short-term memory compared than non-AF controls. In patients with AF, MRI revealed more cerebral microbleeds (β : 1.13, 95% CI: 0.04-2.22; Table 1). The presence of microbleeds in brain MRIs (β : -0.39, 95% CI: -0.59- -0.18; Table 2), old ischemic strokes (β : -0.80, 95% CI: -1.59- 0.006), depression (β : -0.15, 95% CI: -0.24- -0.06), thyroid disease history (β : -2.39, 95% CI: -2.91- -1.87), current smoking status (β : -12.0, 95% CI: -13.0 - -11.1), and alcohol consumption (β : -2.17, 95% CI: -2.26- -2.08) all contributed to lower total MoCA scores. Higher quality of life (QoL) in the psychological and environment domains were related to higher total scores of MoCA.

Conclusion: AF patients with cerebral microbleeds, old ischemic strokes, thyroid disease, smoking status, and alcohol consumption had cognitive function decline as MoCA scores. Patients at higher risk of cognitive decline should be considered for health interventions to prevent future dementia.

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Table 1: Outcomes between non-AF controls and AF patients

Outcomes	Time	Non-AF controls (N=38)	AF patients (N=36)	Model 0: β (95% CI)	P-value	Model 1: β (95% CI)	P-value
Number of micro-breeds observed in brain MRI	Baseline	0.25±0.59	0.54±2.06	1.06 (0.19±1.93)	0.017	1.13 (0.04-2.22)	0.043
MoCA: Total score	Baseline	28.7±1.77	27.3±2.63				
	Month 6	29.0±1.9	28.5±1.61	-0.94 (-1.57- -0.30)	0.004	-0.44 (-2.35- 1.45)	0.64
Visual-spatial perception	Baseline	4.65±0.59	4.36±0.93				
	Month 6	4.88±0.42	4.54±0.66	-0.20 (-0.41- -0.003)	0.047	-0.10 (-1.70- 1.51)	0.91
Naming	Baseline	2.97±0.16	2.94±0.23				
	Month 6	3.00±0.00	3.00±0.00	-0.003 (-0.04- 0.04)	0.88	-0.009 (-0.05- 0.03)	0.68
Attention	Baseline	5.86±0.35	5.92±0.28				
	Month 6	5.78±0.61	5.83±0.64	0.04 (-0.11-0.20)	0.57	0.11 (-0.08-0.31)	0.26
Language abilities	Baseline	2.95±0.23	2.92±0.28				
	Month 6	2.97±0.18	3.00±0.00	-0.009 (-0.08-0.06)	0.79	-0.01 (-0.08-0.06)	0.77
Abstraction	Baseline	2.00±0.00	2.00±0.00				
	Month 6	2.00±0.00	2.00±0.00	Na	Na	Na	Na
Short-term memory	Baseline	4.32±1.13	3.11±1.88				
	Month 6	4.44±0.76	3.88±1.45	-0.86 (-1.33- -0.39)	<0.001	-0.74 (-1.26- -0.22)	0.006
Orientation	Baseline	5.95±0.23	5.97±0.17				
	Month 6	5.97±0.18	6.00±0.00	0.02 (-0.03-0.08)	0.40	0.02 (-0.05-0.10)	0.52

AF: atrial fibrillation; CI: confidence interval; MoCA: Montreal Cognitive Assessment;

Model 0: crude effect; Model 1: Adjusted for age, gender, old stroke, hypertension, diabetes mellitus, renal disease, thyroid disease, smoking status, and alcohol drinking status.

Table 2: Predictors of decreased MoCA scores in AF patients

Predictors	MOCA: Total score β (95% CI)	P-value	MOCA: Short-term memory β (95% CI)	P-value
Age at baseline	-0.90 (-1.48- -0.32)	0.002	-0.06 (-0.09- -0.02)	<0.001
Number of micro-breeds in brain MRI	-0.39 (-0.59- -0.18)	<0.001	-0.38 (-0.53- -0.22)	<0.001
HADS: Depression	-0.15 (-0.24- -0.06)	0.001	-0.09 (-0.35-0.18)	0.52
WHO-QoL-BREFT- Taiwan: Psychological domain	0.35 (0.15-0.55)	0.001	-0.05 (-0.37-0.26)	0.74
WHO-QoL-BREFT-Taiwan: Environment domain	0.24 (0.04-0.43)	0.018	0.15 (-0.22-0.53)	0.44
Old ischemic stroke	-0.80 (-1.59- -0.006)	0.048	0.53 (-0.79-1.85)	0.43
Thyroid disease	-2.39 (-2.91- -1.87)	<0.001	-1.36 (-3.19-0.48)	0.15
Current smoking status	-12.0 (-13.0- -11.1)	<0.001	-4.00 (-5.39- -2.60)	<0.001
Alcohol drinking status	-2.17 (-2.26- -2.08)	<0.001	-0.96 (-1.92- -0.002)	0.049

AF: atrial fibrillation; HADS: Hospital Anxiety and Depression Scale; MoCA: Montreal Cognitive Assessment; MRI: magnetic resonance imaging; QoL: quality of life; Model was adjusted for age, gender, old stroke, hypertension, diabetes mellitus, renal disease, thyroid disease, smoking status, and alcohol drinking status.

Atrial Fibrillation as Contributor to the Mortality in Patients With Dementia: a Nationwide Cohort Study

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Objectives: The purpose of this study was to evaluate the effect of AF on all-cause mortality and other factors associated with death in AF patients with dementia.

Materials and Methods: Using Taiwan's National Health Insurance Research Database (NHIRD, 2013-2014), we conducted a nationwide cohort study. An evaluation of the risk of mortality was conducted on 17384 patients diagnosed with dementia for the first time after entry into the study. Subjects under the age of 18 years or with follow-up period <15 days were excluded. Age was matched for 8707 non-AF controls and 8677 AF patients in the dementia database. To calculate the hazard ratios (HRs) for mortality events, the conditional Cox proportional hazards model was used.

Results: A history of AF was associated with a higher risk of all-cause death in dementia patients (HR: 1.36, 95% CI: 1.28-1.45). AF patients with dementia (mean age: 75.3 years) had a higher risk of death due to higher age (HR: 1.057, 95% CI: 1.051-1.063), diabetes mellitus (HR: 1.27, 95% CI: 1.14-1.42), chronic kidney disease (HR: 1.72, 95% CI: 1.47-2.02), and prior stroke (HR: 1.35, 95% CI: 1.23-1.48). Anti-arrhythmic drugs (HR: 0.91, 95% CI: 0.84-0.99), NOAC (HR: 0.80, 95% CI: 0.74-0.87), ARNI (HR: 0.51, 95% CI: 0.32-0.79), and SGLT2i (HR: 0.54, 95% CI: 0.34-0.85) significantly reduced death risk in AF patients with dementia.

Conclusion: This study found that AF is a deterioration factor of mortality in patients with dementia, and explored several risk factors of mortality for AF patients with dementia.

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Figure: Flow chart

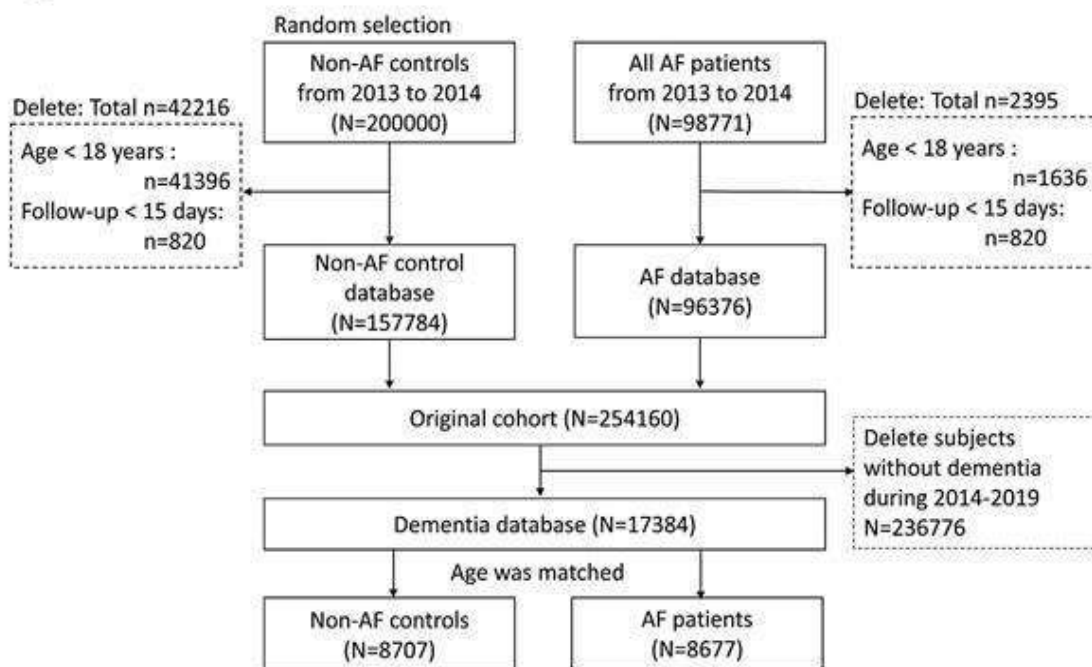


Table: Risk factors of death risk in dementia patients with atrial fibrillation

Variables	Uni-variable model: Hazard ratio (95% CI)	P-value	Multi-variable model: Hazard ratio (95% CI)	P-value
Age (years)	1.062 (1.056-1.068)	<0.001	1.057 (1.051-1.063)	<0.001
Male gender	0.99 (0.92-1.06)	0.72	na	na
Receiving AF ablation	0.42 (0.23-0.77)	<0.001	0.72 (0.40-1.30)	0.28
Underlying diseases				
Hypertension	0.995 (0.925-1.07)	0.89	na	na
Congestive heart failure	1.13 (1.04-1.24)	0.006	1.04 (0.95-1.14)	0.39
Diabetes mellitus	1.21 (1.10-1.34)	<0.001	1.27 (1.14-1.42)	<0.001
Chronic kidney disease	1.69 (1.44-1.99)	<0.001	1.72 (1.47-2.02)	<0.001
Chronic liver disease	1.06 (0.72-1.56)	0.77	na	na
Chronic obstructive pulmonary disease	1.25 (1.09-1.43)	<0.001	1.10 (0.95-1.26)	0.19
Prior stroke	1.26 (1.16-1.38)	<0.001	1.35 (1.23-1.48)	<0.001
Coronary artery disease	0.96 (0.73-1.26)	0.79	na	na
Medication uses				
Anti-arrhythmic drugs	0.83 (0.77-0.90)	<0.001	0.91 (0.84-0.99)	0.031
NOAC	0.74 (0.69-0.80)	<0.001	0.80 (0.74-0.86)	<0.001
Warfarin	0.995 (0.919-1.08)	0.91	na	na
SGLT2i	0.47 (0.30-0.73)	0.001	0.54 (0.34-0.85)	0.008
ARNI	0.51 (0.33-0.79)	0.003	0.50 (0.32-0.79)	0.002

AF: atrial fibrillation; ARNI; angiotensin receptor-neprilysin inhibitor; CI: confidence interval; na: not available; NOAC: novel oral anticoagulants; SGLT2i: sodium glucose co- transporters 2 inhibitor;

A p-value <0.05 in the uni-variable model were selected into multi-variable model.

Effects of SGLT2i on Reducing Dementia Risks in Atrial Fibrillation Patients with Diabetes: A Nationwide Cohort

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Objectives: The effects of sodium-glucose cotransporter-2 inhibitor (SGLT2i) on reducing new-onset cognitive dysfunction in atrial fibrillation (AF) patients with diabetes remain unknown. This study aimed to investigate whether the uses of SGLT2i reduce 5-year dementia risk among AF patients with diabetes.

Materials and Methods: We identified AF patients using the Taiwan's National Health Insurance Research Database (2013-2014). A total of 17925 AF patients with diabetes under the age of 18 years without prior history of dementia were studied. Among AF patients, 1374 patients were prescribed for SGLT2i. SGLT2i group was 1:2 matched with patients without the uses of SGLT2i (N=2747) using the same propensity-score. Dementia events were followed till the end of 2019. Subtypes of dementia were investigated using competing risk models.

Results: During a follow-up period of 5 years, a total of 354 new-onset dementia events occurred during follow-up. Total dementia events significantly decreased in AF patients with diabetes receiving SGLT2i (HR: 0.71, 95% CI: 0.56-0.90). Considering the risks of dementia subtypes, SGLT2i uses were only associated with decreased risks of vascular dementia (HR: 0.42, 95% CI: 0.22-0.79), especially in those who aged < 65 years (HR: 0.28, 95% CI: 0.08-0.94; P-value for interaction=0.06), but not for those who aged ≥ 65 years (HR: 0.77 95% CI: 0.59-1.01).

Conclusion: For AF patients with diabetes, the uses of SGLT2i were associated with decreased risk of vascular dementia. The study results indicate that SGLT2i may improve 5-year cognitive outcomes in AF patients by reducing the effects of vascular risk factors.

SUPPORTING DOCUMENTS

Table: Risk factors of dementia risk in patients with atrial fibrillation

Events	Total number	5-year cumulative rate (%)	Incidence rate (per 1000 person-years, 95% confidence interval)	Cox proportional hazards regression		Interaction analyses [#]		
				Crude hazard ratio, 95% confidence interval	Adjusted hazard ratio*, 95% confidence interval	Age < 65 years: hazard ratio*, 95% confidence interval	Age ≥ 65 years: hazard ratio*, 95% confidence interval	P-value for interaction
Total dementia								
Non-SGLT2i	2747	250 (9.10%)	14.7 (12.9-16.5)	Reference (HR=1)	Reference (HR=1)	Reference (HR=1)	Reference (HR=1)	0.07
SGLT2i	1374	104 (7.57%)	11.6 (9.36-13.8)	0.78 (0.62-0.99); P=0.037	0.71 (0.56-0.90); P=0.005	0.60 (0.36-0.99); P=0.048	0.77 (0.59-1.01); P=0.058	
Vascular dementia								
Non-SGLT2i	2747	66 (2.40%)	3.87 (2.94-4.81)	Reference (HR=1)	Reference (HR=1)	Reference (HR=1)	Reference (HR=1)	0.06
SGLT2i	1374	16 (1.16%)	1.78 (0.91-2.66)	0.44 (0.24-0.82); P=0.010	0.42 (0.22-0.79); P=0.008	0.28 (0.08-0.94); P=0.040	0.52 (0.24-1.11); P=0.09	
Alzheimer's dementia								
Non-SGLT2i	2747	166 (6.04%)	9.75 (8.26-11.2)	Reference (HR=1)	Reference (HR=1)	na	na	na
SGLT2i	1374	82 (5.97%)	9.14 (7.16-11.1)	0.94 (0.72-1.22); P=0.64	0.82 (0.62-1.08); P=0.82			
Other/mixed dementia								
Non-SGLT2i	2747	37 (1.35%)	2.17 (1.47-2.87)	Reference (HR=1)	Reference (HR=1)	na	na	na
SGLT2i	1374	12 (0.87%)	1.34 (0.58-2.09)	0.60(0.30-1.22); P=0.16	0.65 (0.29-1.47); P=0.30			

AF: atrial fibrillation; na: not available; SGLT2i: sodium-glucose cotransporter-2 inhibitor. *Model was adjusted for age, sex, status of AF ablation, underlying diseases (e.g. sleep apnea, hypertension, hyperlipidemia, liver cirrhosis, chronic obstructive pulmonary disease, thyroid disease, peripheral vascular disease, prior stroke, rheumatic heart disease, atrial flutter, paroxysmal supraventricular tachycardia), and medications (e.g. anti-arrhythmic drugs, warfarin, non-vitamin K antagonist oral anticoagulant, anti-platelets, metformin, and dipeptidyl peptidase 4 (DPP4).

[#]Interaction analyses were performed if SGLT2i is a significant factor in reducing dementia risk.

Biomarkers and Recurrence of Atrial Fibrillation after Successful Cardioversion: Results of a Meta-Analysis

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Objectives: An increasing body of evidence suggests the role of inflammation in the genesis and perpetuation of atrial fibrillation (AF). However, inconsistent results have been published with regard to the role of inflammatory markers in predicting the maintenance of sinus rhythm after a successful direct current cardioversion (DCCV).

Methods: Using Ovid and EMBASE, we searched for literature published prior to December 2011. Of the 405 studies identified, 16 studies with 1054 patients (501 with and 553 without AF relapse) were included for analysis.

Results: Mean CRP, BNP group levels from each study were recorded and the standardized difference in mean and odds ratio was calculated. Using the fixed effects model (FEM), CRP and BNP group levels were significantly higher in patients with recurrence of AF post DCCV (odds ratio (OR) for CRP = 2.30 (CI: 1.63-3.26); for BNP = 4.44 (CI: 3.11-6.33)). There was some evidence of heterogeneity (p-value for CRP < 0.002; p-value for BNP group = 0.001). Using random effects model, the effect size for CRP increased to 2.53 (CI: 1.33-4.82) and for BNP group the effect size increased to 6.38 (CI: 1.58-25.82). Publication bias was not evident for CRP and BNP group (p-value 0.43 and 0.24 respectively).

Conclusion: Increased CRP and BNP levels are associated with greater risk of AF recurrence after successful DCCV. The use of these markers for the prediction of those who maintain sinus rhythm after DCCV appears promising but requires further study.

The Effect of Inflammation on Incident Atrial Fibrillation: Results of a Systematic Review and Meta-Analysis

Ms Lukah Q. Tuan^{1,2}, Ms Adriana Tokich^{1,2}, Ms Sienna Wu^{1,2}, Mr Jaganaathan Srinivasan³, Ms Natasha Jones-Lewis¹, Ms Taylah Abbott¹, Ms Lisa George¹, Mr Troy Rimando¹, Prof Rajeev K. Pathak^{1,2,3,4}

¹Canberra Heart Rhythm Centre, Garran, Australia, ²Australian National University, Canberra, Australia, ³The Canberra Hospital, Garran, Australia, ⁴The University of Canberra, Bruce, Canberra

Objectives: Inflammation is considered an important component of the substrate predisposing to Atrial Fibrillation (AF). Recent data suggests inflammation may predict response to therapy and that treatment may improve outcomes in AF. Furthermore, the role of inflammation in the development of thrombogenesis in AF has been suggested. The aim is to determine the association between raised inflammatory markers and AF.

Methods: Ovid and EMBASE were searched to identify prospective cohort and case–control studies that have reported an association between raised inflammatory markers and incident AF.

Results: Of the 405 articles identified, 17 studies that enrolled a total of 3439 individuals met the inclusion criteria. Mean C-reactive protein (CRP), B-type natriuretic peptide (BNP) and IL-6 levels from each study were recorded and the standardized difference in mean and odds ratio was calculated. Using the fixed effects model (FEM), CRP and IL-6 levels were significantly higher in AF patients (odds ratio (OR) for CRP = 2.34 (CI: 1.82-3.01); for IL6 = 2.78 (CI: 1.79-4.32)). There was no evidence of heterogeneity (p-value for CRP = 0.44; p-value for IL-6 = 0.28). Under FEM, the OR for BNP was 4.15 (CI: 3.42-5.04) and heterogeneity was present (p-value < 0.001). Using random effects model, the effect size increased to 7.08 (CI: 3.93-12.76). Publication bias was not evident for CRP, IL-6 or BNP (p-value 0.83, 0.20 and 0.11, respectively).

Conclusion: Raised inflammatory markers are associated with an increased incident risk of AF. The underlying mechanisms whereby inflammation may promote the genesis of AF warrant further investigation.

SUPPORTING DOCUMENTS

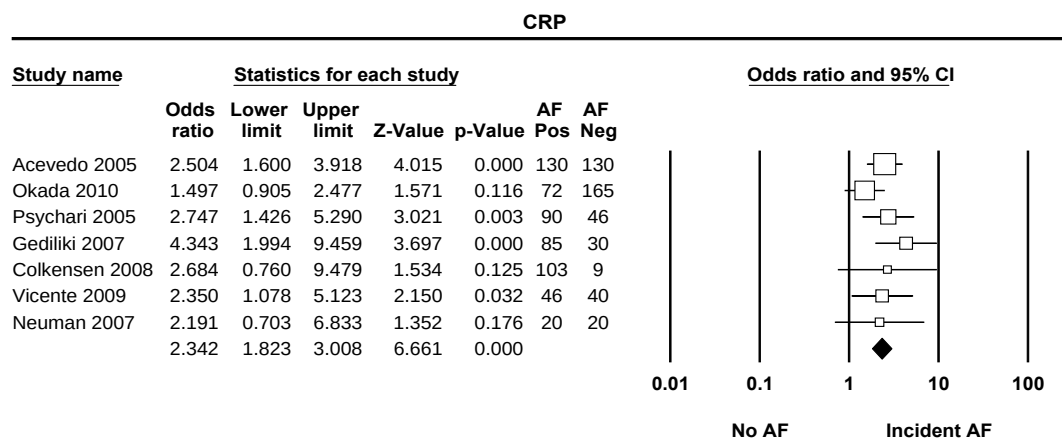


Figure 2: Relation Between raised CRP and risk of incident AF

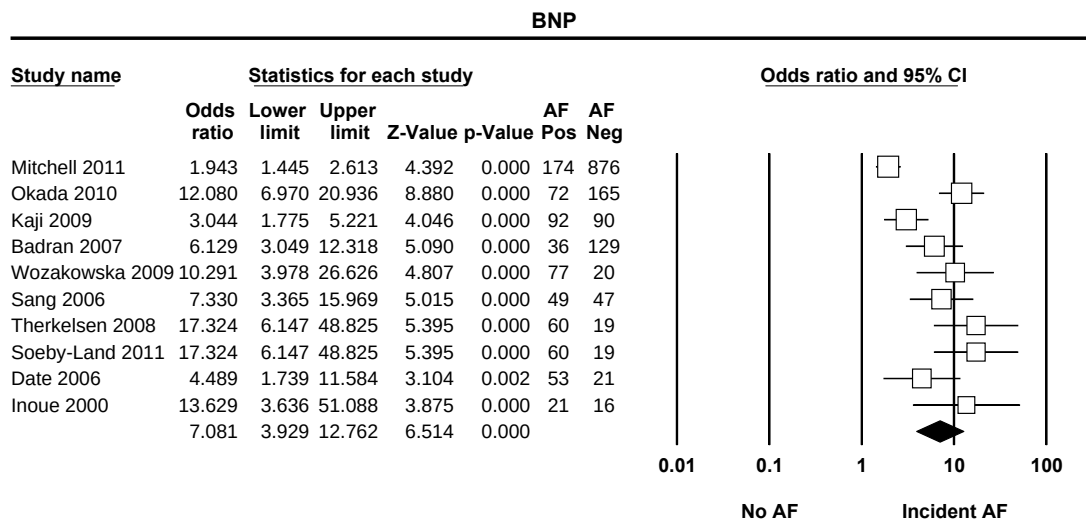


Figure 3: Relation Between raised BNP values and risk of incident AF

Left Atrial Strain Predicts Stiff Left Atrial Syndrome After Catheter Ablation for Atrial Fibrillation

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Objectives: The purpose of this study was to compare the LA strain before and after catheter ablation for AF to predict the development of LA stiffness syndrome by using speckle tracking echocardiography.

Materials and Methods: This prospective observational study was designed to enroll 127 patients who underwent catheter ablation for AF and to perform serial echocardiography including LA strain after the procedure. In this data, 127 patients who underwent PV isolation between July 2019 and June 2021 were included. LA systolic strain was assessed with 2D- and 3D-speckle tracking method at baseline and after one year of follow-up.

Results: In 127 patients, 76 patients (60%) were paroxysmal AF (mean age 57±9 year). LA volume index was significantly decreased after the ablation (43±7 vs. 40±15 ml/m², p<0.001), whereas right ventricular systolic pressure was not changed (p=0.983). The reservoir (LASr) and contraction LA strain (LASct) values were significantly increased after one month of ablation (22±9 vs. 26±8, p<0.001 and 6±7 vs. 9±5, p=0.004) which were consistent in 3D-LA strain. Eighty-two patients (65%) patients were increased LASr after ablation, but forty patients (32%) were decreased LASr.

Conclusion: The LA strain and volume were improved after one month of AF ablation in this data. However, a significant number of patients (32%) showed deterioration of LA function. Serial follow-up is needed to predict the occurrence of stiff LA syndrome in these patients.

A Novel Predictor of Permanent Pacemaker Implantation in Patients With Catheter Ablation of Tachycardia-bradycardia Syndrome

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¹Gyeongsang National University Hospital, Jinju, South Korea, ²Samsung medical center, Irwin dong, South Korea, ³Chungnam National University Hospital, Chungnam, South Korea

Objective: The relationship between sinus node dysfunction and atrial fibrillation(AF) is unclear about which comes first, and reversibility of sinus node dysfunction is very important in determining the treatment strategy in patients with tachycardia-bradycardia syndrome(TBS). We aimed to evaluate a new predictive factor related to the reversibility of sinus node dysfunction for requirement of a permanent pacemaker(PPM) in TBS patients.

Methods: Patients with TBS admitted to our center for catheter ablation(CA) from 2012 to 2021 were reviewed, and a total of 113 patients were enrolled. Patients were divided into two groups based on whether a “sinus node dysfunction(SND)-independent episode of AF” coexist(TBS + SND group, n=20) or not(TBS group, n=93).

Results: Compared to the TBS group, baseline characteristics showed that the TBS + SND group was comprised of more female gender(P=0.043), with hypertension(P=0.033), and with enlarged left atrium(P=0.003). Reevaluation after an average three-year follow-up found that eight patients(8/113, 7%) had a permanent implanted pacemaker(PPM) 5/20, 25% in TBS+SND group vs. 3/93, 3.2% in TBS group, P=0.001). Using a multivariate model, a “SND-independent episode of AF” was associated with PPM implantation after ablation in patients with TBS HR 10.387, 95% CI 2.174-49.628, P=0.003). However, no patient with implanted PPM progressed to persistent AF.

Conclusion: In patients with TBS, an episode of sinus pause without AF predicts the need for implantation of PPM after AF ablation. In addition, even with PPM implantation after CA, we expect better clinical outcomes with decreased AF burden through catheter ablation in TBS patients.

SUPPORTING DOCUMENTS

Table 1. Baseline characteristics

Factor	TBS + SND group (n=20)	TBS group (n=93)	<i>P-value</i>
Age (years)	61.1 ± 57.3	57.3 ± 9.2	0.097
Female (n, %)	11 (55)	29 (31.2)	0.043
BMI (kg/m ²)	25.7 ± 3.5	24.5 ± 2.8	0.087
Longest pause (seconds)	5.9 ± 1.9	5.3 ± 2.0	0.220
CSNRT (msec)	595.6 ± 457.8	411.5 ± 370.2	0.141
Symptom (n, %)			
Dizziness	15 (75.0)	72 (77.4)	0.816
Presyncope	3 (15.0)	15 (16.1)	0.900
Syncope	2 (10.0)	30 (32.3)	0.045
Palpitations	15 (75.0)	60 (64.5)	0.368
Hypertension (n, %)	12 (60.0)	32 (34.4)	0.033
Diabetes (n, %)	4 (20.0)	12 (12.9)	0.409
Stroke/TIA (n, %)	2 (10.0)	12 (12.9)	0.721
PCI history (n, %)	1 (5.0)	3 (3.2)	0.697
CHAD2DS2-VASc score	2.0 ± 1.3	1.4 ± 1.3	0.054
Echocardiographic parameters			
LVEF (%)	63.3 ± 5.6	61.6 ± 5.4	0.214
LA diameter (mm)	45.0 ± 5.2	39.7 ± 7.2	0.003
E/E'	10.1 ± 3.0	8.8 ± 3.5	0.144
Anti-arrhythmic drugs before the procedure (n, %)			0.285
No medication	14 (70.0)	47 (50.5)	
Class Ic	4 (20.0)	31 (33.3)	
Class III	2 (10.0)	15 (16.1)	
Catheter ablation type (n, %)			0.940
RFCA	15 (75.0)	69 (74.2)	
Cryoablation	5 (25.0)	24 (25.8)	
AF duration (months)	27.4 ± 27.1	28.7 ± 37.1	0.884
Baseline heart rate (bpm)	65 ± 19	65 ± 14	0.929
Follow-up (months)	33.2 ± 36.6	36.8 ± 29.2	0.636

BMI, body mass index; TIA, transient ischemic attack; LVEF, left ventricular ejection fraction; LA, left atrium; RFCA, radiofrequency catheter ablation; AF, atrial fibrillation; PCI, percutaneous coronary intervention; CSNRT, corrected sinus node recovery time

Table 2. Predictors of pacemaker implantation following AF ablation.

Factors	HR (univariate analysis)	<i>P-value</i>	HR (multivariate analysis)	<i>P-value</i>
Female	2.021 (0.504-8.107)	0.321		
Age	1.035 (0.957-1.119)	0.391		
Hypertension	1.942(0.346-10.899)	0.451		
LA diameter	1.030 (0.923-1.150)	0.594		
LVEF (%)	0.953 (0.849-1.071)	0.420		
SND-independent episodes of AF	10.241(2.400-43.710)	0.002	10.387 (2.174-49.628)	0.003
Longest pause before CA	1.041 (0.778-1.392)	0.788		

Values are expressed as hazard ratio (HR) with CI 95%. LVEF, left ventricular ejection fraction; LA, left atrium; AF, atrial fibrillation; CA, catheter ablation; SND, sinus node dysfunction.

Table 3. Rhythm outcomes over a three-year follow-up period.

	CA + PPM (n=8)	CA (n=105)	<i>P-value</i>
Baseline heart rate (bpm)	58 ±15	66±15	0.159
>3 sec Pause after CA ablation	8 (100)	10 (9.5)	<0.001
Recurrence of AF	3 (37.5)	30 (28.6)	0.592
Redo/Trido-RFCA	1 (12.5)	15 (14.3)	0.889
Rhythm outcome at last FU			0.001
Sinus rhythm	5 (62.5)	97 (92.4)	
Paroxysmal AF	3 (37.5)	4 (3.8)	
Persistent AF	0 (0.0)	4 (3.8)	
12-month AAD Off NSR	1 (12.5)	58 (55.2)	0.020

CA, catheter ablation; RFCA, radiofrequency catheter ablation; PPM, permanent pacemaker; AF, atrial fibrillation; AAD, anti-arrhythmic drug; NSR, normal sinus rhythm; FU, follow-up.

Figure Legends

Figure 1. Enrollment and flowchart of the study

RFCA, radiofrequency catheter ablation; PPM, permanent pacemaker; TTA, totally thoracoscopic ablation; TBS, tachycardia-bradycardia syndrome; SND, sinus node dysfunction; AF, atrial fibrillation; NSR, normal sinus rhythm

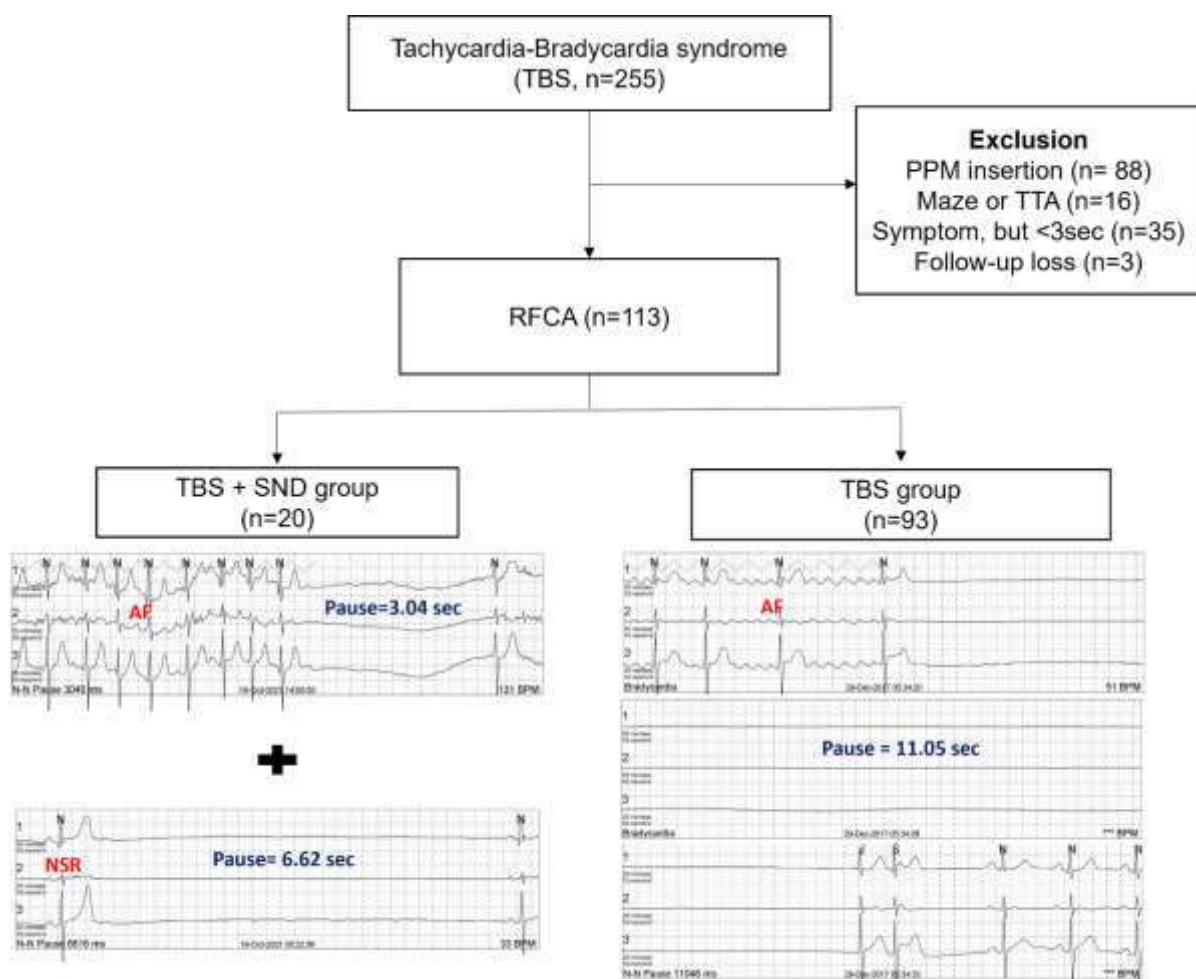


Figure 2. Comparison in rate of permanent pacemaker implantation

PPM, permanent pacemaker; TBS, tachycardia-bradycardia syndrome; SND, sinus node dysfunction

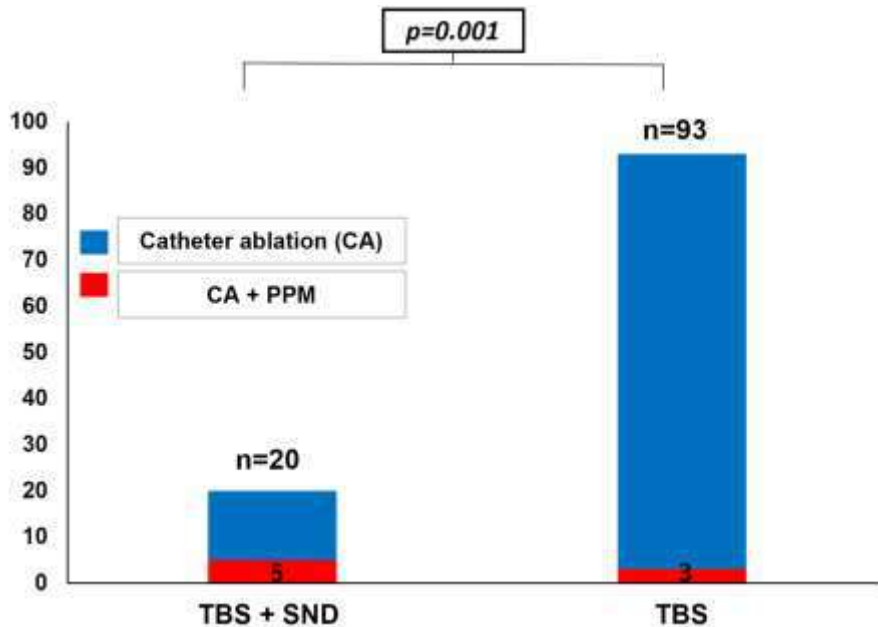
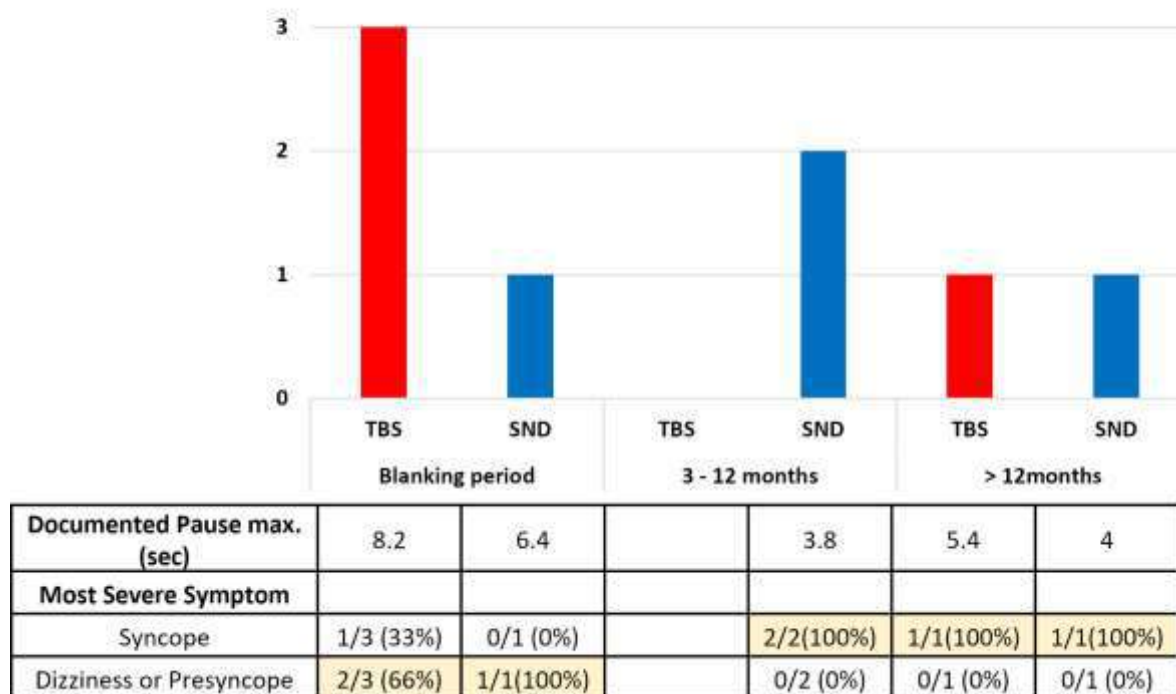


Figure 3. Time of pacemaker implantation after catheter ablation

TBS, tachycardia-bradycardia syndrome; SND, sinus node dysfunction



LAAO: Retrospective Analysis Of Cases Done In A Center From North Of Peninsular Malaysia.

Dr Mohanaraj Jayakumar¹, Dr Ahmad Faiz Mohd Ezanee¹, Dr Kantha Rao Narasamuloo¹, Dr Saravanan Krishinan¹

¹*Ministry of health Malaysia, Cheras, Malaysia*

Atrial fibrillation (AF) confers a four-fivefold increased risk for ischemic stroke.

Left atrial appendage occlusion (LAAO) lowers the risk of stroke by excluding the left atrial appendage from the systemic circulation and preventing thrombus formation and embolization especially in patients with poor socio economic status where they are not able to comply to follow ups for warfarin due to logistic issues and unable to afford DOACs. LAAO also helps in patients with history of life threatening bleeding events.

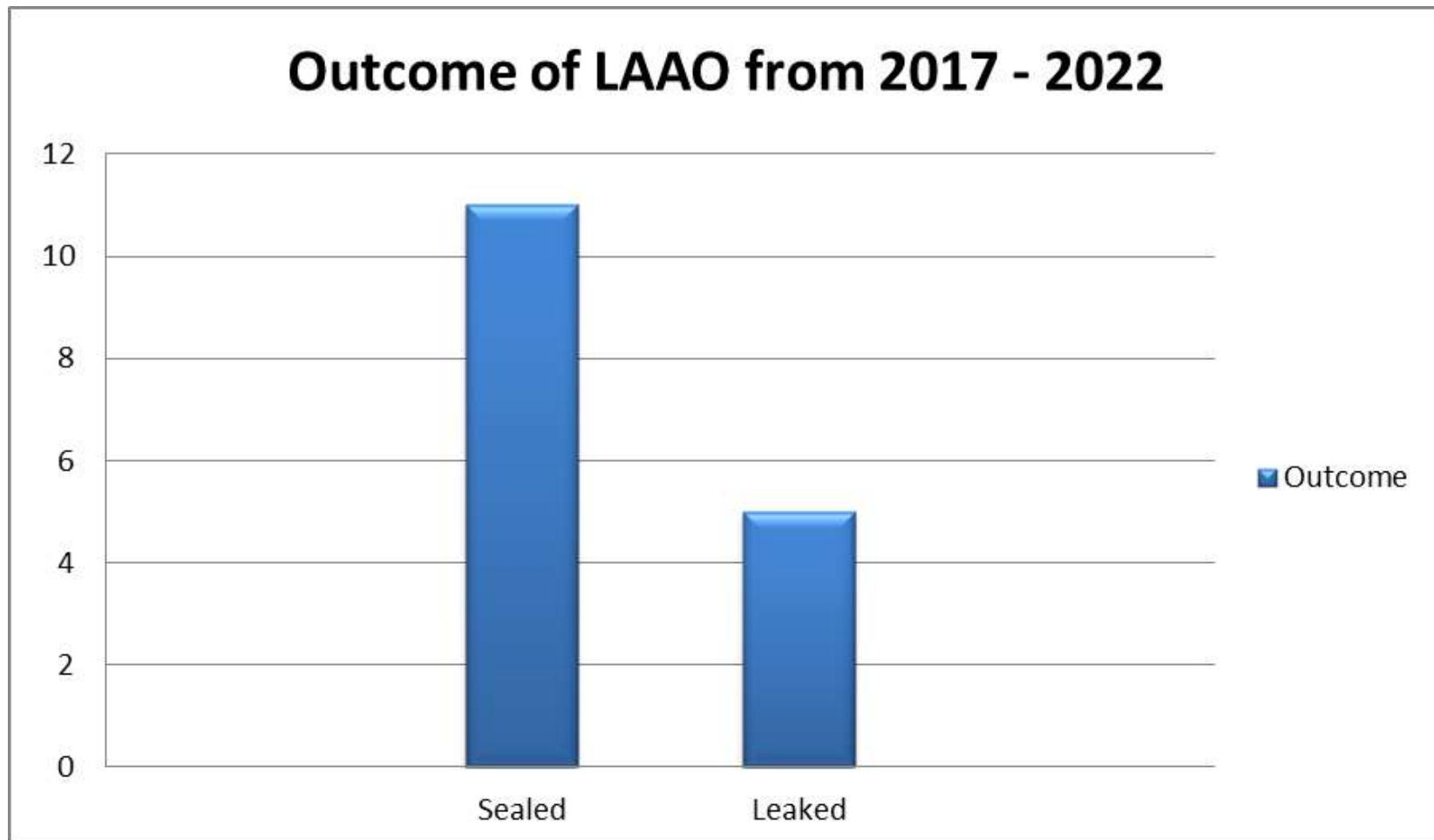
From the year 2017 to 2022, we have implanted 19 patients with LAAO device out of which 12 patients had Watchman, 4 patients had Lambre and 3 patients were implanted the Amulet device. Patients were selected based on HASBLED score, and those unable to afford DOACs or comply to warfarin treatment due to bleeding reasons or logistical issues. Patients age ranged from 60 years old to 86 years old. Fifteen were male and 4 were female patients.

Before implantation, TOE assessment done to assess LAA size and clots. During implantation, the procedure was guided by TTE assessment. No major complications; perforation of the appendage, pericardial effusion, death or major vascular complications occurred. These patients were followed up with TOE assessment at day 45.

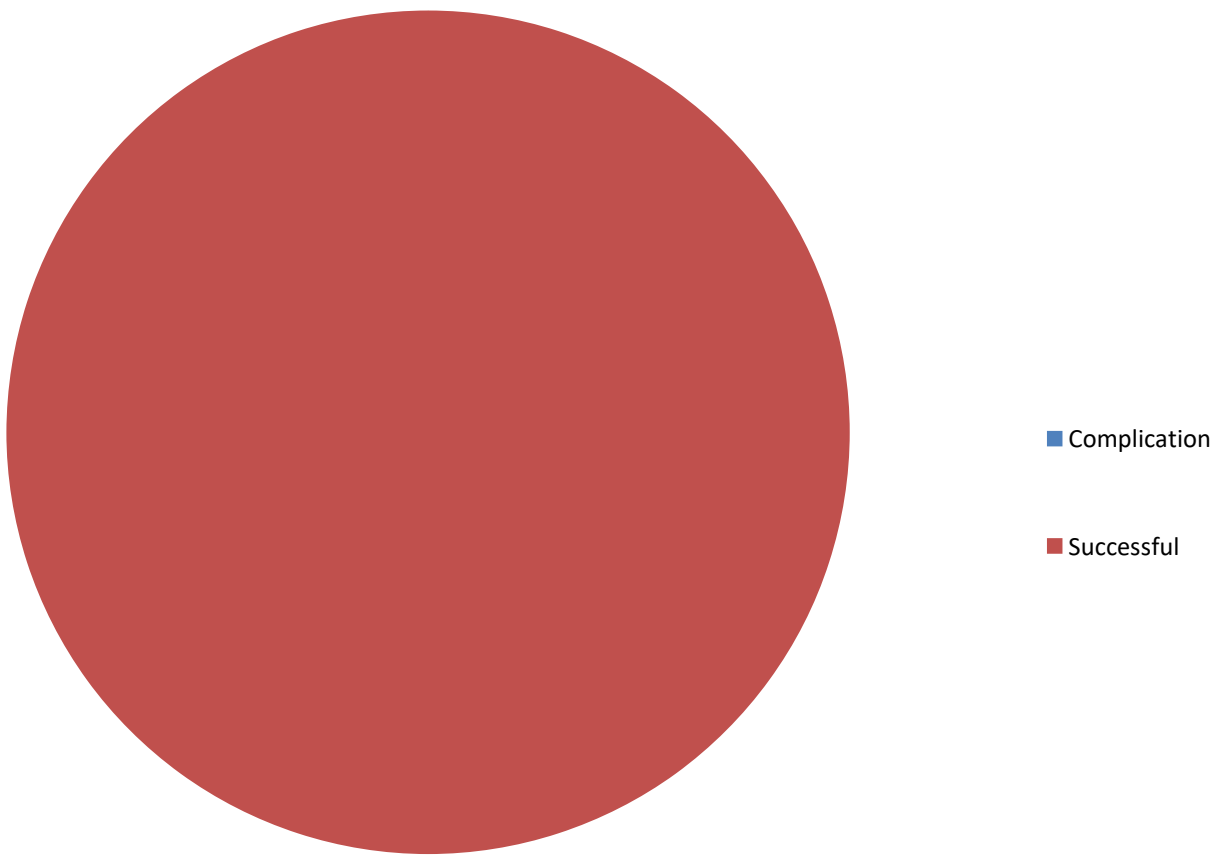
Eleven patients had good seal but 5 patients noted significant leak (>5mm) from the device during TOE assessment. Three patients did not undergo TOE assessment due to various reasons. None of these patients had developed stroke till date and no longer on anticoagulation except the five with leak.

SUPPORTING DOCUMENTS

GRAPH SHOWING OUTCOME OF 16 PATIENTS UNDERWENT LAAO PROCEDURE AT HOSPITAL SULTANAH BAHYAH FROM 2017-2022.



100% Success Rate of LAAO from 2017 -



Warfarin Dose Adjustments and Bleeding Events in Patients Receiving Warfarin and Amiodarone versus Warfarin Alone

Dr Apinut Pengruangrojanachai¹

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Background: Warfarin is the most frequently used to prevent a cardioembolic stroke in atrial fibrillation (AF) patients. Amiodarone is concurrently used with warfarin for rhythm control. However, the interaction of the drugs can increase INR levels and may cause more bleeding events.

Objectives: To assess the correlation of mean dose change and bleeding events between patients with AF receiving warfarin and amiodarone compared with warfarin alone.

Methods: This is a retrospective cohort study with a matching propensity score in a 1:1 ratio according to age and gender enrolled between 2018 and 2020 from the warfarin clinic. Baseline characteristics and mean doses of warfarin were analyzed with Chi-square and Pearson correlation coefficient. Kaplan-Meier analysis and Cox proportional hazard models assessed the bleeding events.

Results: Among 1172 eligible patients, a total of 224 patients were included (mean age 73 years and female = 121). The mean warfarin doses in patients with amiodarone were significantly lower than warfarin alone (13.7 ± 0.8 mg/week vs. 18.8 ± 0.6 mg/week, $p < 0.0001$). The mean time in therapeutic range in both groups was nearly equal (48% vs. 53%, $p = 0.17$). The total bleeding events in patients with amiodarone were slightly lower than warfarin alone (14.2% vs. 17.9%, $p = 0.46$).

Conclusions: The mean doses of warfarin in patients receiving amiodarone were significantly lower than warfarin alone, about 27%. However, total bleeding events were non-significantly different in both groups.

Amplitude of S wave in Lead V1: a New Predictor of AF Recurrence after Cardioversion

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Background: Atrial fibrillation (AF) is a common arrhythmia in clinical practice, and recurrence of AF or atrial flutter (AFL) can be found in after electrical cardioversion (ECV). Many factors were associated with AF recurrence, including electrocardiogram (ECG) and echocardiographic findings. Hence, identifying these predictors after elective ECV might be beneficial in selecting the appropriate patients who are appropriate for this procedure.

Methods: Medical records of all patients with AF who were scheduled for ECV between November 2017 and July 2021 in Phramongkutklao hospital were reviewed. The primary outcome was recurrent AF or AFL after ECV. The patient's baseline characteristics, ECG, and echocardiographic findings were collected, and Cox-proportional hazard model analysis was used to identify the predictors of AF/AFL recurrence.

Results: A total of 172 patients were scheduled for ECV. The mean age of 66.16 ± 12.12 years, 67.44% were male, and 38.95% were diagnosed with paroxysmal AF. Over a median of 127 days, recurrent AF/AFL occurred in 121 patients (70.35%). S wave amplitude >7 mm in lead V1, left ventricular mass index (LVMI) >130 g/m², and left atrial (LA) diameter >40 mm were significantly correlated with the AF/AFL recurrence with the hazard ratio of 0.52 (95% CI of 0.31-0.87), 1.66 (95% CI of 1.03-2.69) and 1.88 (95% CI of 1.15-3.07) respectively.

Conclusion: Early AF/AFL recurrence after ECV is common. Left ventricular hypertrophy (LVH) and dilated LA are strong predictors of AF/AFL recurrence. Deep S wave in lead V1 appears to be a new promising protective predictor for AF/AFL recurrence.

SUPPORTING DOCUMENTS

Table 1 Baseline characteristics

Characteristics	All patients (n=172)
Age (years)	66.16 ± 12.12
Male, n (%)	116 (67.44)
Paroxysmal AF, n (%)	67 (38.95)
Co-morbid disease, n (%)	
Hypertension	115 (66.86)
Hyperlipidemia	119 (69.19)
Diabetes	35 (20.35)
CAD	40 (23.26)
Thyroid diseases	18 (10.47)
OSA	10 (5.81)
COPD	5 (2.91)
Valvular heart diseases, n (%)	
Mild MR	1 (0.58)
Moderate MR	83 (48.26)
Severe MR	14 (8.14)
Mild MS	1 (0.58)
Moderate MS	0 (0)
Severe MS	0 (0)
Mild TR	95 (53.23)
Moderate TR	10 (5.81)
Severe TR	5 (2.91)
eGFR (ml/min/m ²)	60.11 ± 18.63

AF, atrila fibrillation; CAD; coronary artery disease; COPD, chronic obstructive pulmonary disease; MR, mitral regurgitation; MS, mitral stenosis; OSA; sleep apnea; TR, tricuspid regurgitation

Data expressed as Number (percentage) or Mean (standard deviation).

Table 2 ECG and echocardiographic findings

Findings	All patients (n=172)
P wave duration (ms)	103.27 (58, 177)
QRS duration (ms)	
Lead V1	109.23 (54, 213)
Lead V6	96.62 (37, 179)
R wave amplitude (mm)	
Lead aVL	3.58 (1, 14)
Lead V ₅	14.83 (2, 52)
Lead V ₆	12.41 (2, 40)
S wave amplitude (mm)	
Lead V ₁	5.85 (1, 22)
Lead V2	11.15 (2, 31)
Lead V3	11.92 (1, 33)
Combined amplitude (mm)	
R wave in lead aVL + S wave in lead V ₃	15.29 (3, 40)
S wave in lead V ₁ + R wave in lead V ₅	20.76 (6, 60)
S wave in lead V ₁ + R wave in lead V ₆	18.39 (6, 49)
S wave in lead V ₂ + R wave in lead V ₅	25.90 (8, 66)
S wave in lead V ₂ + R wave in lead V ₆	23.60 (9, 56)
Echocardiographic parameters	
LVEF (%)	54.70 ± 14.07
LVEDd (mm)	47.28 ± 7.40
LVEDs (mm)	33.32 ± 9.26
LA diameter (mm)	45.71 ± 8.17
PWT (mm)	10.62 ± 2.53
IVST (mm)	11.12 ± 6.89

Findings	All patients (n=172)
P wave duration (ms)	103.27 (58, 177)
QRS duration (ms)	
Lead V1	109.23 (54, 213)
Lead V6	96.62 (37, 179)
R wave amplitude (mm)	
Lead aVL	3.58 (1, 14)
Lead V ₅	14.83 (2, 52)
Lead V ₆	12.41 (2, 40)
LVMi (g/m ²)	103.95 ± 39.32

IVST, interventricular septal thickness; LA, left atrium; LVEDd, left ventricular end-diastolic diameter; LVEDs, left ventricular end-systolic diameter; LVEF, left ventricular ejection fraction; LVMi, left ventricular mass index; PWT, posterior wall thickness

Table 3 Medications and dosage

Mediations, <i>n</i> (%)	All patients (<i>n</i> =172)
Beta-blockers	129 (75)
Atenolol	1 (0.78)
Bisoprolol	61 (47.29)
Carvedilol	20 (15.5)
Metoprolol	26 (20.16)
Nebivolol	21 (16.28)
RAAS inhibitors	66 (38.37)
Ailsartan	5 (7.58)
Enalapril	14 (21.21)
Irbesartan	1 (1.52)
Losartan	24 (36.36)
Olmesartan	3 (4.55)
Sacubitril/Valsartan	3 (4.55)
Valsartan	6 (9.09)
Class I anti-arrhythmic drugs	40 (23.26)
Propafenone	40 (100)
Class III anti-arrhythmic drugs	90 (52.33)
Amiodarone	83 (92.22)
Dronedarone	7 (7.78)

Table 4 Univariate and multivariate predictors of the primary outcomes

Variables	Univariate model		Multivariate model	
	HR (95% CI)	<i>p</i>	HR (95% CI)	<i>p</i>
Age ≥60 years	1.08 (0.71-1.63)	0.72		
Male	1.13 (0.77-1.66)	0.54		
BMI ≥23 kg/m ²	1.24 (0.81-1.89)	0.32		
Hypertension	1.00 (0.68-1.47)	1.00		
Hyperlipidemia	1.11 (0.75-1.63)	0.62		
Diabetes	0.76 (0.48-1.19)	0.23		
CAD	0.81 (0.52-1.26)	0.35		
Thyroid diseases	1.12 (0.63-2.00)	0.71		
OSA	1.37 (0.67-2.82)	0.39		
COPD	0.54 (0.13-2.17)	0.38		
eGFR <60 ml/min/1.73 m ₂	1.21 (0.84-1.74)	0.30		
P wave duration >120 ms	1.01 (0.65-1.58)	0.97		
R wave amplitude in lead aVL >4 mm	1.03 (0.68-1.55)	0.89		
S wave amplitude in lead V ₁ >7 mm	0.59 (0.38-0.91)	0.02*	0.51 (0.31-0.84)	0.01*
S wave amplitude in lead V ₂ >7 mm	0.76 (0.52-1.12)	0.17		
S wave amplitude in lead V ₃ >7 mm	1.04 (0.71-1.52)	0.83		
R wave amplitude in lead V ₅ >15 mm	0.98 (0.67-1.44)	0.94		
R wave amplitude in lead V ₆ >15 mm	1.03 (0.67-1.59)	0.88		
R wave in lead aVL + S wave in lead V ₃ amplitude ≥20 mm	1.10 (0.71-1.7)	0.68		
S wave in lead V ₁ + R wave in lead V ₅ amplitude ≥35	0.97 (0.67-1.4)	0.87		
S wave in lead V ₁ + R wave in lead V ₆ amplitude ≥35	1.06 (0.73-1.55)	0.76		
S wave in lead V ₂ + R wave in lead V ₅ amplitude ≥35	1.06 (0.71-1.58)	0.78		

Variables	Univariate model		Multivariate model	
	HR (95% CI)	<i>p</i>	HR (95% CI)	<i>p</i>
S wave in lead V ₂ + R wave in lead V ₆ amplitude ≥35	1.02 (0.7-1.49)	0.90		
QRS duration in lead V ₁ >110 ms	1.08 (0.75-1.56)	0.67		
QRS duration in lead V ₆ >110 ms	0.64 (0.41-1.00)	0.05		
LVEF <50%	0.72 (0.45-1.13)	0.15		
LA diameter >40 mm	1.95 (1.21-3.14)	0.01*	1.79 (1.08-2.96)	0.02*
LVMi >125 g/m ²	1.66 (1.06-2.61)	0.03*	1.66 (1.04-2.64)	0.03*
Moderate-severe MR	1.41 (0.77-2.58)	0.27		
Moderate-severe TR	0.90 (0.47-1.74)	0.76		
Beta-blockers	1.41 (0.92-2.17)	0.12		
RAAS inhibitors	0.97 (0.67-1.4)	0.87		
Class I anti-arrhythmic drugs	1.09 (0.73-1.64)	0.67		
Class III anti-arrhythmic drugs	0.89 (0.62-1.27)	0.51		

BMI, body mass index; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate; LA, left atrium; LVEF, left ventricular ejection fraction; LVMi, left ventricular mass index; MR, mitral regurgitation; OSA, obstructive sleep apnea; RAAS, renin-angiotensin-aldosterone system; TR, tricuspid regurgitation

Figure 1 Patient enrollment

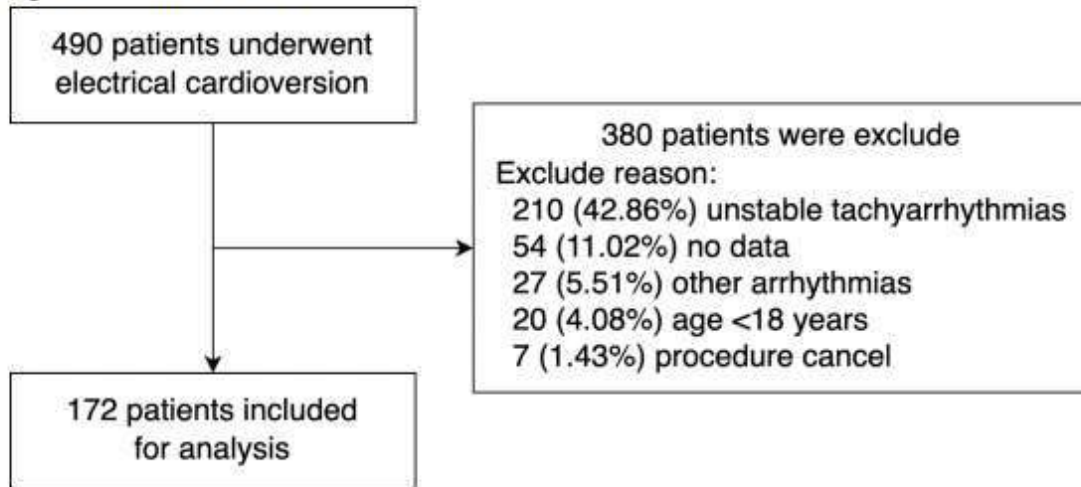
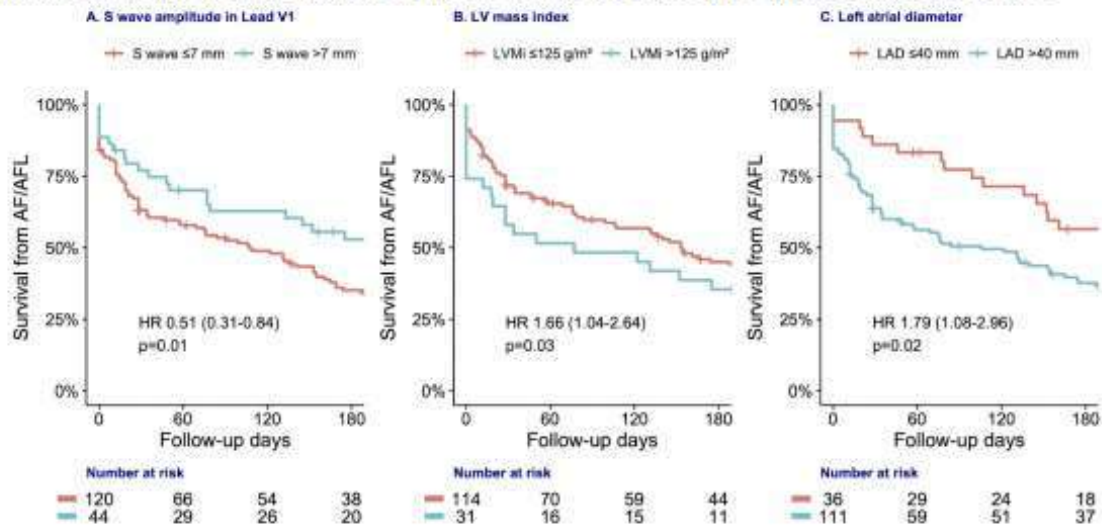


Figure 2 The Kaplan-Meier curves comparing (A) S wave amplitude in Lead V1, (B) LV mass index, and (C) Left atrial diameter as the predictors for survival free from AF/AFL recurrence



Prevalence of Risk Factors In Patients With First Episode Of Atrial Fibrillation In Indian Subcontinent

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Background: AF, most common sustained arrhythmia in clinical practice, major public health impact, due to increased risk of stroke. Therapeutic failures in AF, paradigm shift towards subclinical remodelling related to RFs causing chronic atrial overload, in hope that “upstream” therapy might improve prognosis. Data in Indian perspective lacking.

Objective: To evaluate AF prevalence, study risk factors with first episode of AF, having no significant SHD.

Methods: Evaluated aged ≥ 18 years during camp conducted in Jaipur. Collected demographics, recorded BP, height, weight, 12-lead ECG. Presence of DM, HTN recorded by self-reported history. Also registered patients attending the ER for first episode of AF. With coexistent SHD were excluded. FU done 7-10 days after discharge.

Results: 829 pts. randomly selected, 0.22% have AF. Mean age with AF 58.6 years, 54.5% male. 31.7% had HTN, 20.9% were diabetic; 15.8% CAD; 7.7% OSA; 5.4% each had obesity, COPD, RHD 4.9%, 6.01% hyperthyroidism; 1.64% excess alcoholic, 0.55% practiced high level sports. 33.9% no RFs. One RF in 24.04%, 2 in 22.95%, ≥ 3 19.13%.

Conclusion: Prevalence of AF found to be consistent with previous studies, there was predominance of RFs like HTN, DM, CAD, mostly these could be corrected with purpose of maintaining NSR once it has been achieved. A high % of patients have no RFs and follow-up should reveal if they have a better prognosis for AF control. In patients with no RFs and recurrence of AF, seems important to rule out triggering arrhythmias which could be treated with an ablation such as atrio-ventricular tachycardias and arrhythmogenic foci in pulmonary veins.

Evaluation of Safety and Durability of Pulsed-Field Ablation in Preclinical Setting: PULSE-DOSE Study

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Background: Pulsed-field ablation (PFA) is an emerging ablation modality with myocardial tissue selectivity which works through the delivery of electrical pulses to cause irreversible electroporation and cell death. This technology has been shown to be safe and efficacious in the acute setting.

Objectives: The purpose of this study is to evaluate the safety and durability of PFA lesions for pulmonary vein isolation (PVI) in animal models.

Materials and Methods: 13 swine were divided into 3 different cohorts according to PFA dose (1,800V/ low, 2,300V/intermediate and 2,800V/high voltage). They underwent an index ablation procedure to isolate the pulmonary veins with a follow-up re-map after 12 weeks. Baseline and follow-up data including voltage maps, venous potentials, entrance and exit blocks, phrenic nerve palsy and complications were recorded.

Results: 11 out of 13 swine (85%) completed the follow-up procedure. Repeat voltage mapping showed successful PVI in all 21 veins (100%). Interestingly, 1 PV in the intermediate voltage group (8 applications at 2,300V) that was not acutely isolated post-ablation showed complete isolation at follow-up. No phrenic nerve palsy was observed at follow-up. 2 animals died prior to re-map procedure due to cardiac tamponade and ventricular fibrillation during transseptal puncture.

Conclusion: Durable PFA effects with possible delayed electroporation can be observed at 12-week follow-up. Intraprocedural complications were not directly related to the PFA delivery itself.

Comorbidities of Atrial Fibrillation in Indonesia

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Objective: Atrial fibrillation (AF) is the most common form of cardiac arrhythmia resulting from structural and/or electrophysiological abnormalities with abnormal impulse formation. The risk of AF progression is associated with demographic and lifestyle factors, cardiovascular conditions, and comorbidities. Therefore, this study was conducted to determine the prevalence of AF and its comorbidities in Indonesia

Methods: This was a multicenter collaborative study using an observational cross-sectional design from 2018 to 2019 in tertiary care population in Indonesia. Variables collected were age, gender, and comorbidities such as heart failure, hypertension, diabetes, stroke, coronary heart disease, peripheral arterial disease, and previous history of atrial fibrillation. An electrophysiologist in each center professionally evaluated the interpretation of the electrocardiogram.

Result: There were a total of 9,773 subjects included in this study (54.5% were women) with mean age of 44.40±14.80 years. Prevalence of AF was 3.5%. AF was found in 7.4% subjects older than 65, in 14.2% of those with heart failure, 5% of those with hypertension, 7.3% of those with diabetes, 13.9% of those with stroke, 6.6% of those with coronary artery disease, and 10% of those with peripheral arterial disease.

Conclusion: Around seven out of two hundreds people (3.5%) in Indonesia suffer from AF. AF was more common among subgroups older than 65 years, male gender, history of heart failure, hypertension, diabetes, stroke, coronary artery disease, stroke and peripheral artery disease.

Smartphone Electrocardiogram for Atrial Fibrillation Screening in Malaysian Elderly

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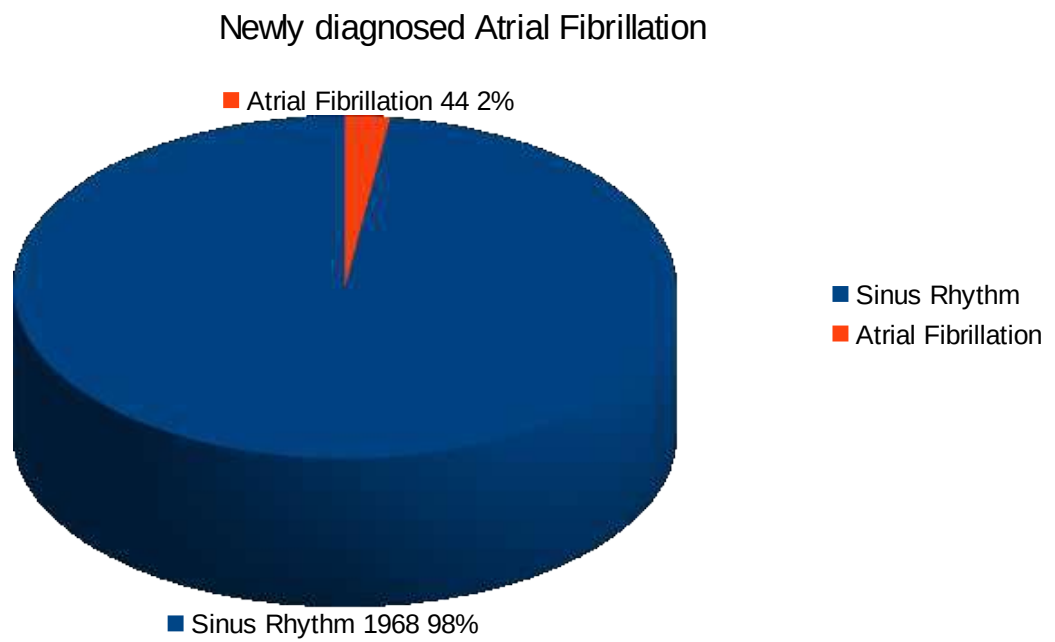
Objectives: Atrial Fibrillation(AF) is the commonest cardiac arrhythmia that is associated with increased risk of stroke, heart failure and cardio-vascular mortality. Systemic screening at community level for atrial fibrillation with smartphone electrocardiogram had shown to pick up undiagnosed AF, but the data in Asia Pacific region is scarce. Hence, the aim of this study is to assess the feasibility of smartphone electrocardiogram for atrial fibrillation screening in Malaysian elderly.

Methods: In the period between 1st January 2018 to 31st December 2018, 2149, participants were screened with smartphone electrocardiogram using Kardia Mobile (AliveCorVR , Mountain View, CA, USA) in the community-based AF screening program. The inclusion criteria included age ≥ 65 years old who consented to the study. The electrocardiograms were classified into three groups, namely sinus rhythm, AF and uninterpretable. Participants with uninterpretable electrocardiogram were referred conventional 12-lead ECGs, which were reviewed by the prime investigator.

Results: 137 (6.4%) out of 2149 smartphone electrocardiogram were uninterpretable. 44(2%) participants had newly diagnosed AF, with 31(70.4%) were asymptomatic. The prevalence rates of AF detected by smartphone electrocardiogram was 6.9% and prevalence rates of AF detected by smartphone electrocardiogram or self-reported by participants was 8.1%. Independent predictors of AF such as male gender, history of stroke, heart failure, valvular heart disease and thyroid disease were identified utilizing multivariable logistic regression analysis.

Conclusion: Community screening for AF with smartphone electrocardiogram was feasible and effective. High proportion of asymptomatic AF (70.4%) illustrated the importance of community screening in elderly population.

SUPPORTING DOCUMENTS



No Anchor Technique on Creation of Left Atrial Bottom Lesion with Cryoballoon for Atrial Fibrillation

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Objectives: Recent study reported that the efficacy of posterior wall isolation(PWI) created by cryoballoon for atrial fibrillation(AF). The success rate of left atrial roof block(LA-RB) creation has generally exceeded 90%. On the other hand, there is a limited outcome of left atrial bottom block(LA-BB) creation. To improve the success rate of LA-BB creation, we devised a “No-Anchor Technique”, which is a new method of applying the balloon in sufficient contact with the appropriate position by inverting the sheath without using the Achieve catheter as an anchor. This study aimed to clarify whether No-Anchor Technique could improve the success rate of LA-BB creation.

Materials and Methods: The study population included consecutive 16 patients(12 males, 71.6±2.1years) who underwent PVI and PWI using cryoballoon for AF from January 2022 to May 2022. We evaluated the success rate of LA-BB and PWI, efficacy and safety of No-Anchor Technique.

Results: All patients underwent PWI using cryoballoon. First pass bidirectional LA-BB creation using No-Anchor Technique was achieved in 10 of 16 patients(62.5%). Final success of PWI was achieved in 15 of 16 patients(93.8%). After a median follow-up of 4 months, the clinical recurrence rate was 18.8%. Complications were absent except for one patient with pericarditis.

Conclusion: Although LA-BB creation by cryoballoon sometimes have difficulty to apply the balloon to the targeted site with sufficient contact, No-Anchor Technique allowed us to maintain a high success rate of PWI using cryoballoon without touch-up radiofrequency ablation.

Risk Factors of New Onset Atrial Fibrillation in Breast Cancer Survivors

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Background: The risk of atrial fibrillation (AF) is increased among breast cancer survivors, and it is supposed that multiple risk factors are involved. However, the contribution of risk factors to the development of AF is not well established.

Method and Results: The study cohort consisted of 1,256 female BC patients from four medical centers in Korea. During 48.7 months of follow-up, 19 (1.5%) patients were diagnosed with AF. Multiple Cox regression model identified that the number of conventional risk factors (Hypertension, diabetes, chronic kidney disease, body mass index ≥ 30 kg/m², prior myocardial infarction, and prior heart failure) is associated with newly diagnosed AF. But, cancer-treatment-related risk factors including doxorubicin dose and radiation to the left breast were not significant predictors of new-onset AF in these patients. In the multiple Cox regression model for prediction of major adverse cardiovascular events (MACE), new-onset AF was not significantly associated with MACE.

Conclusion: Number of conventional risk factors of AF significantly predicts new-onset AF with adjustment of cancer-related risk factors. Individualized screening for AF and preventive measures in breast cancer patients with multiple risk factors for AF may improve the CV outcome.

Low Dose Dopamine and New Onset Atrial Fibrillation After Coronary Artery Bypass Surgery

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Objectives: To determine whether the administration of low dose dopamine are related to the incidence of new onset Atrial Fibrillation in patients that had undergone Coronary Artery Bypass Surgery procedures.

Materials and Methods: A systematic review were conducted in the following database : PubMed, Embase and Google Scholar. The following keywords and it's variations were used : New Onset Atrial Fibrillation, Low Dose Dopamine, Post-Coronary Artery Bypass Surgery. From the initial keywords search, seven literatures were identified. Further reading of the literature revealed that two literatures discusses about the topic and critical appraisal using CEBM critical appraisal tool were done. Appraisals were done by two distinct appraiser.

Results: Two retrospective cohort studies were included in this paper. The first article were a retrospective cohort study involving 1731 patients administered renal dose dopamine. This study found that administration of renal dose dopamine may increase the risk of the appearance of paroxysmal AF by 74%. The second article showed that dopamine administration do not influence the incidence of paroxysmal atrial fibrillation. The benefit of the dopamine administration was also controversial: in the first study, no hemodynamic benefits were seen in the patients whereas in the second study, there's a significant hemodynamic benefits of dopamine administration. Critical appraisal analysis showed that the first study has higher VIA score compared to the second.

Conclusion: Low dose dopamine administration may lead to increased risk of the paroxysmal atrial fibrillation appearance.

Association of Concomitant Use of Proton Pump Inhibitor With Effectiveness and Safety of Oral Anticoagulants

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Objectives: A drug interaction can affect the drugs' effects. Proton pump inhibitor (PPI) is one of the most common drugs used in patient with oral anticoagulant. We hypothesized that the concomitant use of PPI would affect the effectiveness and safety of oral anticoagulant in patient with atrial fibrillation.

Materials and Methods: The cohort was identified from four tertiary referral hospitals. Concomitant use of drug was defined as total overlapping period with oral anticoagulant more than 70% of total period of anticoagulant. Drugs were classified as warfarin, nonvitamin K antagonist anticoagulant, PPI, nonsteroid anti-inflammatory drug, antiplatelet, renin-angiotensin system inhibitor, diuretics, beta blocker, calcium channel blocker, statin, and P-glycoprotein inhibitors for dabigatran and edoxaban.

Results: Data were analyzed for 20,750 episodes (median [IQR] age, 71 [63-78] years; female, 42.5%; warfarin, 37.3%; median [IQR] CHA2DS2-VASc score, 3 [2-5]). The incidences of ischemic stroke, systemic embolism, or intracardiac thrombus were 64.7 and 22.2 per 1000 patient-year with concomitant use and no or less use of PPI, respectively. The incidences of major bleeding were 44.3 and 19.6 per 1000 patient-year, and with concomitant use and no or less use of PPI, respectively. Compared with no or less use of PPI, concomitant use of PPI was associated with higher risks of thromboembolism and bleeding (adjusted hazard ratio, 2.12 [95% CI, 1.75–2.56] and 1.45 [1.17–1.81], respectively).

Conclusion: Among patients with oral anticoagulant for atrial fibrillation, incidences of thromboembolism and major bleeding were higher in patients with concomitant PPI.

Racial Differences in stroke and mortality associated with atrial fibrillation

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Objectives: The adverse outcomes associated with atrial fibrillation (AF) in Asians have not been fully elucidated yet. We evaluated the race-specific associations of AF with total, ischemic and hemorrhagic stroke, and all-cause death.

Materials and Methods: The UK Biobank and Korean National Health Insurance Service (NHIS) study are prospective and observational cohorts. During the registration period (UK 2006–2010; NHIS 2002–2003), 959,932 adults were enrolled. Participants with the following history at baseline were excluded: AF, valvular heart disease and hyperthyroidism. Also, participants who died within 180 days from registration were excluded.

Outcomes Total, ischemic and hemorrhagic stroke and all-cause death (adjudicated using hospital discharge codes, and death certificates) after one-to-one propensity score matching.

Results: After propensity score matching, each race included 166,410 participants (mean[SD] age: 55.0[8.3] years in UK, 55.7[8.2] years in NHIS; men: 55.2% in UK, 54.7% in NHIS). During the follow-up (mean: 11.7 years in UK, 7.3 years in NHIS), the incidence rates of all types of stroke were significantly higher in Koreans than in whites irrespective of AF status. Hazard ratios of AF for total, ischemic and haemorrhagic stroke and all-cause death were approximately 2.5, 3.0, 2.0 and 7.0, respectively, and there were no significant interactions between the impact of AF and race.

Conclusion: Although the incidence of stroke events in Koreans was greater than that of whites, our results suggest that AF is unlikely to be the cause of this. Continued investigation is essential to explain race differences in AF-related outcomes, especially stroke.

SUPPORTING DOCUMENTS

	British Individuals		Korean Individuals		P for interaction
	No AF	AF	No AF	AF	
Total Stroke					
No. of events	1791	187	4058	177	
Person-time, y	1871349	32160	1172568	9594	
Model 1 ^a	1	2.74 (2.35–3.20)	1	2.93 (2.52–3.41)	0.944
Model 2 ^b	1	2.42 (2.07–2.83)	1	2.68 (2.30–3.12)	0.750
Ischemic Stroke Admission					
No. of events	1306	156	3187	165	
Person-time, y	1878561	32468	1178102	9792	
Model 1 ^a	1	3.00 (2.53–3.55)	1	3.32 (2.83–3.89)	0.850
Model 2 ^b	1	2.57 (2.16–3.05)	1	3.01 (2.57–3.53)	0.517
Hemorrhagic Stroke					
No. of events	585	51	1177	34	
Person-time, y	1902524	34734	1202528	11008	
Model 1 ^a	1	2.30 (1.72–3.08)	1	1.75 (1.24–2.47)	0.094
Model 2 ^b	1	2.13 (1.58–2.86)	1	1.62 (1.15–2.29)	0.122
All-cause death					
No. of events	7993	1502	5357	484	
Person-time, y	1911036	35148	1210009	11317	
Model 1 ^a	1	7.51 (7.09–7.97)	1	7.02 (6.39–7.72)	0.095
Model 2 ^b	1	6.65 (6.27–7.06)	1	6.74 (6.13–7.43)	0.063

^aModel 1 adjusted for age and sex. ^bModel 2 adjusted for age, sex, body mass index, hypertension, diabetes mellitus, dyslipidemia, heart failure, previous stroke, previous myocardial infarction, coronary heart disease, peripheral artery disease, hypertrophic cardiomyopathy, previous cardiovascular implantable electronic device implantation, major bleeding history, any bleeding history, anemia, history of peptic ulcer disease, venous thromboembolism, chronic kidney disease, hypothyroidism, chronic obstructive pulmonary disease, osteoporosis, HIV infection and malignancy.

AF, atrial fibrillation; MI, myocardial infarction.

The Long-term Renal Outcomes of Taiwan Atrial Fibrillation Patients Underwent Novel Oral Anticoagulants Therapy

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Objective: The aim of this study is to investigate the long-term renal outcomes of Taiwan AF patients who underwent novel oral anticoagulant (NOAC) therapy in a single tertiary center.

Methods: 252 AF patients were retrospectively enrolled between the years of 2014 and 2021 in our hospital. They underwent antithrombotic therapy at outpatient department with regular follow up the renal function. The renal outcomes were defined as $\geq 30\%$ decline in estimated glomerular filtration rate (eGFR), doubling of the serum creatinine level and kidney failure.

Results: Total 234 patients had regular renal function data for renal outcomes analysis. During the mean follow up of 48 months, the renal function was not significantly decline after 6 years when compared with baseline (creatinine 1.14 vs 1.09 mg/dL, and eGFR 67.6 vs 69.5 mL/min/1.73m², both P values > 0.05). During the long-term follow up, 12 patients (5.1%) had doubling of the serum creatinine level, $\geq 30\%$ decline in eGFR occurred in 63 (26.9%) patients and two patients (0.85%) developed kidney failure. The NOAC treatment group (176 patients) had significantly less doubling of the serum creatinine level (1.7% vs 15.5%, $P < 0.05$) and non-significantly less $\geq 30\%$ decline in eGFR (25% vs 32.8%, $P > 0.05$) and kidney failure (0% vs 3.4%, $p > 0.05$) when compared with the non-NOAC treatment group (58 patients).

Conclusion: Our AF patients had preserved renal function during the long-term follow up with or without NOAC treatment. However, the NOAC treatment group had better renal outcomes (significantly less doubling of the serum creatinine level) when compared with non-NOAC treatment group.

Baseline Anemia and Complications After Atrial Fibrillation/ Atrial Flutter Ablation: A Meta-Analysis

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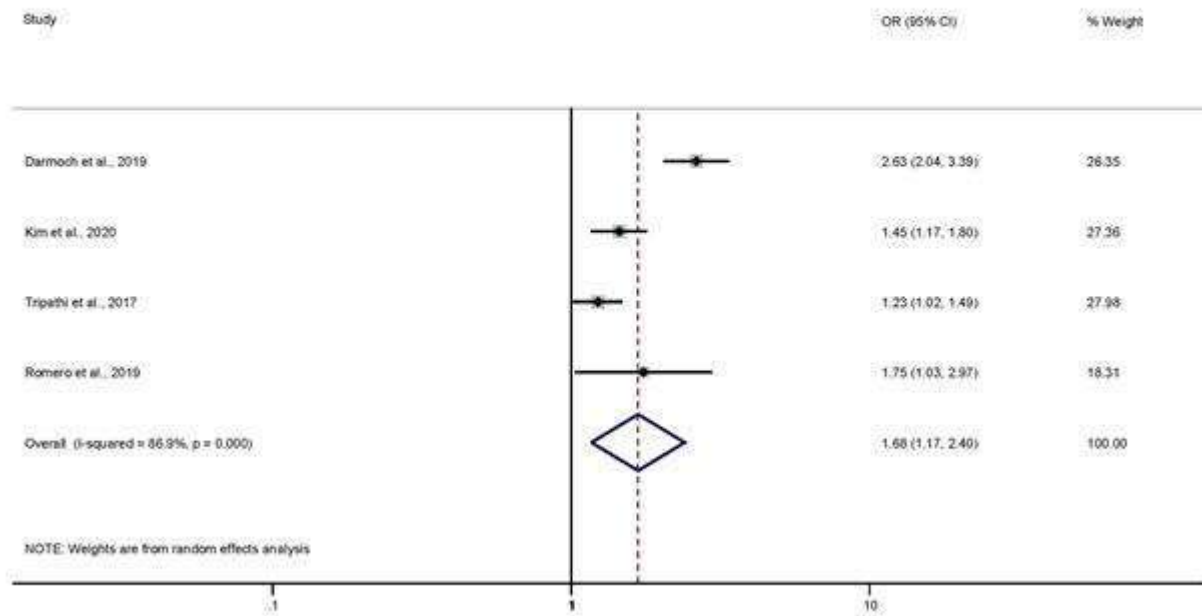
Objective: Several factors have been identified as poor prognostication factors in patients undergoing atrial fibrillation/ atrial flutter ablation. Baseline anemia has been proposed as one of the risk factors for poor outcomes, although the data were unclear. We conducted a meta-analysis to investigate the effect of baseline anemia on complications following atrial fibrillation/ atrial flutter ablation.

Methods: We conducted a literature search from inception through December 2021 in the databases of EMBASE and MEDLINE. We included randomized controlled trials or cohorts that compared complications in atrial fibrillation/ atrial flutter ablation between patients with and without baseline anemia. Data were combined using the random-effect, generic inverse variance method of DerSomonian and Laird to calculate the weighted mean difference (WMD), odds ratio (OR), and 95% confidence interval (CI).

Results: Four studies were included in the study (134,654 patients, and 7,017 patients with baseline anemia). Baseline anemia is associated with significantly increased complications following atrial fibrillation/ atrial flutter ablation (OR 1.68, 95% CI 1.17-2.40)

Conclusion: Our study suggested that baseline anemia increase complications after AF/ AFL ablation. Anemia should be optimized to improve the outcomes in patients undergoing AF/ AFL ablation.

SUPPORTING DOCUMENTS



Real-World Outcomes of a Rhythm Control Strategy for Atrial Fibrillation with Reduced Left Systolic Function

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Objectives: It has not been well known how effective is rhythm control strategy in atrial fibrillation (AF) patients with reduced left ventricular ejection fraction (LVEF <50%). We aimed to evaluate the real-world prognosis of AF patients with reduced LVEF who received a rhythm control strategy.

Methods: We retrospectively reviewed medical records of AF patients with reduced LVEF who received rhythm control strategy between March 2015 and December 2021.

Results: A total of 84 patients were included (Age, 63.4 ± 11.0 ; Men, 81.0%; LVEF, $34.1 \pm 8.2\%$). Initial rhythm control was performed in 68 patients (81.0%), whereas 16 patients (19.0%) received rate control. In short-term echo follow-up, a significant improvement in LVEF was observed in both the rhythm control group (Pre vs. Post; $34.8 \pm 8.0\%$ vs. $54.7 \pm 9.1\%$; $P < 0.001$) and the rate control group (Pre vs. Post; $32.7 \pm 8.9\%$ vs. $43.0 \pm 9.1\%$; $P < 0.001$). However, improvement in LVEF was more significant in the rhythm control group (Rhythm control vs. Rate control; $54.7 \pm 9.1\%$ vs. $43.0 \pm 9.1\%$; $P < 0.001$). Rhythm control was continued except for two patients in the initial rhythm control group, and all patients in the rate control group received rhythm control therapy thereafter. Significant improvement in LVEF was observed after rhythm control in the initial rate control group (Pre vs. Post; $42.6 \pm 9.3\%$ vs. $54.8 \pm 10.1\%$; $P < 0.001$).

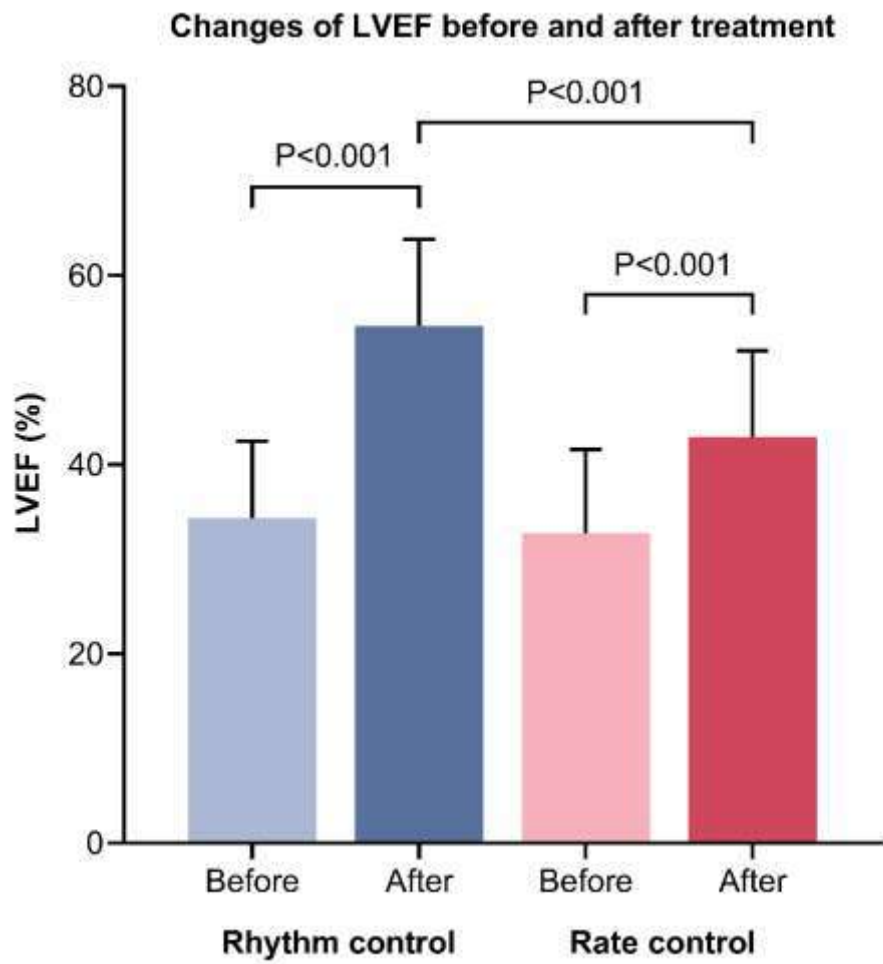
Conclusion: In real-world practice, a rhythm control strategy is feasible and effective for improving LVEF in AF patients with reduced LVEF.

SUPPORTING DOCUMENTS

	Rhythm control group (n=68)	Rate control group (n=16)	P-value
Age, years	64.2 ± 11.2	59.9 ± 9.5	0.161
Male sex, n (%)	56 (82.4)	12 (75.0)	0.493
Body mass index, kg/m ²	25.4 ± 3.5	25.8 ± 3.2	0.660
Atrial fibrillation type			0.033
Paroxysmal	7 (10.3)	0	
Persistent	50 (73.5)	9 (56.3)	
Longstanding persistent	11 (16.2)	7 (43.8)	
Hemoglobin, g/dL	14.6 ± 1.6	14.5 ± 2.3	0.924
Creatinine, mg/dL	0.99 ± 0.27	1.30 ± 1.18	0.309
Hypertension, n (%)	34 (50.0)	9 (56.3)	0.653
Diabetes, n (%)	17 (25.0)	8 (50.0)	0.068
Congestive heart failure, n (%)	25 (37.3)	10 (62.5)	0.067
Coronary artery disease, n (%)	12 (17.6)	3 (18.8)	1.000
Stroke/TIA, n (%)	5 (7.4)	1 (6.3)	1.000
CHA ₂ DS ₂ VASc score, mean	2.3 ± 1.6	2.9 ± 2.3	0.355
LVEF, %	34.4 ± 8.1	32.7 ± 8.9	0.474
LA diameter, cm	4.6 ± 0.5	4.6 ± 0.5	0.781
LA volume index, ml/m ²	51.2 ± 15.5	55.4 ± 18.4	0.380
Beta-blocker, n (%)	63 (92.6)	15 (93.8)	1.000
ACEi/ARB, n (%)	53 (77.9)	15 (93.8)	0.286
MRA, n (%)	49 (72.1)	12 (75.0)	1.000
NDH-CCB, n (%)	17 (25.0)	4 (25.0)	1.000
Digoxin, n (%)	17 (25.0)	9 (56.3)	0.032

Table 1. Baseline characteristics

TIA, transient ischemic attack; LVEF, left ventricular ejection fraction; LA, left atrium; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; MRA, mineralocorticoid receptor antagonist; NDH-CCB, non-dihydropyridine calcium channel blocker.



Diagnostic Value Of Wearable Electrocardiogram Patch For New Onset Atrial Fibrillation In High Risk Patients

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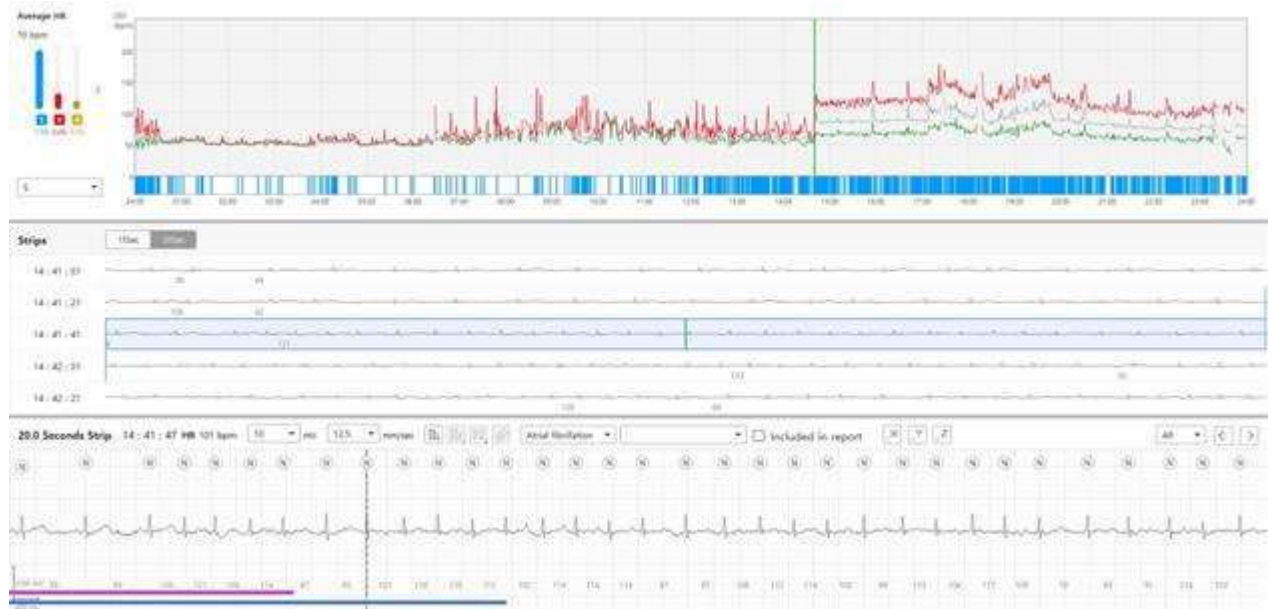
Objectives: We designed to investigate: (1) the rate of detection of new-onset atrial fibrillation by ATP-C120 in high risk groups, (2) its advantage(s) over conventional 12 lead ECG monitoring systems in diagnosing new-onset atrial fibrillation, and lastly (3) the incidence of death, stroke, myocardial infarction, or systemic embolism in the diagnosed new-onset atrial fibrillation group.

Methods: This study is a non-randomized, multi-center, prospective cohort study. We are planning to enroll 320 adults aged 19 years or older using the following inclusion criteria: (1) patients who provide written and informed consent to participate; and (2) those whose calculated CHA2DS2-VASc score is ≥ 2 . A patch-type device, ATP-C120 will be attached to individuals for 11 days and analyzed for record of new-onset atrial fibrillation. If atrial fibrillation is not detected by the device, participants will be scheduled to visit on the 90th and 180th days for basic clinical assessment.

Results: Two hundred and forty participants have been enrolled in this study. The mean age was 73.3 ± 7.9 , and the average of CHA2DS2-VASc score was 3.7 ± 1.3 . Among the population, 14 participants were diagnosed as paroxysmal atrial fibrillation (5.8%), and one participant presented an episode of atrial flutter (0.4%).

Conclusion: Prolong ECG monitoring has been proven to increase the detection rate of paroxysmal atrial fibrillation, and therefore, we predict a higher diagnostic yield by this new patch-type device. Due to its conveniences, it will become largely used in real-world and it may improve patients' participation and promote overall good health.

SUPPORTING DOCUMENTS



Cost-effectiveness of NOACs Versus Warfarin for Atrial Fibrillation in Patients With Intermediate Stroke Risk

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Objectives: Atrial fibrillation is the most common type of arrhythmia, especially among older people with high prevalence and incidence rates. With the aging of Korean society, the prevalence rate of AF is expected to rise to 5.8 percent by 2060. Newly diagnosed non-valvular AF patients over 18 years of age were extracted from the National Health Insurance Review and Assessment Service database, and the intermediate stroke group was based on the CHA₂DS₂-VASc score. In addition, only patients who received non-vitamin K antagonist oral anticoagulants (NOACs; rivaroxaban, apixaban, dabigatran, edoxaban) and warfarin during the study period were included in the participants group.

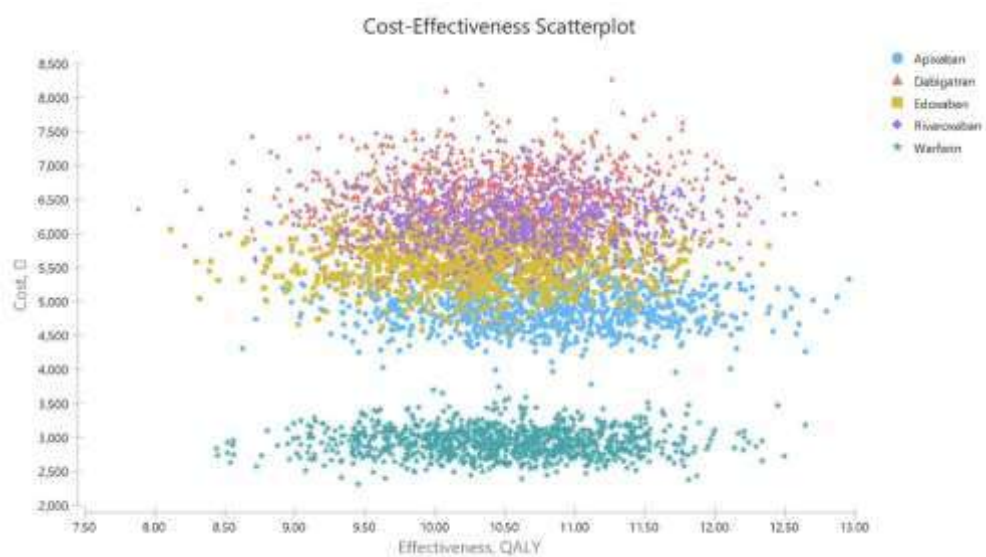
Materials and Methods: The Markov Chain model was used to evaluate the cost-effectiveness, and the transition probability was set to be one-year, and a total of 20 cycles were carried out.

Results: The total cost of warfarin, rivaroxaban, dabigatran, apixaban, edoxaban in non-valvular AF patients was 2,874\$, 6,379\$, 5,761\$, 5,151\$ and 5,851\$, respectively. The gained Quality-adjusted life years were 10.83, 10.95, 10.49, 11.10, and 10.99 years, respectively. The incremental cost-effectiveness ratio of warfarin, rivaroxaban, dabigatran, apixaban, edoxaban is 29,743.99\$, -8483.04\$, 8426.71\$ and 18,483.55\$ each. The result of analysis indicated that rivaroxaban, apixaban were had lower cost than willing to pay 32,000\$. Thus, rivaroxaban, apixaban had cost-effectiveness.

Conclusion:

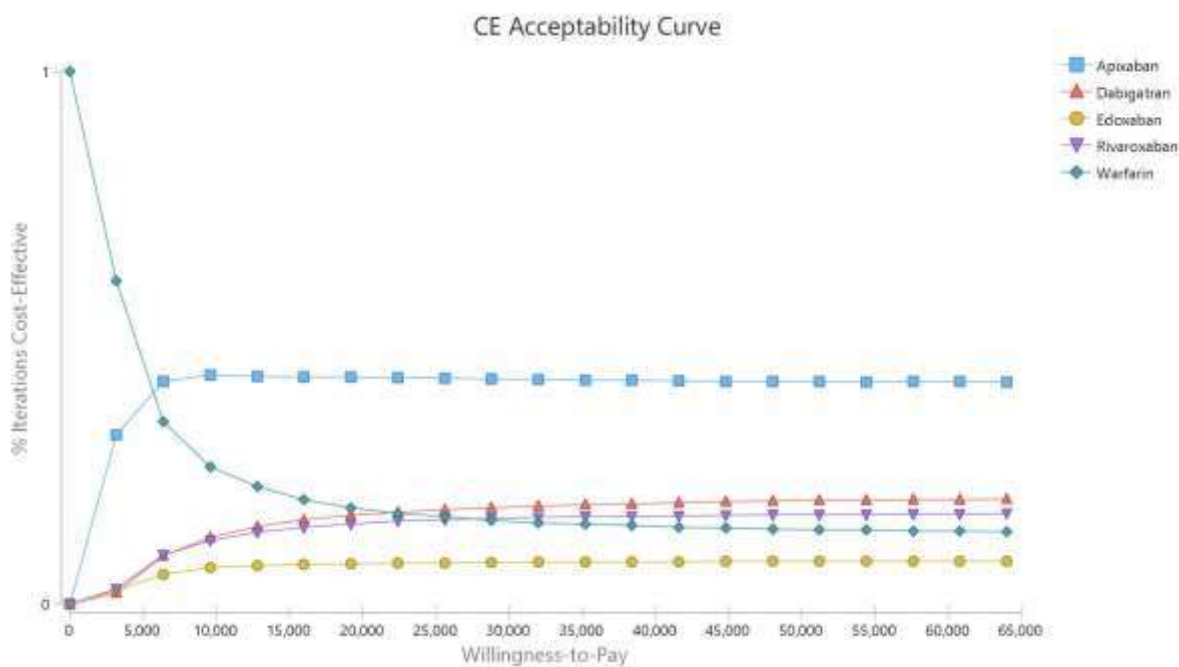
Our findings represented that Apixaban showed the best cost-effectiveness and rivaroxaban was also investigated to be cost-effective than warfarin in the intermediate stroke risk group. The results of this study are expected to be a good basis for making policy decisions.

SUPPORTING DOCUMENTS



Cost-effectiveness scatterplot of Warfarin vs. NOACs for prognosis in AF with intermediate stroke risk group

Abbreviations ICER = incremental cost-effectiveness ratio; NOACs= non-vitamin K antagonist oral anticoagulants; AF= Atrial fibrillation.



Changes in ICER estimates for NOACs compared to warfarin with different time horizon acceptability CE curve

Clinical Characteristics and Efficacy of Cryoballoon Atrial Fibrillation Ablation in Ramathibodi Hospital

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Background: Atrial fibrillation (AF) is the common arrhythmia especially in older and multiple comorbidities patients. Pulmonary vein isolation (PVI) is recommended strategies for rhythm control of AF. The traditional strategy for PVI was radiofrequency ablation however, cryoballoon ablation was novel technology for PVI in Thailand and we have done cryoballoon AF ablation for 4 years.

Objective: The purpose of our study was to describe clinical characteristics and efficacy of cryoballoon AF ablation in Ramathibodi Hospital.

Methods: To describe clinical characteristic and efficacy of cryoballoon ablation in 17 patients with AF underwent PVI with cryoballoon in Ramathibodi between January 2018 to December 2021.

Results: From Jan 2018 to Dec 2021 in Ramathibodi hospital, cryoballoon AF ablation had done for 17 patients, all of these patients were paroxysmal AF, mean age was 59.5 years old, mean LA diameter was 62.1 mm. There were 5 patients (29%) who had recurrent paroxysmal AF and all of these patients were prescribed antiarrhythmic drug to control rhythm.

Conclusion: Cryoballoon technique for AF ablation is feasible and low complication, however most of the patients were paroxysmal AF. The study about the outcome of cryoballoon AF ablation in persistent AF should be further investigated.

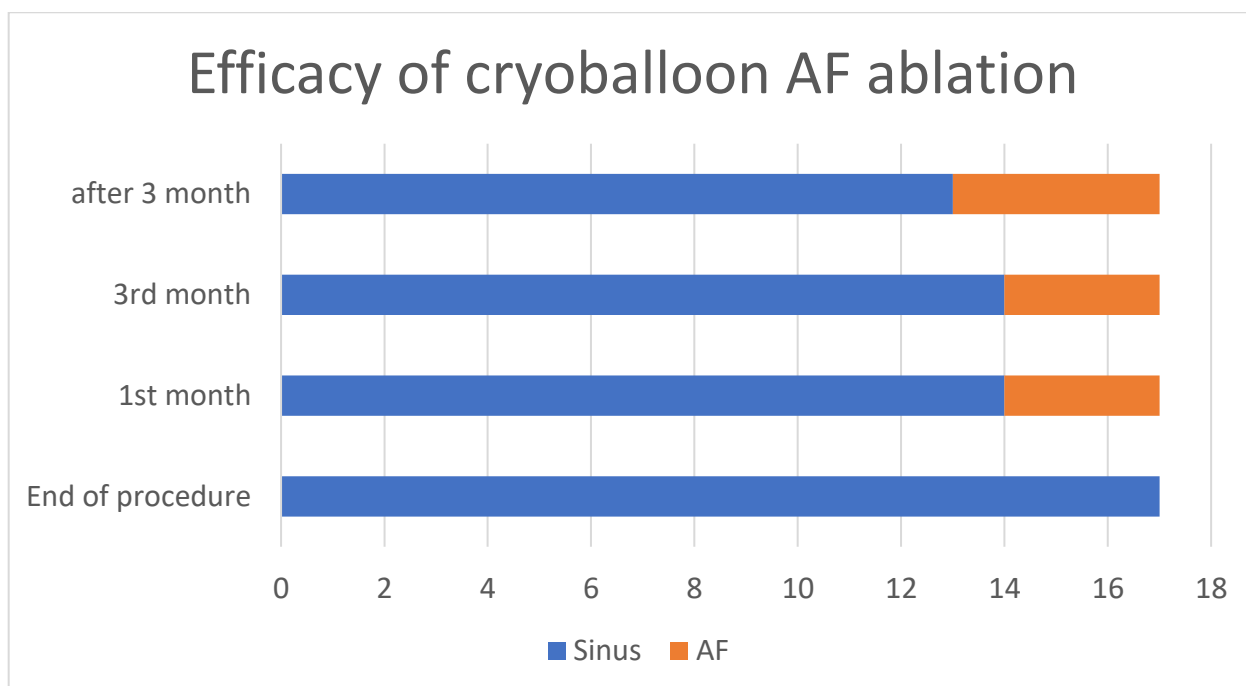
Table 1 Clinical characteristics

Clinical characteristics	All patients (N = 17)
Age-yr (mean $\pm$ SD)	59.6 $\pm$ 2.1
Body weight- kg (mean $\pm$ SD)	70.3 $\pm$ 2.9
LVEF - % (mean $\pm$ SD)	64.0 $\pm$ 2.4
LA diameter- cm (mean $\pm$ SD)	3.6 $\pm$ 0.5
Comorbidities – No. (%)	
CAD	1 (5.9)
Hypertension	5 (29.4)
Diabetes mellitus	2 (11.8)
Dyslipidemia	5 (29.4)
Obstructive sleep apnea	1 (5.9)
Stroke	1 (5.9)
None	7 (41.2)
Antiarrhythmic drug – No.(%)	
Amiodarone	4 (23.6)
Dronedarone	2 (11.8)
Betablocker	11 (64.7)
CCB	1 (5.9)
Flecainide	1 (5.9)
None	2 (11.8)

Table 2 Procedural details

Procedural details	All patients (N=17)
Total procedural time – minutes (mean±SD)	118.2 ± 34.1
Fluoroscopic time – minutes (mean±SD)	27.0 ± 12.0
Contrast volume – ml (mean±SD)	38.2 ± 20
Numbers of PV founded PV potential – No. (%)	
0	1 (5.9)
1	3 (17.6)
2	7 (41.2)
3	6 (35.3)
4	0 (0)
Minimal temperature – °C (mean±SD)	
LSPV	-48.9±7.2
LIPV	-44.7±5.6
RSPV	-51.1±5.8
RIPV	-37.6±16.6
Cardioversion post procedure – No. (%)	5 (29)
Complications	
Groin hematoma	1
Phrenic	0
Stroke	0
Cardiac perforation	0
Atrioesophageal fistula	0
Contrast reaction	0
Death	0
Rhythm at the end of procedure – No. (%)	
Sinus	17 (100)
AF	0 (0)
Rhythm at 1 st mo. Follow up – No. (%)	
Sinus	14 (82.4)
AF	3 (17.6)
Rhythm at 3 rd mo. Follow up – No. (%)	
Sinus	14 (82.4)
AF	3 (17.6)
Rhythm after 3 rd mo. Follow up – No.(%)	
Sinus	13 (76.5)
AF	4 (23.5)

Figure 1 Results



Reduced Time of Redo AF Ablation With PURE EP Recording System: A Randomized Study.

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Objective: To determine the difference in procedural times of redo atrial fibrillation (AF) ablations guided via two different systems for ECG/EGM visualization: the PURE EP system (BioSig Technologies) versus the commercially available CardioLab (GE).

Materials and Methods: Consecutive non-paroxysmal AF patients with post-ablation arrhythmia recurrence were enrolled. Baseline and redo procedures were performed by the same electrophysiologist. At first procedure, all patients had received the same lesion set (pulmonary vein plus posterior wall isolation). At redo procedure, patients were randomly assigned (1:1) to a PURE EP- or CardioLab-guided procedure; only tracings from the system randomly allocated to the procedure were displayed. Procedural time was calculated from first to final EGM recorded.

Results: Twenty patients (mean age: 67+/-11) were randomized to CardioLab (n = 10) and PURE EP (n = 10). Rhythm at presentation was sinus/junctional (36.9%) or AFlu/AF (63.1%). Overall, 6 (30%) patients had at least one reconnected vein, with no differences between groups (p=0.33). Mean ablation time was 14+/-9min with PURE EP and 18+/-10min with CardioLab (p=ns). The mean procedural time in the PURE EP and CardioLab groups were 54.8±25.2min and 66.1±26.2min, respectively.

Given an average EP lab cost is \$37/min in the USA, PURE EP led to a mean procedure time reduction of 11.3 minutes, which corresponds to \$418.10 saved per case compared to a commercially available system.

Conclusion: PURE EP might promote shorter procedural times, resulting in cost savings. Further studies are warranted.

Analysis of 202 Patients With Paroxysmal AF Evaluated for GAP and DC After CBA

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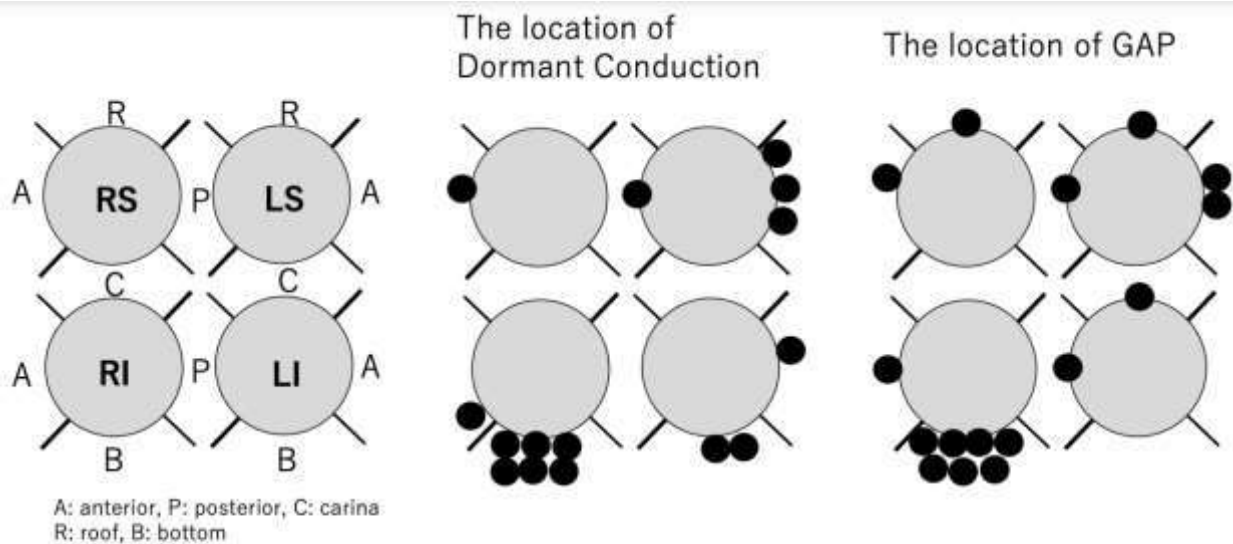
Background: Cryoballoon ablation (CBA) based pulmonary vein isolation (PVI) may improve the procedural outcome. However, the frequency and distribution of electrical conduction gap (GAP) and dormant conduction (DC) after CBA remains unclear. The incidence and distribution of GAP and DC after CBA based PVI and the recurrence rate of atrial fibrillation (AF) were investigated.

Method: 202 patients with paroxysmal AF underwent CBA based PVI with variable ring catheter (Ring) from August 2017 to December 2021. After isolation of each pulmonary vein by CBA, a 20-mg bolus of ATP was administered and the location of GAP and DC in each pulmonary vein using a ring catheter (ring) was analyzed.

Results: The mean age was 61.5 ± 10.7 years, 163 patients (80.6%) were male, their mean CHADS₂ score was 0.9 ± 0.98 . 16 PVs in 14 patients showed GAP and 15 PVs in 14 patients showed DC, so additional touch up ablation was performed. Both GAP and DC were more common at the bottom of the RIPV. There was no significant difference between those with and without GAP or DC regarding the recurrence rate of AF ($p = 0.92$, $p = 0.13$). An average of 2.41 years have passed, 86.6% patients remained in sinus rhythm without AAD.

Conclusions: The location of GAP and DC may have anatomical background. It is important to be aware of the use of guidewires and deflectable sheaths to contact areas where GAP and DC are likely to remain.

SUPPORTING DOCUMENTS



	LSPV	LIPV	RSPV	RIPV	total
Dormant Conduction	4 (1.98%)	3 (1.49%)	1 (0.50%)	7 (3.47%)	15 (7.43%)
GAP	4 (1.98%)	2 (0.99%)	2 (0.99%)	8 (3.96%)	16 (7.92%)

Antithrombotic Management in Atrial Fibrillation Patients With Chronic Coronary Syndrome: a Single-center Cohort Study

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Objectives: The optimal antithrombotic therapy in atrial fibrillation (AF) patients with chronic coronary syndrome (CCS) remains unclear. The aim of this cohort study is to investigate the contemporary antithrombotic strategy and clinical outcomes.

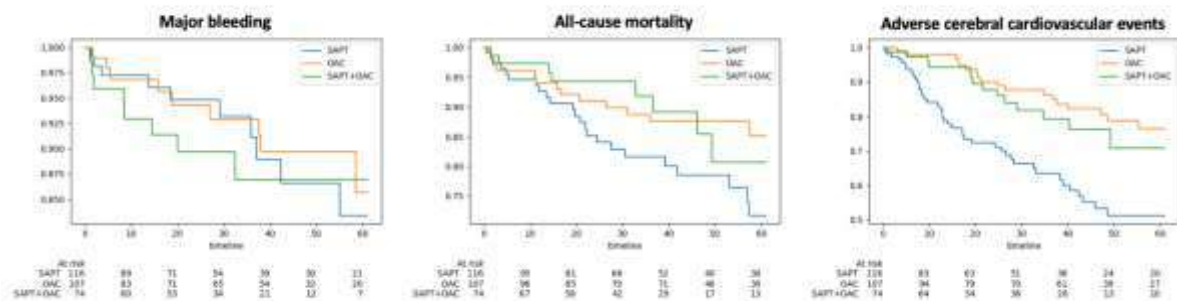
Materials and Methods: Tri-Service General Hospital-Coronary Heart Disease (TSGH-CHD) registry is a single-center, prospective and longitudinal cohort database. Patients with AF who underwent percutaneous coronary intervention or coronary artery bypass grafting more than 1 year or angiographically confirmed coronary artery disease not requiring revascularization were included and analyzed. The study endpoints were major bleeding, all-cause mortality, and adverse cerebral cardiovascular events, including stroke, systemic embolism, non-fatal myocardial infarction (MI), and coronary revascularization.

Results: A total of 297 patients with AF and CCS were included into analysis, of which 116 were treated with a single antiplatelet agent (SAPT), 107 with an oral anticoagulant (OAC) monotherapy, and 74 with a combination of SAPT and OAC. The prevalence of diabetes, previous MI, and end-stage renal disease was significantly higher in patients treated with SAPT compared with other groups. During follow-up, there were no significant differences in the risk of major bleeding and all-cause mortality between 3 groups ($p=0.74$ and 0.11 , respectively). Regarding adverse cerebral cardiovascular events, SAPT group had a significantly higher risk than other 2 groups, while those on OAC monotherapy and those on SAPT plus OAC had no differences ($p=0.40$).

Conclusions: Among AF patients with CCS, OAC-based strategy may be associated with lower risk of adverse cerebral cardiovascular events than SAPT treatment, without increased risk of major bleeding.

SUPPORTING DOCUMENTS

Figure 1 Kaplan-Meier curve of each study endpoints



General Anesthesia Improves Contact Force Variability and Reduces Gap Formation in Pulmonary Vein Isolation

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Background: Compared to conscious sedation (CS), the use of general anesthesia (GA) in pulmonary vein isolation (PVI) is associated with a lower recurrence rate of atrial fibrillation (AF). GA may improve catheter stability and mapping system accuracy compared to CS, but its influence on contact force (CF) parameters during PVI is unclear.

Objectives: The purpose of this study is to evaluate improve catheter stability and PVI success rate by GA.

Methods: This retrospective study included 100 consecutive patients (50 in GA group and 50 in CS group) who underwent initial PVI for paroxysmal or persistent AF using the CARTO system, open-irrigated contact force catheter and the VisiTag™ module. We retrospectively assessed CF parameters, and First-pass PV isolation rate.

Results: First-pass PV isolation was achieved in 48 patients (96%) in the GA group、 but only 37 patients (74%) in the CS group (P = 0.05). Average CF parameters were same in the GA group than in the CS group (average CF: 14.4 ± 14.6 g vs. 14.5± 14.6 g, P=n.s) and CF variability is lower in the GA group than in the CS group (CF variability: 6.85 vs 8.22 P<0.01)

Conclusions: GA improve catheter stability and CF variability, reduced gap formation after ipsilateral PVI.

Comparing Cryoballoon and Radiofrequency Catheter For Persistent Atrial Fibrillation With Performing Posterior Wall Intervention

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Objectives: We aimed to investigate atrial fibrillation (AF) patients who underwent posterior wall ablation in addition to pulmonary vein (PV) isolation.

Materials and Methods: This single center retrospective study included 99 consecutive patients (64.2±8.3 years old, 13 woman) who underwent the posterior wall ablation in addition to PV isolation in their initial AF ablation; box isolation using RF catheter in 64 patients (the RF group) and PV isolation and roof line ablation using cryoballoon in 35 patients (the cryoballoon group). If PV isolation or roof line was not accomplished by cryoballoon, RF applications were added. The baseline characteristic, procedural data and AF recurrence were evaluated.

Results: The RF group included younger population and longer persistent duration (61.6±7.5 vs. 68.8±7.9 years old, $P<0.01$ and 14.5±15.4 vs. 8.5±9.1 months, $P=0.04$). There was no significant difference in comorbidities and examination data such as left atrium parameter and brain natriuretic peptide. Among the cryoballoon group, 17 patients (48.6%) needed additional RF application. The procedure and fluoroscopy time were not different between the RF and cryoballoon group (209.3±73.3 vs. 192.9±66.4 min, $P=0.27$ and 32.5±10.7 vs. 35.1±12.3 min, $P=0.28$). During the follow-up (360±260 days), 14 patients had AF recurrences. Using univariate COX regression analysis, using cryoballoon tended to be the risk for recurrences (hazard ratio 2.7, $P=0.08$).

Conclusion: PV isolation and roof line ablation using cryoballoon catheter have more recurrence comparing to box isolation using RF catheter. The different background data such as age might influence the result. Further research should be performed in the future.

Failure of Internal Cardioversion Before Catheter Ablation of Atrial Fibrillation Predicts Clinical Recurrence

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¹Korean University College of Medicine and Korea University Medical Center, Seoul, Republic of Korea, ²United Christian Hospital, Hong Kong, ³Hasna Medika Cirebon Heart Hospital, Cirebon, Indonesia

Objectives: Radiofrequency catheter ablation is a well-established treatment for atrial fibrillation (AF) 5-9. However, many patients required repeat procedures and late recurrences are not infrequent 10-12. This study sought to investigate whether the success or failure of internal cardioversion before AF ablation is a significant predictor of AF recurrence.

Materials And Methods: This is a single center retrospective cohort study. A total of 94 patients who underwent catheter ablation of AF from 1/2019 to 8/2019 were included. Patients in AF or atrial tachycardia were routinely cardioverted to sinus rhythm before ablation. AF ablation was then performed under atrial pacing. For patients who failed cardioversion (CV) or with immediate recurrence of AF (IRAF), ablation was done under AF. The patients were followed up for any late recurrence of AF which was defined as 8 weeks after ablation. The mean follow-up was 29+/- 12 months.

Results: Among 94 patients who were included in this study, 7 patients failed initial CV (failed CV group), in which 4 patients developed AF recurrence during the follow-up period. In contrast, 87 patients did not require or had successful cardioversion initially (successful CV group), in which 22 patients developed AF recurrence during the follow-up period. Kaplan Meier analysis showed a shorter time to recurrence in patients who failed initial CV (P=0.045, Figure 1.).

Conclusion: Patients who failed initial internal cardioversion had a shorter time to recurrence than those who did not require or had successful cardioversion.

Haplotype Analysis of Phagocytic NADPH Oxidase Polymorphisms in Atrial Fibrillation

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Objectives: Cardiac myocyte nicotinamide adenine dinucleotide phosphate (NADPH) oxidase (NOX) activity within the atrial tissue is an important source of oxidative stress during atrial fibrillation (AF). This study aimed to verify the effect of the polymorphisms of phagocytic NOX on AF and the systemic oxidative stress burden in Korean AF patients.

Materials and Methods: A total of 220 consecutive patients were divided into two groups: 103 non-AF and 117 AF (52 non-paroxysmal AF) groups. We analyzed 25 single nucleotide polymorphisms (SNPs) of 6 subunits of the phagocytic NOX and compared the difference between the groups. To evaluate the in vivo oxidative stress burden between groups, the plasma level of 8-iso-prostaglandin F₂α (8-iso-PGF₂α) was also measured

Results: A difference in the distribution of the haplotypes of p22phox between groups was found in the likelihood ratio tests ($P=0.0380$). The distribution of the C-C-G-G-T and C-T-A-G-T haplotypes differed between the groups. The oxidative stress burden (8-iso-PGF₂α) was higher in the AF group (72.62 ± 46.29 vs. 47.55 ± 38.38 pg/mL, $P=0.00004$). The presence of AF ($\beta=22.6$, $P=0.001$) and the C-C-G-G-T haplotype ($\beta=17.1$, $P=0.049$) were significant determinants of plasma 8-iso-PGF₂α level. AF patients carrying a haplotype C-C-G-G-T showed higher 8-iso-PGF₂α levels than AF patients without haplotype C-C-G-G-T (91.04 ± 57.64 vs. 68.79 ± 42.93 pg/mL, $P=0.05$).

Conclusion: The polymorphism in the gene coding phagocytic NOX subunit p22phox significantly differed between the AF and non-AF groups. The specific haplotype C-C-G-G-T was associated with AF and a more elevated oxidative stress burden in the Korean AF population

SUPPORTING DOCUMENTS

Table 1. 8-iso-PGF2 α Level and Inflammatory Markers

	No AF (n=103)	AF (n=117)	<i>P</i> -value
8-iso-PGF2 α , pg/mL	47.55 $\pm$ 39.38	72.62 $\pm$ 46.29	0.00004
WBC counts, $\times 10^3$ /mL	6.27 $\pm$ 1.80	6.96 $\pm$ 2.05	0.009
Neutrophil counts, $\times 10^3$ /mL	3.52 $\pm$ 1.30	4.21 $\pm$ 2.00	0.003
NLR	1.89 $\pm$ 0.89	2.28 $\pm$ 1.83	0.048
hs-CRP, mg/dL	0.18 $\pm$ 0.30	0.18 $\pm$ 0.29	0.960

WBC, white blood cell; NLR, neutrophil to lymphocyte ratio; hs-CRP, high sensitivity C-reactive protein; 8-iso-PGF2 α , 8-iso-prostaglandin F2 α

Table 2. Factors Associated with 8-iso-PGF2 α

Variable	Univariate		Multivariate	
	$\beta \pm SE$	<i>P</i> -value	$\beta \pm SE$	<i>P</i> -value
Age, yr	-0.166 $\pm$ 0.290	0.567		
AF	25.075 $\pm$ 5.974	< 0.001	22.635 $\pm$ 6.696	0.001
AF duration, month	-0.013 $\pm$ 0.102	0.895		
BMI, kg/m ²	1.590 $\pm$ 0.873	0.070		
Smoking	0.798 $\pm$ 7.543	0.916		
DM	7.283 $\pm$ 8.745	0.406		
CHA ₂ DS ₂ VASc	-3.221 $\pm$ 2.583	0.214		
Hb, g/dL	3.775 $\pm$ 2.039	0.066		
TG, mg/dL	0.079 $\pm$ 0.036	0.031	0.073 $\pm$ 0.037	0.051
hs-CRP, mg/dL	3.244 $\pm$ 10.495	0.758		
NT-proBNP, pg/mL	0.000 $\pm$ 0.005	0.948		
LA AP diameter, mm	1.403 $\pm$ 0.542	0.010		
Haplotype "CCGGT"	18.799 $\pm$ 8.775	0.034	17.123 $\pm$ 8.641	0.049

AF, atrial fibrillation; BMI, body mass index; DM, diabetes mellitus; Hb, hemoglobin; TG, triglyceride; hs-CRP, high sensitivity C-reactive protein; NT-proBNP, N-terminal pro-B-type natriuretic peptide; LA AP, left atrial anteroposterior.

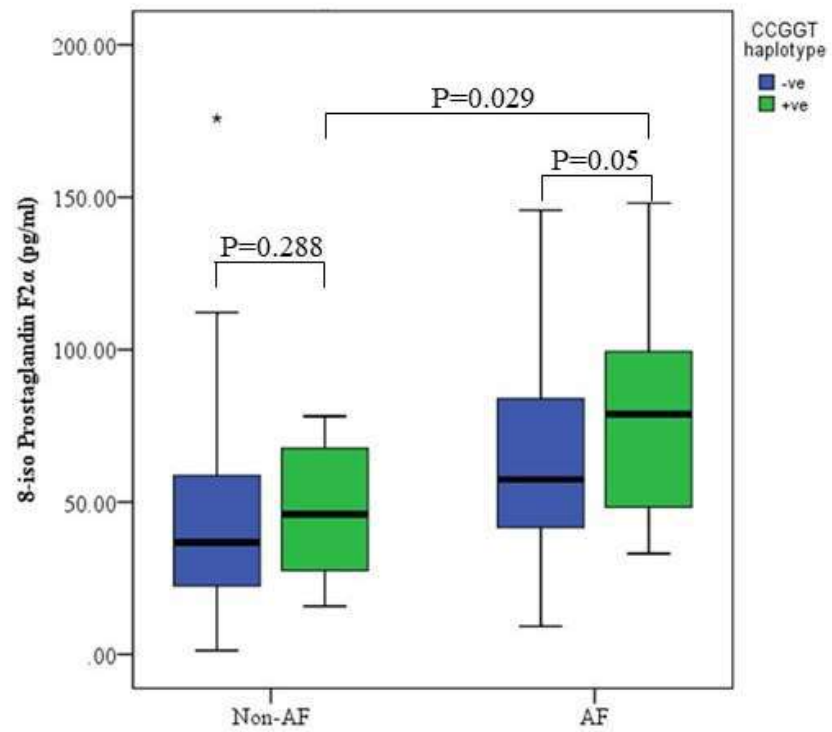


Figure 1. Boxplot depicting the difference of the 8-iso-PGF2α level depending on the presence of a C-C-G-G-T haplotype in the non-AF and AF groups. AF, atrial fibrillation; 8-iso-PGF2α, 8-iso-prostaglandin F2α.

The Role of Soluble ST 2 on the Progression and Therapeutic Effect of Atrial Fibrillation

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Objectives: Soluble ST2 acts as a decoy receptor and is known as a pathophysiological mediator of myocardial fibrosis. Soluble suppression of tumor necrosis factor-2 (sTNF-2) is a strong risk predictor in patients with heart failure (HF) and provides additional prognostic value to NT-proBNP. This study aims to investigate the value of sTNF-2 in Atrial fibrillation (AF) patients.

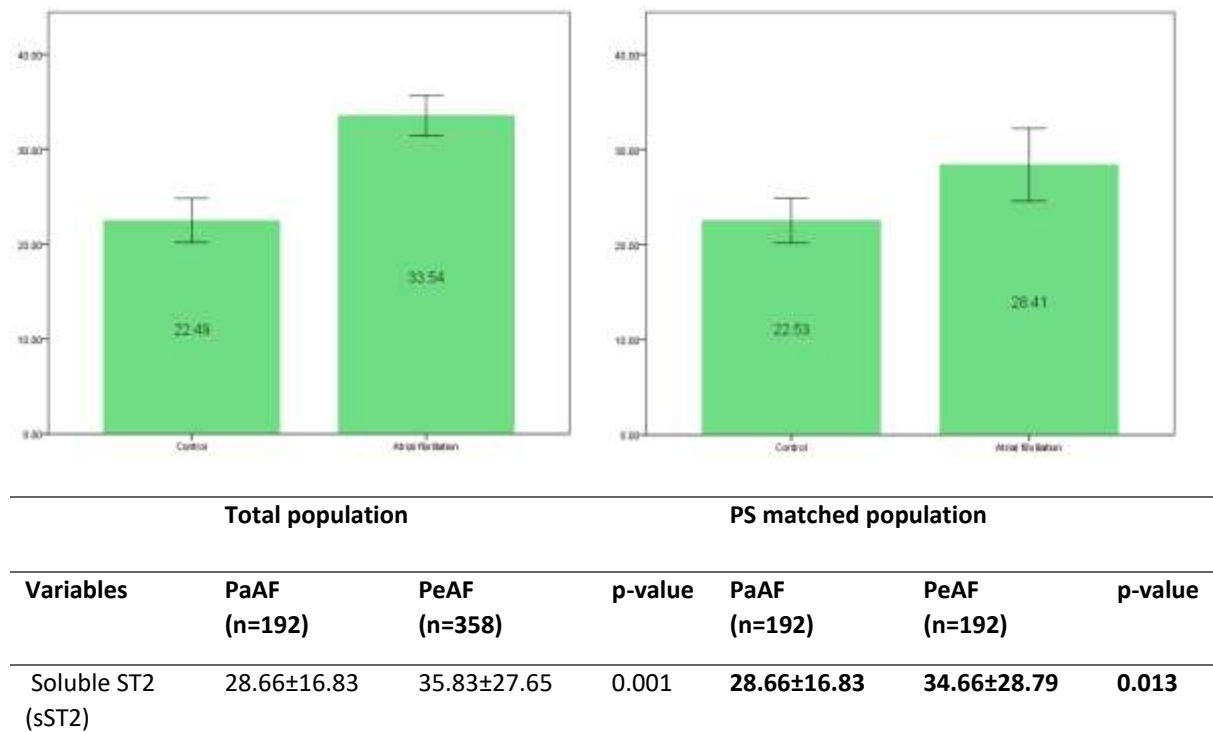
Materials and Methods: A total of 628 consecutive patients were divided into two groups: 551 AF (192 paroxysmal AF and 358 persistent AF, 114 asymptomatic AF and 436 symptomatic AF), and 77 non-AF control groups. The propensity score matching method was used to correct the difference in baseline characteristics between the groups.

Results: The mean sTNF-2 value between the AF group and the control group were $28.41 \pm 16.56 \text{ ng/ml}$ and $22.53 \pm 10.31 \text{ ng/ml}$, respectively ($p=0.010$). The mean sTNF-2 value in patients with persistent AF was higher than in patients with paroxysmal AF ($34.66 \pm 28.79 \text{ ng/ml}$ vs $28.66 \pm 16.83 \text{ ng/ml}$, $p=0.013$). In the symptomatic AF group, the mean sTNF-2 value was higher than in the non-symptomatic AF group, but there was no statistically significant difference ($33.13 \pm 21.27 \text{ ng/ml}$ vs 31.16 ± 22.18 , $p=0.493$). The mean sTNF-2 value of the pre-ablation group was higher than that of the post-ablation group ($48.20 \pm 43.22 \text{ ng/ml}$ vs $24.85 \pm 11.39 \text{ ng/ml}$, $p=0.000$).

Conclusion: Mean sTNF-2 was higher in AF, persistent AF, and symptomatic AF patients and decreased after ablation. sTNF-2 is an effective biomarker that can predict the progression and therapeutic effectiveness of AF.

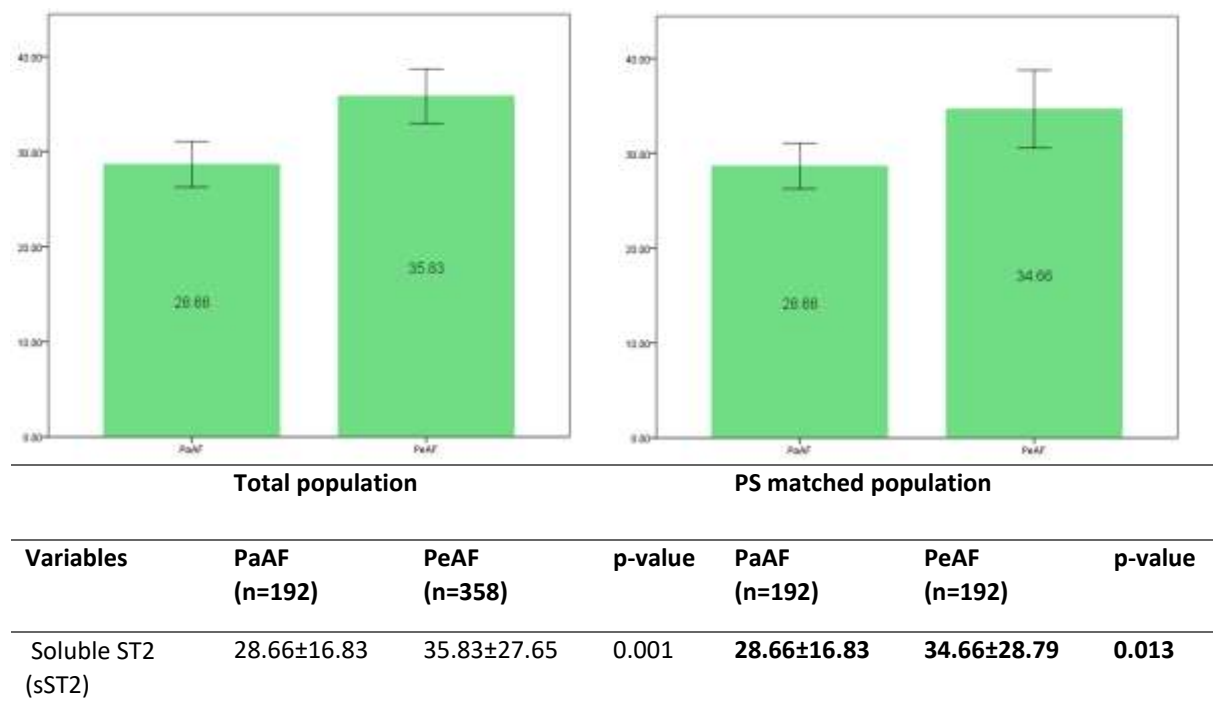
SUPPORTING DOCUMENTS

Figure 1



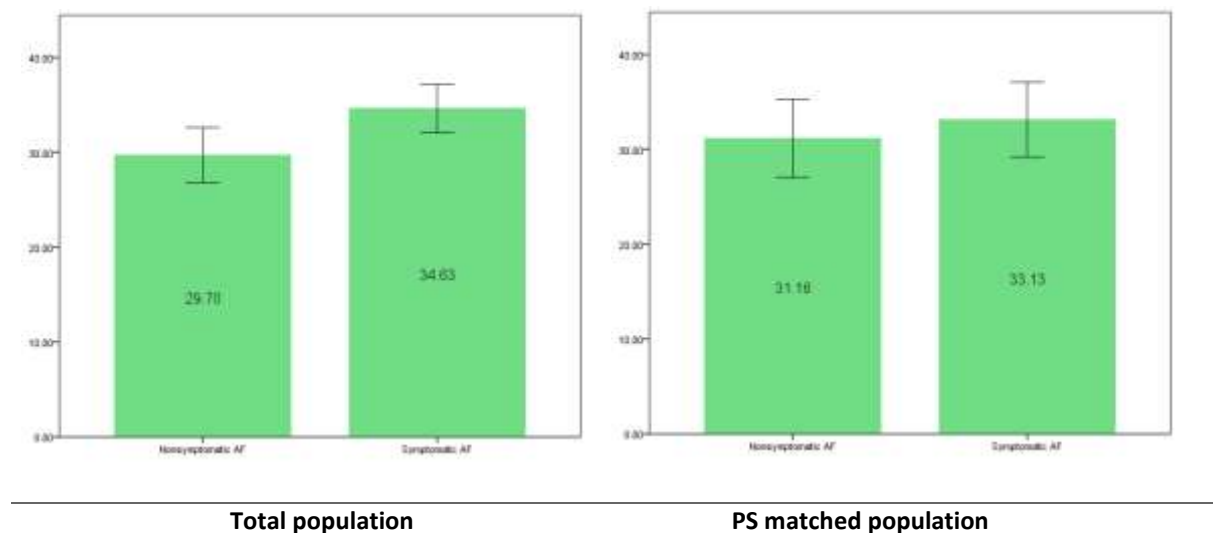
Soluble ST2 level was significantly higher in AF than the control group in the total population, and PS matched population.

Figure 2



The soluble ST2 level was significantly higher in Persistent AF than Paroxysmal AF in the total population, and PS matched population.

Figure 3



Variables	PaAF (n=192)	PeAF (n=358)	p-value	PaAF (n=192)	PeAF (n=192)	p-value
Soluble ST2 (sST2)	28.66±16.83	35.83±27.65	0.001	28.66±16.83	34.66±28.79	0.013

The soluble ST2 level in symptomatic AF was higher, but there was no statistically significant difference

Figure 4

Total population			
Variables	Before RFA (n=96)	After RFA (n=96)	p-value
Soluble ST2 (sST2)	48.20±43.22	24.85±11.39	0.000

The soluble ST2 level decreased significantly after RF ablation.

Omnipolar Electrograms Are More Consistent and Improve Substrate Characterisation in Human Atrial Flutter.

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Objectives: To investigate the difference between peak-to-peak voltage of omnipolar and bipolar electrograms in atrial flutter(AFL).

Materials and Methods: This study has been approved by an ethical committee. We recruited 18 patients with typical AFL. 10 second segments were recorded in areas of the Right Atrium using the HD Grid catheter and Precision. Beat-to-beat correlation curves were calculated as a surrogate for catheter stability (Fig. 1A) and only highly stable (Pearson's $r > 0.7$) segments were analysed. Omnipolar (OPV) and the maximum (maxBPV) voltage on the vertical (Along -AL) or horizontal (Across -AC) bipolar pairs were compared (Fig.1B).

Results: OPV mean was 0.25mV higher than the maxBPV mean and 0.69mV higher than the overall BPV mean($P < 0.001$). This difference was observed along all segments (Fig.2C).

OPV highly correlated (mean Pearson's r : 0.98) with maxBPV for each bipolar pair and was always higher (OPV: 2.41 ± 2.88 mV vs maxBPV: 2.16 ± 2.55 mV, $P < 0.001$)(Fig.2B). OPV was more consistent on a beat to beat basis than either AL or AC BPV individually (Coefficient of Variation: OTV 0.34 ± 0.2 vs AC 0.58 ± 0.57 and AL 0.43 ± 0.24 , $P < 0.001$)(Fig.2A).

Conclusion: The ability of Omnipolar electrograms to record maximum voltage irrespective of current direction increases the sensitivity of detecting healthy tissue. Higher beat by beat consistency increases confidence in the fidelity of the maps created. Omnipolar mapping has the potential to improve detection of scar border zones which may serve as isthmuses for arrhythmia maintenance and therefore improve ablation outcomes.

SUPPORTING DOCUMENTS

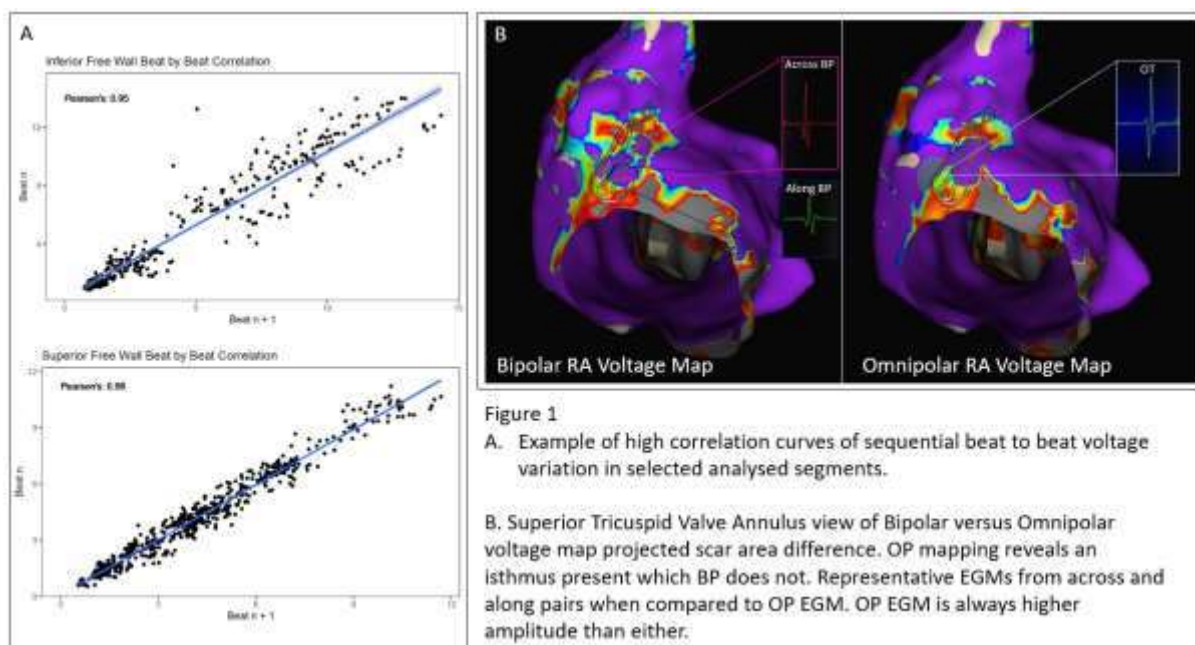


Figure 1

A. Example of high correlation curves of sequential beat to beat voltage variation in selected analysed segments.

B. Superior Tricuspid Valve Annulus view of Bipolar versus Omnipolar voltage map projected scar area difference. OP mapping reveals an isthmus present which BP does not. Representative EGMs from across and along pairs when compared to OP EGM. OP EGM is always higher amplitude than either.

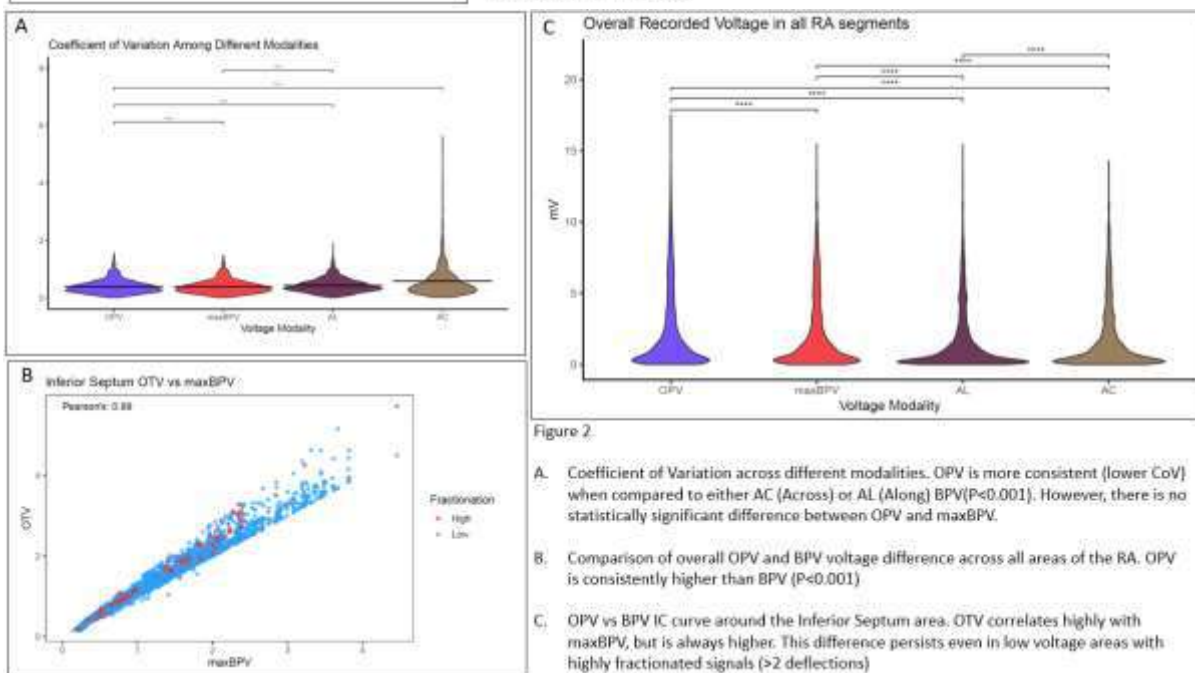


Figure 2

A. Coefficient of Variation across different modalities. OPV is more consistent (lower CoV) when compared to either AC (Across) or AL (Along) BPV ($P < 0.001$). However, there is no statistically significant difference between OPV and maxBPV.

B. Comparison of overall OPV and BPV voltage difference across all areas of the RA. OPV is consistently higher than BPV ($P < 0.001$).

C. OPV vs BPV IC curve around the Inferior Septum area. OTV correlates highly with maxBPV, but is always higher. This difference persists even in low voltage areas with highly fractionated signals (> 2 deflections).

Role of Low Voltage Region Ablation in the Treatment of Persistent Atrial Fibrillation.

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¹Imperial College London Healthcare NHS Trust, London, United Kingdom, ²Imperial College London, London, UK, ³Abbott Inc., St Paul, USA

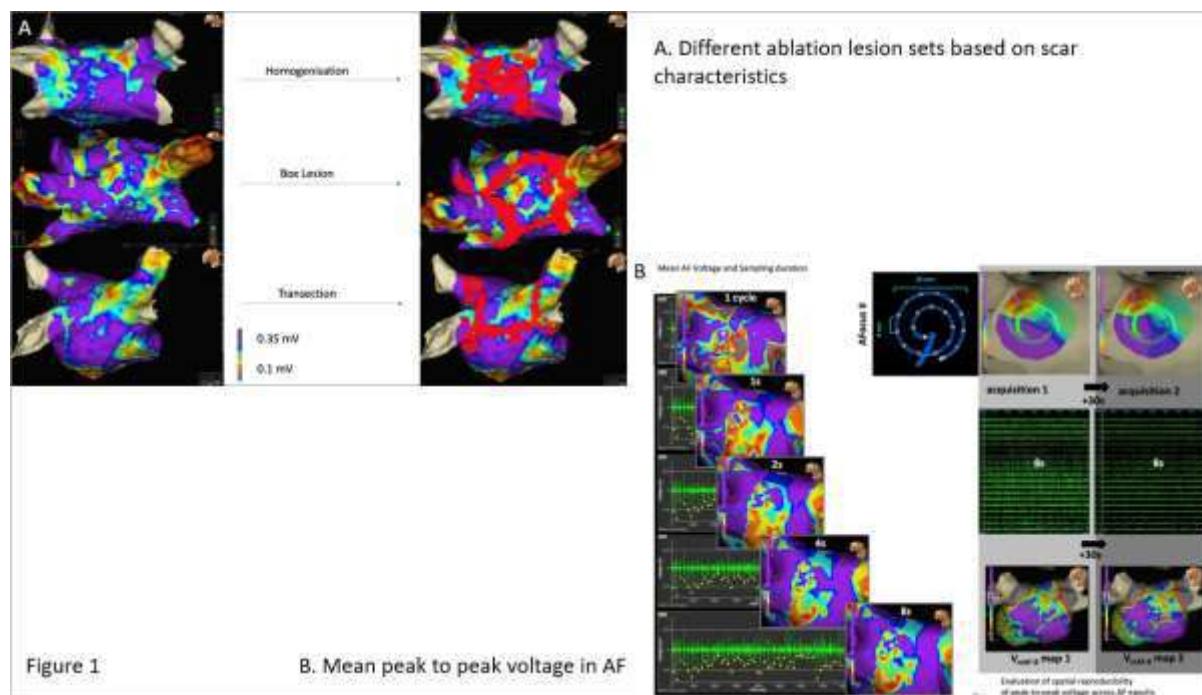
Objective: To evaluate the clinical efficacy of additional ablation of low voltage regions, mapped in AF, in conjunction with Pulmonary Vein Isolation (PVI).

Materials and Methods: This study has been approved by an ethics committee. We compared the effectiveness of additional radiofrequency ablation of low voltage regions in AF (<0.35mV) to PVI.

Results: We have complete follow up in 22 patients (median: 24m, IQR: 9m). All patients are at least 12 months after their procedure. 15 patients remain in SR (68%) with 7 recurrences when compared to 59% of a historical control (P = 0.63) (Fig. 2). 12 patients remain in SR off antiarrhythmics (54.5%).

Conclusion: Ablation of low voltage areas in addition to PVI appears to offer an incremental benefit for the PsAF population. Although not statistically significant there is a trend of curve separation. Further randomised studies are needed to better assess this effect.

SUPPORTING DOCUMENTS



22 PsAF patients undergoing PVI were recruited. Voltage maps were created using 8s segments of AF with the AFOCUSII catheter and Precision(Fig. 1B). Standard PVI was performed in all patients, followed by scar-based ablation in the form of scar homogenisation, transection or “boxing” of the low voltage areas (Fig. 1A), anchoring to points of non-conductive tissue.

Patients were followed up with a clinic review in 3 and 12 and Holter in 3, 6 and 12 months. We defined as recurrence, any atrial arrhythmia lasting more than 30 seconds, after a blanking period of 3 months. Results were compared to a contemporary historical control.

ABLOVO vs Historic Control

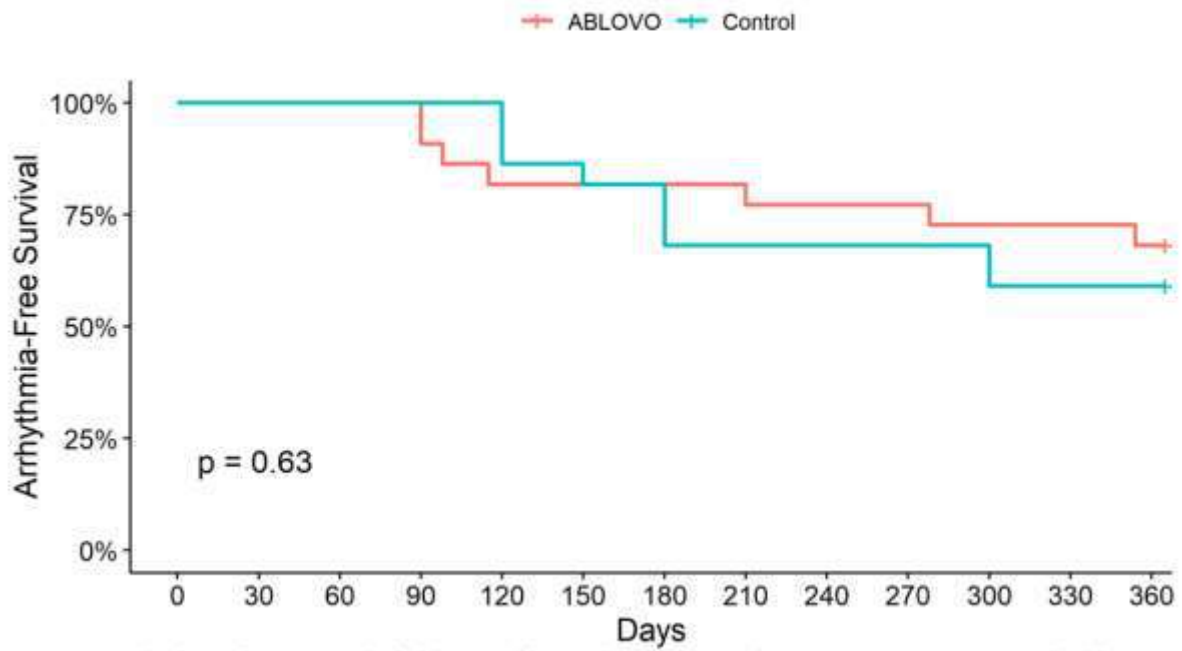


Figure 2: Arrhythmia free survival of ablation of low voltage (ABLOVO) group versus an age-matched historic control group

Resting Heart Rate and Cardiovascular Outcomes in Patients With Atrial Fibrillation: CODE-AF Registry

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¹*Yonsei University, College Of Medicine, Seoul, South Korea*, ²*Ewha Womans University, School of Medicine, Seoul, South Korea*, ³*Hanyang University Seoul Hospital, Seoul, South Korea*, ⁴*Eulji University Hospital, Seoul, South Korea*, ⁵*Korea University Medical Center, Seoul, South Korea*, ⁶*Kyung Hee University School of Medicine, Seoul, South Korea*, ⁷*Ulsan University School of Medicine, Seoul, South Korea*, ⁸*Seoul National University Hospital, Seoul, South Korea*, ⁹*Chonnam National University Medical School, Chonnam, South Korea*, ¹⁰*Catholic University of Daegu School of Medicine, Daegu, South Korea*

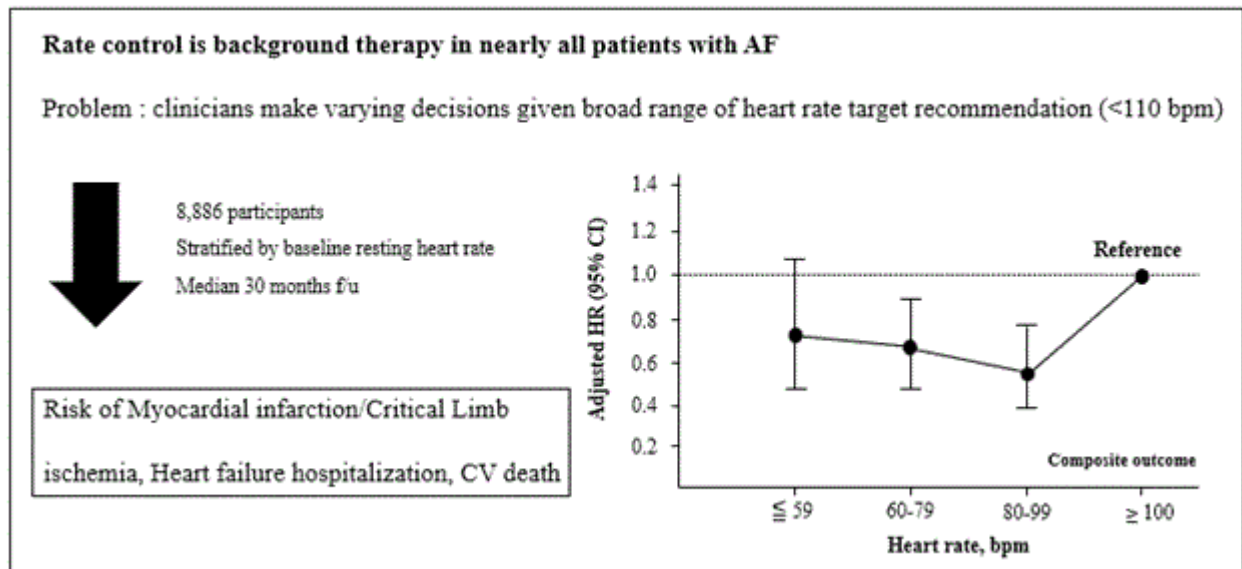
Objective: The prognostic significance of resting heart rate and its therapeutic target in atrial fibrillation (AF) is uncertain. We sought to investigate the relationship between resting heart rate and cardiovascular outcomes in patients with AF.

Methods: A total of 8,886 patients with AF was included from the Comparison study of Drugs for symptom control and complication prEvention of AF (CODE-AF) registry. Patients were categorized according to baseline heart rate, and cardiovascular outcomes were accessed during a median follow-up of 30 months. The primary outcome was a composite of cardiovascular death, hospitalization due to heart failure, and myocardial infarction/critical limb ischemia.

Results: Compared to heart rate ≥ 100 beats per minute (bpm), heart rate 80-99 bpm was associated with the lowest risk of primary outcome (adjusted hazard ratio [HR] 0.56, 95% confidence interval [CI] 0.40-0.79, $p=0.001$). In subgroup of patients with heart failure with preserved ejection fraction (HFpEF), heart rate between 80-99 bpm was associated with reduced risk of primary outcome compared to heart rate ≥ 100 bpm (HR 0.40, 95% CI 0.16-0.98, $p=0.045$). However, in patients with heart failure with reduced ejection fraction (HFrEF), there was no association between resting heart rate and cardiovascular outcomes (P for interaction 0.001).

Conclusion: Resting heart rate was associated with cardiovascular outcomes in patients with AF, and those with resting heart rate between 80-99 bpm had the lowest risk of adverse events. The impact of resting heart rate on adverse events persisted in patients with concomitant HFpEF but was not apparent in those with concomitant HFrEF.

SUPPORTING DOCUMENTS



Oral Anticoagulation Therapy in Atrial Fibrillation Patients With Advanced Chronic Kidney Disease: CODE-AF Registry

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Objectives: Advanced chronic kidney disease (CKD), including end-stage renal disease (ESRD) on dialysis, increases thromboembolic risk among patients with atrial fibrillation (AF). This study examined the comparative safety and efficacy of direct-acting oral anticoagulant (DOAC) compared to warfarin or no OAC among AF patients with advanced CKD or ESRD on dialysis.

Methods: Using data from the COmparison study of Drugs for symptom control and complication prEvention of AF (CODE-AF) registry, 260 non-valvular AF patients with advanced CKD (defined as estimated glomerular filtration rate [eGFR] <30ml/min per 1.73/m²) or ESRD on dialysis were enrolled from June 2016 to July 2020. The study population was categorized into DOAC, warfarin, and no OAC group, and differences in major or clinically relevant non-major (CRNM) bleeding, stroke/systemic embolism (SE), myocardial infarction/critical limb ischemia (CLI), and death were assessed.

Results: During a median 24 months of follow-up, major or CRNM bleeding risk was significantly reduced in the DOAC group compared to the warfarin group (hazard ratio [HR] 0.21, 95% confidence interval [CI] 0.05 to 0.95, p=0.042). In addition, the risk of composite adverse clinical outcome (major or CRNM bleeding, stroke/SE, myocardial infarction/CLI, and death) was significantly reduced in the DOAC group compared to the no OAC group (HR 0.32, 95% CI 0.11 to 0.96, p=0.043).

Conclusion: Among AF patients with advanced CKD or ESRD on dialysis, DOAC was associated with a lower risk of major or CRNM bleeding compared to warfarin and a lower risk of composite adverse clinical outcome compared to no OAC.

Cardiac Autonomic Modulation and Genetic Contribution to Improve Pacemaker Implantation After Atrial Fibrillation Catheter Ablation

Dr Je-wook Park¹, PhD Myunghee Hong², Dr. Daehoon Kim¹, Dr. Hee Tae Yu¹, Dr. Tae-Hoon Kim¹, Dr. Jae-Sun Uhm¹, Dr. Boyoung Joung¹, Dr. Moon-Hyoung Lee¹, Dr. Hui-Nam Pak¹

¹*Yonsei University College Of Medicine, Seoul, South Korea*, ²*Department of Biomedical Informatics, CHA University School of Medicine, CHA University, Seongnam, South Korea*

Introduction: The role of the cardiac neural modulation and genetic contribution for a permanent pacemaker (PPM) implantation after AFCA is not well investigated in AF patients.

Methods: Among 4,257 patients with first AFCA and without previous the PPM, 362 patients had SND prior to the AFCA. After excluding patients with extra-pulmonary vein (PV) left atrial (LA) ablation and the PPM implantation within 3-month AFCA, 22 patients underwent the PPM after 3-months AFCA (PPM3moAFCA) among 250 patients (age 65 [58,72], male 56.8%, paroxysmal AF 84.4%).

Results: The patients with increasing mean heart rate (MHR) after 3-month AFCA showed lower risk for the PPM3moAFCA (adjusted HR 0.97 for increasing 1% of MHR, 95% confidence interval [CI]: 0.94-1.00, p=0.042). Among 44 SNPs, which was related to SND and AF, in this group, the rs3922844, rs9851724, and rs7633988 in SCN5A, rs17042171 and rs220733 in PTX2, and rs9320841 in CJA1 were associated with the PPM3moAFCA. The higher polygenic risk score (PRS), which consisted of rs3922844, rs9851724, rs220733, and rs9320841, were associated with higher risk for the PPM3moAFCA (adjusted HR 2.89, 95% CI [1.81-4.62], p<0.001). The additional superior venal cava to right atrial septal (SVC-L) ablation after PV isolation (PVI) showed trends in an increasing of MHR after 3-month AFCA compared to the PVI alone (adjusted OR 2.37, 95% CI: 0.19-1.55, p=0.012).

Conclusions: In AF patients with SND, cardiac autonomic neural modulation by AFCA combined with SVC-L ablation delayed PPM implantation after the AFCA. Also, specific genetic feature contributed to PPM implantation after the AFCA.

Meta-analysis Comparing NOACs Versus VKA Anticoagulant in Patients After TAVR Complicated with Atrial Fibrillation

Ms Lu Wang¹, Prof Yaodong Li¹

¹*The First Affiliated Hospital Of Xinjiang Medical University, China*

Objective: This study aimed to compare the efficacy of the new oral anticoagulants (NOACs) with the traditional anticoagulant vitamin K antagonist (VKA) in patients after transcatheter aortic valve replacement (TAVR) complicated with atrial fibrillation.

Materials and Methods: PubMed, EMBASE, Medline, the Cochrane Library were searched systematically to identify studies and the scope was included from the establishment of the database to August 2022. Controlled studies which compare the use of NOACs and VKA in AF patients with oral anticoagulation indication after TAVR were collected. The risk ratio (RR) or odds ratio (OR) and 95% confidence interval (CI) were calculated from the comprehensive end point of related clinical adverse events, all-cause mortality, stroke and major bleeding. Review Manager 5.3 software was used for meta-analysis.

Results: Thirteen studies with 29,778 patients after TAVR complicated with atrial fibrillation were included. There was no significant difference in stroke between the NOACs group and the VKA group, but the comprehensive end point in the NOACs group (6.10% vs 6.07%, RR 0.97, 95%CI [0.81, 1.17], $P = 0.002$, $I^2 = 65\%$), the incidence of major bleeding (10.84% vs 13.67%, RR 0.86, 95%CI [0.70, 1.07], $P = 0.001$, $I^2 = 66\%$) and mortality (14.35% vs 17.86%, RR 0.83, 95%CI [0.78, 0.87], $P < 0.00001$, $I^2 = 83\%$) were lower than those in VKA group (Fig. 1).

Conclusion: In AF patients with oral anticoagulant indications after TAVR, NOACs did not significantly reduce the incidence of stroke, but had lower mortality and major bleeding rates than VKA, suggesting that NOACs had a better therapeutic effect.

SUPPORTING DOCUMENTS

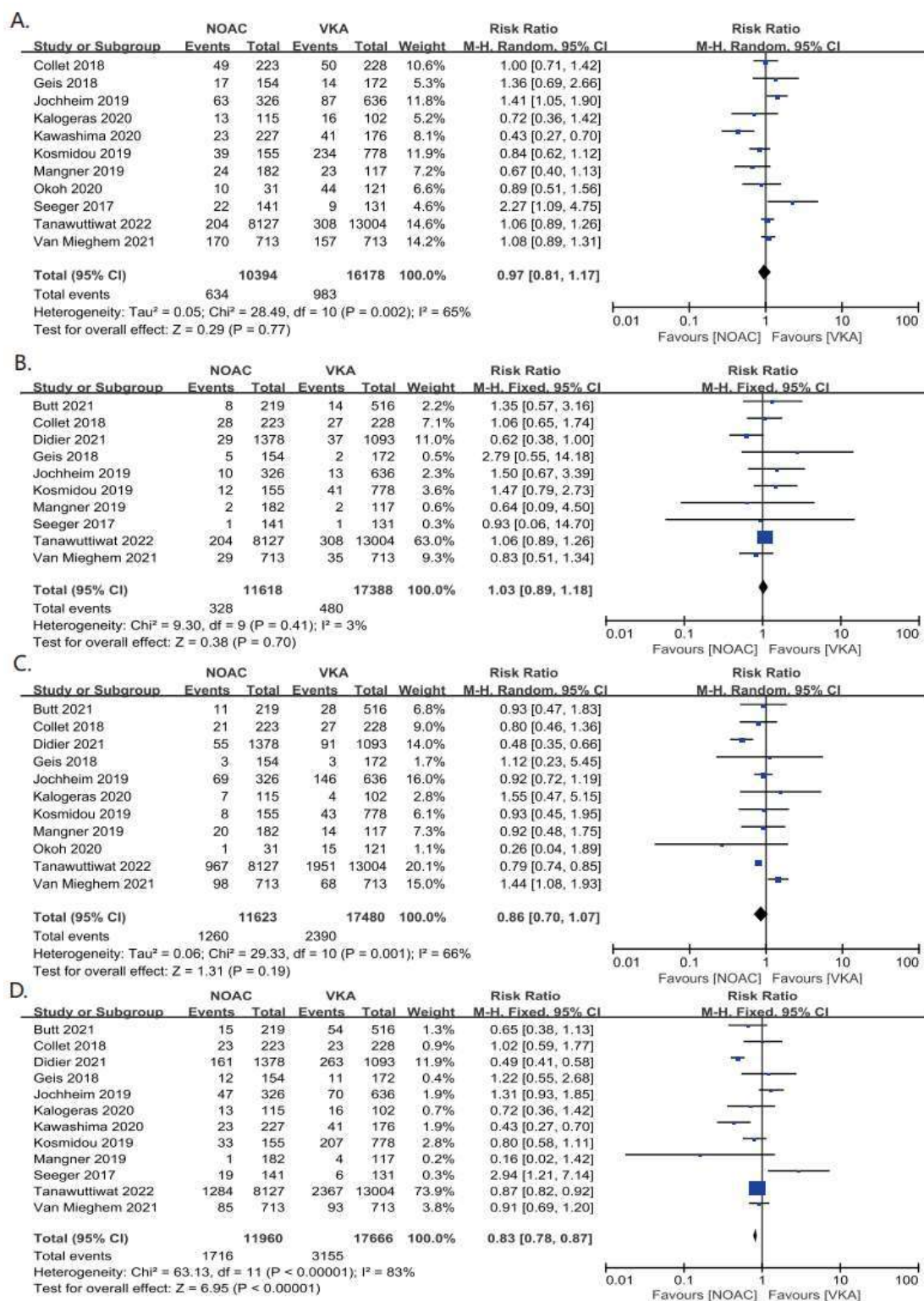


Fig.1. Forest plot. A. comprehensive end point, B. Stroke, C. Major bleeding, D. Mortality.

Association of obesity with incident atrial fibrillation in Korea and the United Kingdom

Dr Sung Hwa Choi¹, Dr Pil-Sung Yang², Asst Prof Daehoon Kim¹, Dr Jung-Hoon Sung², MS Eunsun Jang¹, Asst Prof Hee Tae Yu¹, Asst Prof Tae-Hoon Kim¹, Prof Hui-Nam Pak¹, Prof Moon-Hyoung Lee¹, Dr Gregory Y.H Lip³, Prof Boyoung Joung¹

¹*Yonsei University Health System, Seoul, South Korea*, ²*CHA Bundang Medical Center, Bundang, South Korea*, ³*University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool, United Kingdom*

Objective: Obesity has been linked to atrial fibrillation (AF) burden and severity, and epidemiological studies suggest that AF is more prevalent in whites than Asian or Afro-Caribbean populations. We aimed to investigate whether obesity mediates associations with AF in Europe and Asia using patient-level data comparisons of two cohort studies.

Methods and Methods: Using Korean National Health Insurance Service's Health Screening (NHIS-Heals) and U.K. Biobank data, we included 401,206 Korean and 477,926 British aged 40–70 years without previous AF who received check-ups. The incidence and risk of AF were evaluated regarding different body mass index (BMI) values.

Results: The obese proportion (BMI ≥ 30.0 kg/m², 2.8% vs. 24.3%, $P < 0.001$) was higher in the U.K. than the Korean. In the Korean and U.K. cohort, the age- and sex-adjusted incidence rates of AF were 3.52 and 3.95 per 1,000 person-years among overweight individuals (BMI, 25 to <30 kg/m²), and 4.97 and 6.54 per 1,000 person-years among obese individuals, respectively. Compared to Koreans, the risk of AF was higher in the British population, with adjusted hazard ratios of 1.16 (95% CI, 1.11–1.22) and 1.11 (95% confidence interval [CI], 1.04–1.19) in overweight participants and 1.69 (95% CI, 1.57–1.83) and 1.45 (95% CI, 1.30–1.62) in obese participants, respectively (P for interaction < 0.05).

Conclusions: Obesity was associated with AF in both populations. British subjects had a greater incidence of AF related to the high proportion of obese individuals, but the risk of AF was also increased when separating participants into overweight and obese categories.

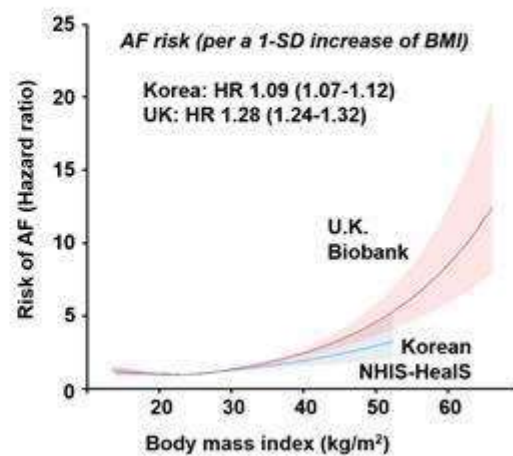
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CENTRAL ILLUSTRATION Incidence and risk of AF according to BMI in Korea and UK

	Underweight	Normal	Overweight	Obese
Proportion (%)				
Korea	1.8%	63.2%	32.2%	2.8%
U.K.	0.5%	32.8%	42.4%	24.3%
AF incidence* (/1,000 PYRs)				
Korea	3.10	2.77	3.52	4.97
U.K.	4.22	3.35	3.95	6.54
AF risk† (Hazard ratio)				
Korea	1.12	1 (ref)	1.16	1.45
U.K.	0.77	1 (ref)	1.11	1.69

* Age- and sex- adjusted

† Adjusted for clinical variables



Clinical characteristics and mechanisms of very late recurrence of atrial fibrillation 5-years after catheter ablation

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¹*Yonsei University Health System, Seoul, South Korea*

Background: Atrial fibrillation (AF) is a chronic progressive disease that recurs continuously even after successful AF catheter ablation (AFCA).

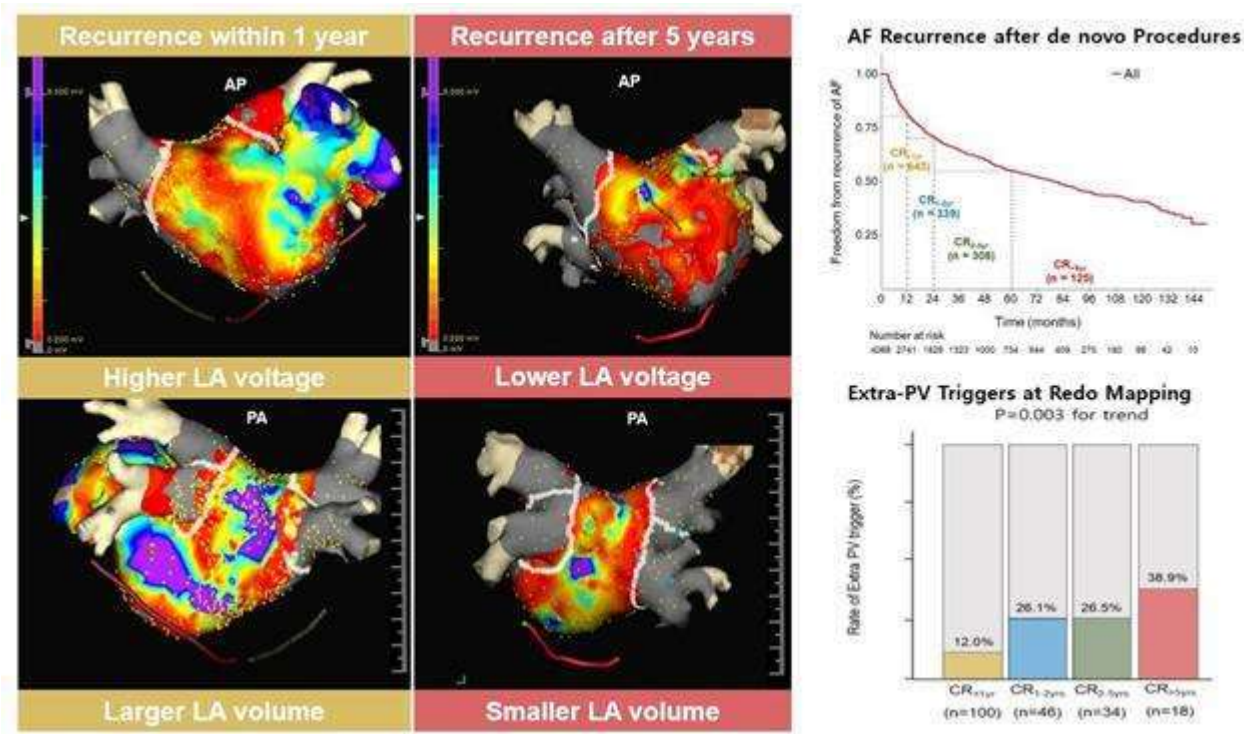
Objective: We explored the mechanism of this long-term recurrence by comparing the patient characteristics and redo-ablation findings.

Methods: Among 4,248 patients who underwent a de novo AFCA and protocol-based rhythm follow-up at single centers, we enrolled 1,417 patients (71.7% male, age 60.0 [52.0–67.0] years, 57.9% paroxysmal AF) who experienced clinical recurrences (CRs) of the disease, and divided them according to the period of recurrence: within one year (n=645), 1–2 years (n=339), 2–5 years (n=308), and after 5-years (CR>5yr, n=125). We also compared the redo-mapping and ablation outcomes in 198 patients.

Results: In patients with a CR>5yr, the proportion of paroxysmal AF was higher (p=0.014); however, the left atrial (LA) volume (computed tomography, p=0.003), LA voltage (p=0.003), frequency of early recurrence (p<0.001), and use of anti-arrhythmic drugs (p<0.001) were lower. A CR>5yr was independently associated with the low LA volume (odds ratio [OR] 0.99 [0.99–1.00], p=0.019), low LA voltage (OR 0.62 [0.41–0.95], p=0.030), and lower early recurrence (OR 0.39 [0.23–0.64], p<0.001). Extra-pulmonary vein (PV) triggers (P for trend 0.003) during repeat procedures were significantly greater in patients with a CR>5yr, despite no difference in the de novo protocol. The rhythm outcome of repeat ablation procedures did not differ with the timing of the CR (log-rank p=0.330).

Conclusions: Patients with a later CR showed a smaller LA volume, lower LA voltage, and higher extra-PV triggers during the repeat procedure, suggesting progression of AF.

SUPPORTING DOCUMENTS



Impact on Marshall vein of pulmonary vein isolation using cryoballoon ablation

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Objective: The effect of pulmonary vein isolation using cryoballoon on the Marshall vein is unknown.

Materials and Methods: A case report of a 74-year-old man who underwent pulmonary vein isolation using a cryoballoon for paroxysmal atrial fibrillation. A 2-F 8-pole electrode catheter was placed in the Marshall vein using a SL0 and 5-F multipurpose catheter to confirm the effect of cryo application to the left pulmonary vein on the potential of the Marshall vein preceding pulmonary vein isolation.

Pulmonary vein isolation was performed starting from the left pulmonary vein, sequentially cryo applying and isolating the left superior pulmonary vein and the left inferior pulmonary vein.

Result: Marshall vein potential could not be identified during or after isolation of the left superior pulmonary vein, but during isolation of the left inferior pulmonary vein, an isolated potential that appeared to be Marshall vein potential appeared at 110 seconds (-40°C) after the start of cryo application, delayed from the atrial potential. The potential was further delayed by continued application and disappeared at 220 s after the start of application (minimum temperature -46°C).

Conclusion: It is suggested that cryoballoon ablation to the left pulmonary vein created a conduction block in part of the Marshall vein tract, which is a potential additional benefit to atrial fibrillation ablation with cryoballoon.

SUPPORTING DOCUMENTS



Prolonged Sinus Pause on Termination of Atrial Fibrillation After Catheter Ablation: a Reversible Phenomenon

Dr Yi Guo¹, Dr Hongwu Chen¹, Dr Weizhu Ju¹, Dr Gang Yang¹, Dr Kai Gu¹, Dr Zidun Wang¹, Dr Hailei Liu¹, Dr Jiaojiao Shi¹, Dr Mingfang Li¹, Dr Minglong Chen¹

¹*Division Of Cardiology, The First Affiliated Hospital Of Nanjing Medical University, Nanjing, 中国*

Objectives: We studied the time-related features of prolonged sinus pause (PSP) on termination of atrial fibrillation (AF) and the necessity of pacemaker implantation (PMI) in patients with this phenomenon post radiofrequency catheter ablation (RFCA) for AF in the blanking period and the one-year follow-up duration.

Materials and Methods: This prospective observational study included consecutive patients with PSP ≥ 3 seconds on termination of AF during hospitalization after RFCA for AF at our center between October 2020 and June 2022. After ablation, 24-hour Holter monitoring was performed at 1 and 3 months, and 7-day Holter monitoring was performed at 6 and 12 months after RFCA in all patients.

Results: Eleven patients (mean age 63.2 ± 2.0 years, 6 female, and 9 paroxysmal AF) were included. PSP ≥ 3 seconds on termination of AF initiated on 2.0 (IQR: 1.0-4.0) days and the longest PSP appeared on 3.0 (IQR: 1.0-5.0) days after ablation. PSP ≥ 3 seconds vanished on 6.5 (IQR: 3.8-8.3) days after ablation. One patient received permanent PMI during hospitalization. Two patients had temporary pacemaker implanted and removed before discharge, and no further PMI was needed. One patient was rehospitalized for permanent PMI in the blanking period, and an additional 1 patient had a single episode of PSP of 3 seconds on termination of AF during the one-year follow-up.

Conclusion: PSP ≥ 3 seconds on termination of AF after RFCA could be reversible. This condition could be treated with cessation of anti-arrhythmic drugs or bridging with temporary PMI. Permanent PMI may be necessary in some circumstances.

Real-world Clinical Outcomes of Oral Anticoagulants Among Japanese Atrial Fibrillation Patients With Coronary Artery Disease

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Objectives: Stroke prevention is complicated in patients with atrial fibrillation (AF) and coronary artery disease (CAD). We compared the risk of major bleeding among Japanese AF patients with CAD commencing warfarin, dabigatran or rivaroxaban.

Materials and Methods: This study included AF adults with CAD who were newly prescribed dabigatran, rivaroxaban (non-vitamin K antagonist oral anticoagulants [NOACs]) or warfarin, registered between 18 April 2011 through 31 December 2020 in the Medical Data Vision hospital-based clinical database (ClinicalTrials.gov: NCT05051904). Primary outcome was major bleeding. Secondary outcome was the composite of stroke/systemic embolism/myocardial infarction/all-cause inpatient mortality/major bleeding/major gastrointestinal bleeding/intracerebral brain hemorrhage. Cox proportional hazard models with stabilized inverse probability treatment weighting were used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) via a two-step approach; first between warfarin and each NOAC, and then within NOACs if sample size conditions were met.

Results: Dabigatran, rivaroxaban and warfarin groups included 6712, 20329, and 12316 patients, respectively. Risks of major bleeding was lower in the NOAC versus warfarin treatment groups (dabigatran: HR 0.50, 95% CI: 0.40–0.62; rivaroxaban: HR 0.78, 95% CI: 0.69–0.90); this risk was lower with dabigatran when compared with rivaroxaban (HR 0.64, 95% CI: 0.51–0.79). The net clinical benefit was observed to be superior in both NOAC groups (dabigatran: HR 0.78, 95% CI: 0.71–0.85; rivaroxaban: HR 0.83, 95% CI: 0.78–0.88) compared with warfarin (Figure).

Conclusion: Among real-world Japanese AF patients with CAD, NOACs were associated with better clinical outcomes than warfarin. Dabigatran presented a lower risk of major bleeding than rivaroxaban.

SUPPORTING DOCUMENTS

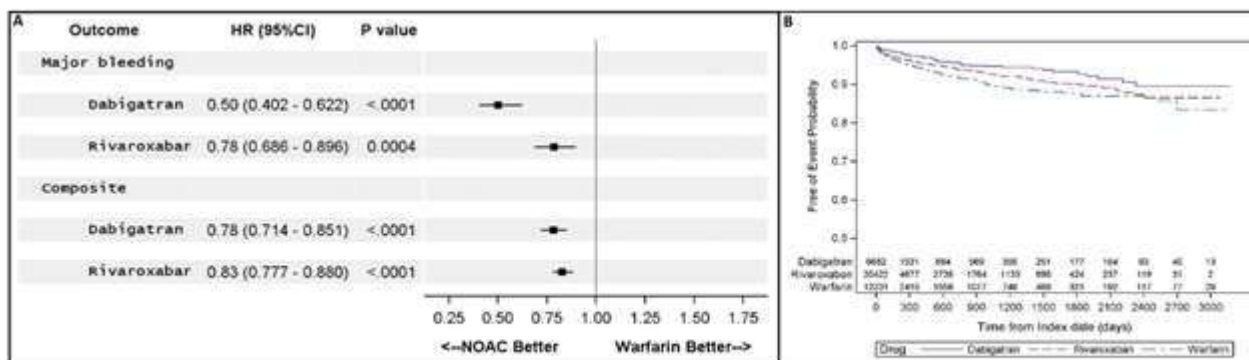


Figure. Primary and secondary endpoint results (A) and time to fatal or non-fatal major bleeding episodes (B)

Dementia Risk Factors in Patients with Atrial Fibrillation: A Nationwide Cohort Study

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Objectives: The risk factors of dementia in patients with atrial fibrillation (AF) are not well understood. During long-term follow-up, this study examined risk factors associated with new-onset dementia risk in Asian patients with AF

Methods: A total of 68387 AF patients over the age of 18 years without prior history of dementia were identified from the Taiwan's National Health Insurance Research Database (NHIRD, 2013-2014), 2.3% AF patients had ablation therapy (N=1561; Table 1). New onset of dementia of each subject was identified by ICD-9-CM (290.0-290.4, 294.1-294.2, 331.0) / ICD-10-CM (F01-F03, G30) codes. The Cox proportional hazards model was used to determine the hazard ratios (HRs) for events. C-index was calculated for comparing the prediction performance of 5-year dementia.

Results: During a median follow-up of 6.78 (IQR: 6.09-6.98) years, a total of 8704 new-onset dementia events occurred (avg 1.87% per patient-year). After multivariable adjustment, higher age (HR: 1.091, 95% CI: 1.089-1.094), male gender (HR: 1.25, 95% CI: 1.19-1.30), sleep apnea (HR: 1.13, 95% CI: 1.07-1.38), and prior stroke (HR: 1.26, 95% CI: 1.19-1.34) were associated with incidence of 5-years risk of dementia (Tables 2). Both CHA2DS2-VASc and AF-CA-Stroke scores are significant risk factors for 5-year dementia. In contrast, dementia risk significantly decreased in AF patients who received ablation (HR: 0.74, 95% CI: 0.58-0.94; Table 1).

Conclusion: In a long-term follow-up study based on a national survey, we found that certain risk factors predicted the onset of new-onset dementia in patients with AF. Long-term new-onset dementia was reduced by rhythm control of catheter ablation.

SUPPORTING DOCUMENTS

Figure 1:

Study flow chart

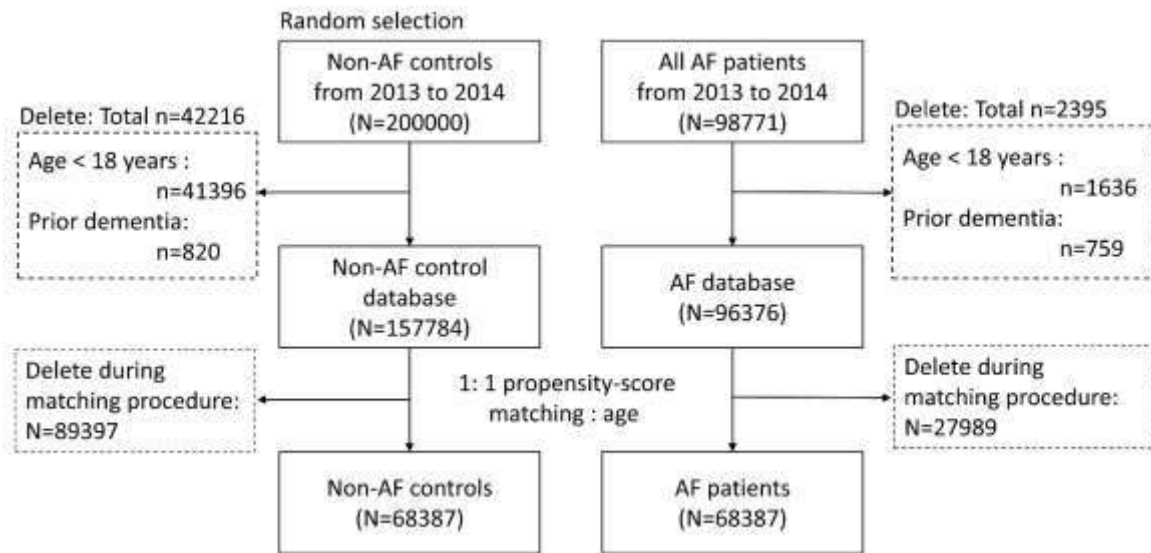


Table 1: Baseline characteristics after propensity-score matching

Variables	AF cohort (N=68387)	Gp 0: AF – No ablation (N=66826)	Gp 1: AF –Ablation (N=1561)	P-value
Age (years)	66.8±11.8	67.4±11.7	56.4±10.8	<0.001
Male gender (n, %)	36313 (53.1%)	35241 (52.7%)	1072 (68.7%)	<0.001
CHA ₂ DS ₂ -VASc	1.78±1.18	1.97±1.18	1.18±1.03	<0.001
AF-CA-Stroke	8.47±2.08	8.59±1.92	3.11±1.54	<0.001
Underlying diseases (n, %)				
Hypertension	28048 (41.0%)	27436 (41.1%)	612 (39.2%)	<0.001
Congestive heart failure	12767 (18.7%)	12621 (18.9%)	146 (9.35%)	<0.001
Diabetes mellitus	8726 (12.8%)	8595 (12.9%)	131 (8.39%)	<0.001
Hyperlipidemia	7421 (10.9%)	7165 (10.7%)	256 (16.4%)	<0.001
Hyperuricemia	1305 (1.91%)	1286 (1.92%)	19 (1.22%)	0.13
Chronic kidney disease	2466 (3.61%)	2436 (3.65%)	30 (1.92%)	<0.001
Chronic liver disease	741 (1.08%)	724 (1.08%)	17 (1.09%)	<0.001
Chronic obstructive pulmonary disease	3514 (5.14%)	3480 (5.21%)	34 (2.18%)	<0.001
Thyroid disease	1641 (2.40%)	1590 (2.38%)	51 (3.27%)	<0.001
Sleep apnea	1727 (2.53%)	1664 (2.49%)	63 (4.04%)	<0.001
Prior stroke	8523 (12.5%)	8445 (12.6%)	78 (5.00%)	<0.001
Peripheral vascular disease	964 (1.41%)	953 (1.43%)	11 (0.70%)	<0.001
Coronary artery disease	1226 (1.79%)	1205 (1.80%)	21 (1.35%)	<0.001
Cardiomyopathy	1010 (1.48%)	977 (1.46%)	33 (2.11%)	<0.001
Rheumatic heart disease	3542 (5.18%)	3501 (5.24%)	41 (2.63%)	<0.001
Amyloidosis	4 (0.01%)	4 (0.01%)	0 (0.00%)	0.64
Atrial flutter	518 (0.76%)	412 (0.62%)	106 (6.79%)	<0.001
Paroxysmal supraventricular tachycardia	3831 (5.60%)	3593 (5.38%)	238 (15.3%)	<0.001
Ventricular tachycardia	310 (0.45%)	287 (0.43%)	23 (1.47%)	<0.001

AF: atrial fibrillation.

Table 2: Risk factors of dementia risk in patients with atrial fibrillation

Variables	Uni-variable model: Hazard ration (95% CI)	P-value	Multi-variable model: Hazard ration (95% CI)	P-value
Age (years)	1.094 (1.092-1.097)	<0.001	1.091 (1.089-1.094)	<0.001
Male gender (n, %)	1.75 (1.68-1.83)	<0.001	1.25 (1.19-1.30)	<0.001
Receiving AF ablation	0.30 (0.24-0.39)	<0.001	0.74 (0.58-0.94)	0.015
Underlying diseases (n, %)				
Hypertension	1.14 (1.10-1.19)	<0.001	1.007 (0.96-1.05)	0.74
Congestive heart failure	1.05 (0.995-1.11)	0.08	N/A	N/A
Diabetes mellitus	1.11 (1.05-1.18)	0.001	1.05 (0.99-1.12)	0.12
Hyperlipidemia	0.82 (0.76-0.88)	<0.001	1.02 (0.95-1.10)	0.55
Hyperuricemia	0.88 (0.74-1.03)	0.11	N/A	N/A
Chronic kidney disease	1.10 (0.98-1.23)	0.11	N/A	N/A
Chronic liver disease	0.75 (0.60-0.95)	0.016	1.001 (0.79-1.27)	>0.99
Chronic obstructive pulmonary disease	1.28 (1.17-1.39)	<0.001	0.93 (0.85-1.02)	0.10
Sleep apnea	1.19 (1.05-1.34)	0.007	1.13 (1.07-1.38)	0.002
Prior stroke	1.58 (1.49-1.67)	<0.001	1.26 (1.19-1.34)	<0.001
Peripheral vascular disease	1.51 (1.30-1.75)	<0.001	1.06 (0.85-1.31)	0.62
Coronary artery disease	1.06 (0.91-1.24)	0.48	N/A	N/A
Cardiomyopathy	0.57 (0.46-0.72)	<0.001	0.91 (0.73-1.15)	0.44
Atrial flutter	0.53 (0.39-0.74)	<0.001	0.92 (0.67-1.27)	0.60
Paroxysmal supraventricular tachycardia	0.81 (0.74-0.90)	<0.001	1.08 (0.98-1.20)	0.13
Ventricular tachycardia	0.74 (0.52-1.05)	0.09	N/A	N/A
Prediction performance	C-index	P-value for comparison	Hazard ratio (95% CI)	P-value
CHA ₂ DS ₂ -VASc	0.588 (0.581-0.594)	<0.001	1.27 (1.25-1.29)	<0.001
AF-CA-Stroke	0.690 (0.686-0.695)		1.29 (1.28-1.30)	<0.001

CI: confidence interval; N/A: not available;

A p-value <0.05 in the uni-variable model were selected into multi-variable model.

CHA₂DS₂-VASc:

Congestive heart failure (point=1), hypertension (point=1), age≥65 years (point=1), age≥75 years (point=2), diabetes mellitus (point=1), stroke (point=2), vascular diseases (point=1), female (point=1).

AF-CA-Stroke:

Age (maximal point=5), not receiving ablation of atrial fibrillation (point=4), prior history of stroke (point=4), chronic kidney disease (point=2), diabetes mellitus (point=1), and congestive heart failure (point=1).

Safety and Efficacy of Oral Anticoagulants Use in Atrial Fibrillation Patients after Catheter Ablation

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Objectives: Given the lack of evidence on the safety and efficacy of warfarin and non-vitamin K antagonist oral anticoagulants (NOACs) in Asian patients with atrial fibrillation (AF) after catheter ablation (CA), We made a comprehensive evaluation in a Chinese real-world cohort.

Materials and Methods: 942 AF patients receiving oral anticoagulation therapy for three months after CA were included. Perioperative OACs use and adverse events related to thromboembolism and bleeding were evaluated.

Results: 50.7% of AF patients eligible for CA did not take oral anticoagulants before the procedure. Rivaroxaban and dabigatran were the most prescribed anticoagulants after the procedure. The real-world data showed no significant difference in the incidence of major bleeding events (0.8% vs. 0.0% vs. 0.2%, $p=0.138$) and thromboembolic events (0.8% vs. 0.9% vs. 1.3%, $p=0.908$) among warfarin, dabigatran and rivaroxaban groups. Dabigatran group experienced less periprocedural bleeding (4.2% vs 9.0%, $p=0.008$), procedure-unrelated bleeding (3.9% vs. 8.7%, $p=0.008$) and minor bleeding (4.2% vs 9.0%, $p=0.008$) than rivaroxaban, which was consistent in a propensity score-matched cohort and 11 subgroups. Mitral regurgitation was associated with bleeding risk in multivariable logistic regression analysis (OR=1.557, 95% CI: 1.099-2.204, $p=0.013$), the effect of which is more significant in the rivaroxaban group ($p=0.032$).

Conclusion: No statistically significant difference was found in the risk of thromboembolic events and major bleeding events among several OACs in AF patients undergoing catheter ablation, while rivaroxaban was associated with a significantly higher risk of minor bleeding compared with dabigatran. Mitral regurgitation was another independent risk factor for preprocedural bleeding.

SUPPORTING DOCUMENTS

Figure 1. Pairwise comparisons of outcomes among different OACs.

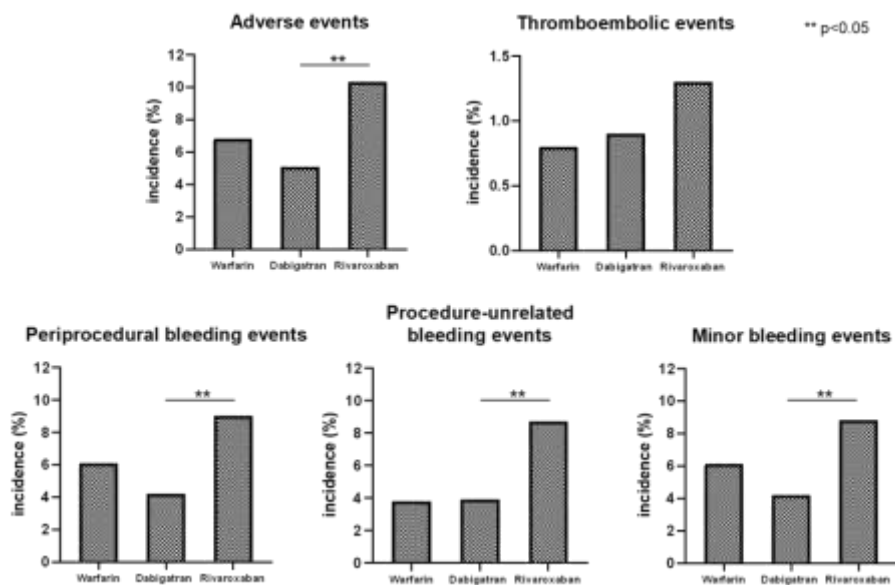
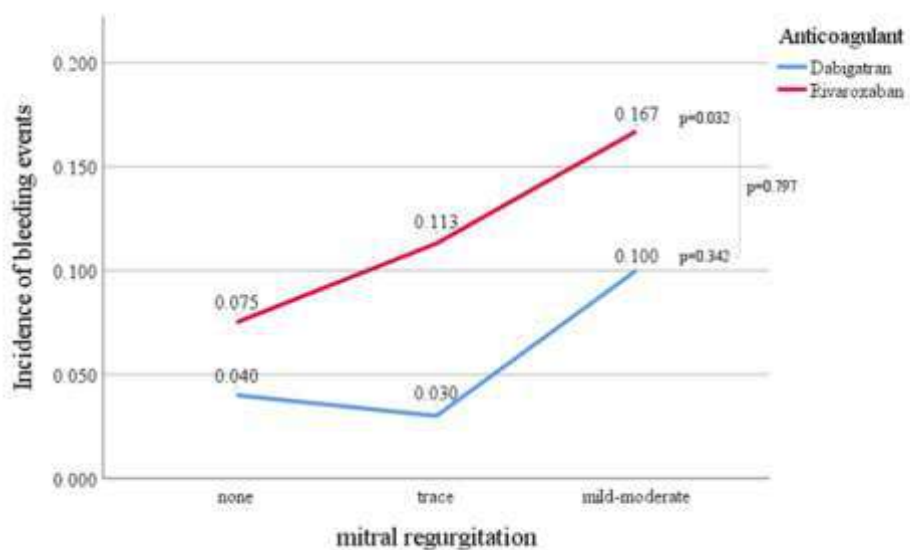


Figure 2. Incidence of bleeding events in Dabigatran and Rivaroxaban groups with different levels of mitral regurgitation.



Perspectives of Chinese Nurse from Tertiary Hospital on the Management of Atrial Fibrillation

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Objective: To understand the perceptions of Chinese nurses from tertiary hospitals regarding their role in the AF care pathway and any barriers or facilitators to optimal AF management in China.

Research Design and Methods: Three focus groups with nurses on the management of AF were conducted in Chinese PLA General between Jan 2020 and Jun 2021. Focus groups were facilitated by a topic guide based on literature review and experts' opinions.

Results: Our study demonstrated that the nurses from tertiary hospital of China were lacking of knowledge about AF management. Nurses expressed their limitation of knowledge concerning AF risk stratification (symptoms, stroke, and bleeding), choosing of appropriate anticoagulants, monitoring of drug's side effects, and nursing follow-up of AF patients. The nurses were keen to get access to training and education materials as well as developing useful tools aiding their management of AF patients. They also expressed concerns about nurses' career planning, lacking of personnel, respect (from doctors, patients and public), and safety issue in medical environment.

Conclusion: Chinese nurses from tertiary hospital showed insufficient knowledge of AF management, which suggests that an educational materials and tools for AF might be beneficial to promote and support nurses in the China.

Next Generation Sequencing Mitochondrial DNA Analysis in Atrial Fibrillation

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Objective: The mitochondrial function determines cardiac function and also affects arrhythmogenesis. Mitochondrial DNA (mtDNA) damage is linked to aging. We hypothesize that mtDNA changes are present in atrial myopathy and atrial fibrillation (AF).

Materials and Methods: This study prospectively had enrolled patients receiving elective coronary bypass grafting and/or valve surgery and subjects were divided into three groups: normal sinus (NS, n=50), postoperative AF (POAF, n=50), and chronic AF (CAF, n=17). Small pieces of the right atrial appendage and blood samples were collected during the surgery before initiating the cardiopulmonary bypass. Buffy coat and tissues were frozen stored until the extraction of mtDNA. The mitoRNA-seq approach, which enriches full length mtDNA and minimizes contamination from the nuclear-encoded mtDNA sequences. The cutoff for missing data is of a site <30 mapped reads.

Results: Common single nucleotide variants (SNVs), POAF-specific and CAF-specific nucleotide changes were identified according to the MITOMAP database. Atrial mtDNA non-synonymous mutations and identified SNVs were shown to be highly correlated with POAF and CAF. In addition, nucleotide transition variants were found, including m.16A>T, m.189A>T (H-strand origins), m.310Cins (H-strand replication origin), and m.16304T>C in the D-loop control region of the mtDNA in the atrial tissues of CAF and POAF groups.

Conclusion: Several nucleotide changes of mtDNA in the atrial tissues were associated with POAF and CAF. Alterations in frequency of D-loop SNVs of mtDNA in peripheral leukocytes and atrial tissue were correlated with persistence of AF. This study provides new insights into the role of mtDNA nucleotide changes in AF.

The Evaluating Lesion Characteristics on High-power Short Duration in Radiofrequency Catheter Ablation Using Simulation Model

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¹Toho University Ohashi Hospital, Meguro, Japan, ²University of Aizu, Aizu, Japan, ³Odawara Cardiovascular Hospital, Odawara, Japan

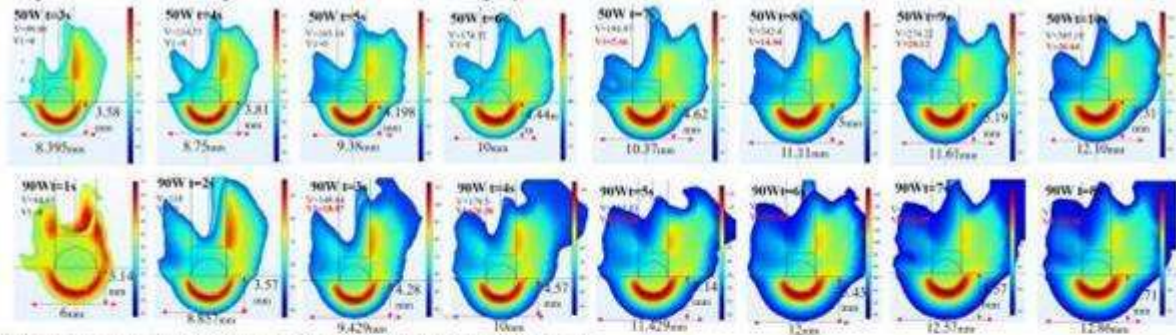
Introduction: There is increased interest in creating high-power short duration (HPSD) ablation lesions in the field of atrial fibrillation (AF), one of new technology in radiofrequency ablation (RFA), because it reduces procedure duration. However, the achieving durable lesion or improving safety are not well evaluated. We evaluated the lesion characteristics and potential complications produced by computer simulation model with multi-hole open-irrigated catheter.

Methods and Results: Total of 4 RFA setting including conventional setting (20 W and 35 W) and HPSD (50 W and 90W) were tested using simulation system. And we also evaluate the effect of impedance in RFA lesion. Although the lesion volume was similar, the 90 W in RFA creates wider lesions compared to 50 W (Figure 1). In all four settings, there was an inverse relationship between the increase in Imp at the start of ablation and lesion size, with a tendency for lesions to become smaller as Imp increased. Furthermore, when ablation time exceeded 3 seconds, the ablation layer with a deep temperature of 100°C or higher increased linearly and significantly compared to the 50 W setting (Table 1). (Table 1).

Conclusion: The assessment of computer simulation maximizes clinical benefit in optimum power and duration in RFA application maximizes clinical benefit and may help to avoid complications.

SUPPORTING DOCUMENTS

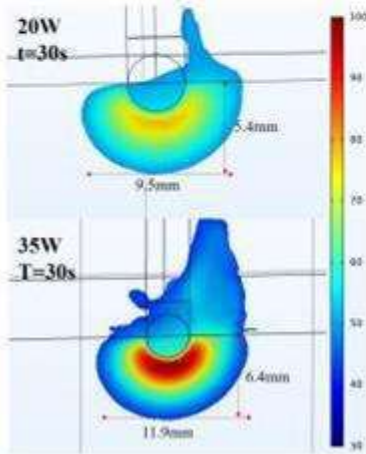
Figure 1: Lesion changes and Ablation time in High-power short duration; 50W and 90W



V: Ablated tissue volume more than 50°C (mm³), V1: Ablated tissue volume more than 100°C (mm³)

Table 1: Comparison of Lesion characteristics in 2 type setting of HPSPD

Time(s)	50W,10s					90W,10s				
	MAX depth >50°C (mm)	MAX diameter >50°C (mm)	V >50°C (mm ³)	V1 >80°C (mm ³)	V2 >100°C (mm ³)	MAX depth >50°C (mm)	MAX diameter >50°C (mm)	V >50°C (mm ³)	V1 >80°C (mm ³)	V2 >100°C (mm ³)
1	—	—	—	—	—	3.143	6.000	44.43	0	0
2	—	—	—	—	—	3.571	8.857	110.00	24.10	0
3	3.580	8.395	99.08	0	0	4.286	9.429	149.64	36.70	18.87
4	3.810	8.750	114.55	17.92	0	4.571	10.000	179.50	57.01	26.96
5	4.198	9.583	145.14	28.94	0	5.143	11.429	263.81	66.72	52.18
6	4.444	10.000	174.52	33.20	0	5.429	12.000	307.00	74.08	50.69
7	4.617	10.370	194.97	39.93	8.66	5.571	12.571	345.73	86.61	61.89
8	5.000	11.111	242.40	48.49	14.04	5.714	12.857	370.92	100.30	62.90
9	5.185	11.605	274.22	53.93	20.12	6.057	13.429	428.95	104.04	65.86
10	5.309	12.099	305.19	53.95	26.64	6.143	14.286	492.34	124.32	72.73



Antiarrhythmic Effects of Exosome Extracted From Atrial Fibrillation Patients by Inhibiting HDAC6

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Objective: This study evaluated the effect of exosome from AF patients on electrical characteristics, Ca²⁺ release, histone deacetylases 6 (HDAC6) of HL-1 cells using tachypacing model.

Methods: Exosome was isolated from peripheral blood of AF (AF-Exo) and healthy control patients (Con-Exo) by Exo-quick. We analyzed contents of miRNA, which were derived exosomes, using the Affymetrix GeneChip miRNA 3.0 array. The effects of AF-Exo and Con-Exo on tachypacing (5Hz) model of HL-1 atrial cardiomyocytes were examined using a confocal microscopy.

Results: In tachypacing model of HL-1 atrial cardiomyocytes, Ca²⁺ wave frequency were increased and amplitude were decreased. In contrast, AF-Exo reduced Ca²⁺ wave frequency (53%, p=0.015) and recovery of Ca²⁺ transient amplitude (41%, p=0.021). However, Con-Exo had no effect. Tachypacing induced contractile dysfunction was prevented by AF-Exo, but not by Con-Exo. The depolymerization of microtubules through Histone Deacetylase-6 (HDAC-6) were increased by the duration of tachypacing. The increase of depolymerization of microtubules were prevented by AF-Exo, but not by Con-Exo. In HL-1 tachypacing model, total CaMKII δ (T-CaMKII) and phosphorylated CaMKII δ (P-CaMKII) protein expression were significantly increased but AF-Exo reduced the ratio of T-CaMKII and P-CaMKII (42%, p=0.001). Finally, the level of miR-548az-5p, which is related with HDAC6 and CaMKII was significantly increased in AF-Exo.

Conclusions: Exosome was isolated from peripheral blood of AF but not control patients protects against AF-related atrial remodeling, by reducing HDAC6. Inhibition of HDAC6 with exosome from AF patients protects against AF remodeling, indicating exosome delivery as an effective therapeutic target in clinical AF.

PITX2c Impairment Electrical Remodeling Increases Susceptibility to Atrial Fibrillation

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Objectives: Functional mutations in the PITX2 (Paired-like homeodomain transcription factor 2) gene have been shown to cause genetically inherited Atrial fibrillation (AF). However, the mechanisms of pathogenesis remain poorly understood. Here, we aimed to develop PITX2c knock-out human iPSC atrial cardiomyocytes (hiPSC-atrial CMs) and understand the mechanism of PITX2 insufficiency leading to AF.

Materials and Methods: Generated a PITX2 knock-out iPSC line using CRISPR/Cas9-based genome editing system. hiPSCs were electroporated with Cas9/sgRNA ribonucleoprotein (RNP) complexes. hiPSC-CMs were differentiated into atrial CMs by treatment of retinoic acid (1uM). For the 3D culture model, cells were plated at 250,000 cells/well in the spherical plate 5D. Electrophysiological properties and oxidative stress were assessed in PITX2c-deficient cardiomyocytes. Proarrhythmic effects of the PITX2c knock-out were quantified with AP morphology, AP duration (APD) restitution, wavelength (WL) and conduction velocity (CV) restitution using microelectrode arrays (MEA)

Results: PITX2c knock-out hiPSC-CMs differentiated into atrial cardiomyocytes, based on the manipulation of retinoic acid signaling. We demonstrated that atrial-specific differentiated hiPSC-CMs expressed atrial-specific genes and the properties of action potentials were like those of human atrial cardiomyocytes. Both 2D and 3D PITX2c knock-out atrial hiPSC-CMs showed signs of APD shortening and reduced WL and increased CV restitution. In addition, a functional assessment of calcium homeostasis has shown that PITX2c causes atrial arrhythmias by impairing calcium handling genes.

Conclusion: This study provides an understanding of electrical remodeling by PITX2c loss-of-function mutations, leading to an understanding of the development of arrhythmias

Engineered exosomes with cardiac targeting peptide for treatment of cardiac hypertrophy

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Objectives: Exosomes have gained attention as nanocarrier; however, the poor targeting ability after systemic administration restrict exosomes' clinical application. Therefore, this study aimed to develop exosomes endowed with heart-targeting properties to serve as a promising therapeutic tool for cardiac hypertrophy.

Materials and methods: We firstly generated heart-targeted delivery system (CTP-Exo) by engineering the surface of exosomes with cardiac targeting peptide (CTP) using genetic modification. Next, we loaded siRNA into CTP-Exo, and siRNA-mediated cardioprotective effects were examined in angiotensin II (Ang II)-treated human induced pluripotent stem cell-derived cardiomyocytes (iPSC-CMs) and mice.

Results: We confirmed that generated cell line released exosomes (CTP-Exo), which highly express CTP on their surface. Isolated CTP-Exo had typical exosome properties, such as ~ 150 nm rounded or cup-shaped morphology, and the presence of marker proteins. Compared with unmodified-Exo, CTP-Exo specifically accumulated in the heart ($P < 0.05$). In addition, siRNA-loaded CTP-Exo (siRNA/CTP-Exo) exerted strong cardioprotective effects with excellent heart-targeting ability. In Ang II-treated iPSC-CMs, siRNA/CTP-Exo exhibited the decreased ROS production; the decreased cell surface area; and the upregulation of the hypertrophic markers (ANP, BNP, and b-MHC). After intravenous injection of siRNA/CTP-Exo in Ang II-treated mice, there was a significant improvement in cardiac function with reduced cardiomyocyte cross-sectional areas ($P < 0.05$).

Conclusion: Taken together, our results suggest that CTP-Exo function as efficient vehicles for heart-targeted delivery of siRNA, which in turn may potentially be used for the treatment of cardiac hypertrophy.

Lamp2Y228* Knock-in Mouse Models Successfully Simulated Clinical Manifestations of Patient With Danon Disease

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Objectives: Danon disease (DD) is a rare X-linked lysosomal storage disorder caused by mutations in the gene encoding the lysosome-associated membrane protein 2 (LAMP2). It is characterized by glycogen accumulation, cardiac and skeletal myopathy, and intellectual disability. LAMP2 is a key mediator of the lysosome-mediated autophagy degradation pathway, which is required for lysosome biogenesis. Although abnormal macroautophagy has been implicated in the pathogenesis of DD, its pathogenesis has remained largely unknown.

Materials and methods: DNA samples from a young patient with DD and his family members were analyzed by whole-exome sequencing and the key findings were confirmed by Sanger sequencing. A knock-in mouse model carrying the homologous Lamp2-Y228* was generated.

Results: The proband was a 17-year-old boy presenting with severe left ventricular hypertrophy, heart failure, and skeletal myopathy. A c.669T>G de novo nonsense variant in the LAMP2 gene, which generated a premature stop codon (p. Tyr223Ter). Knock-in of the mutation into the mouse Lamp2 gene (Lamp2Y228*) led to a phenotype resembling the typical DD, including the short PR interval, pre-excitation pattern on electrocardiogram, a smaller body size, lower body weight and higher mortality. Transmission electron microscopy and immunofluorescence assay showed an aberrant accumulation of autophagolysosome and glycogen in the heart tissue.

Conclusion: Our findings suggest that Lamp2-Y228* mouse models successfully reproduce clinical manifestations of patient with Danon disease, which will further be used to explore the exact role of LAMP2 in an impaired autophagy causing Danon disease.

Myocardial injury, inflammation and pro-thrombotic response after pulsed-field ablation in animal models

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Background: Radiofrequency ablation is known to cause significant myocardial injury as well as a substantial increase in various inflammation markers. The effect of pulsed-field ablation (PFA) on these parameters in animal studies is unclear.

Objectives: We aimed to evaluate the immediate extent of myocardial injury, inflammation and pro-thrombotic response occurring during PFA procedure in porcine models.

Materials and Methods: 11 healthy swine underwent pulmonary vein isolation (PVI) and cavotricuspid isthmus (CTI) line ablation using an integrated prototype PFA system with three different voltage protocols (1,800V, 2,300V and 2,800V). Levels of C-reactive protein (CRP), Troponin-T, D-dimer, along with white cell counts (WCC) were measured pre and post-ablation.

Results: Mean number of PFA applications per animal was 26 +/- 7.2. There was no significant difference between the levels of CRP (p=0.5) and D-dimer (p = 0.09) before and after ablation. On the other hand, Troponin-T levels increased significantly from a median of 16ng/l to 399ng/l (p < 0.05). There was also a significant increase in WCC from a mean of 14.4 +/- 2.9 (x10⁹ /L) to 17.9 +/- 3.7 (x10⁹ /L) (p < 0.05) along with neutrophil counts from 5.0 +/- 1.8 ng/l to 14.4 +/- 2.9 ng/l (p < 0.05). None of the animals had any intraprocedural complications.

Conclusion: This acute animal model showed that there was significant myocardial injury and some inflammation response without pro-thrombotic response immediately after pulsed-field ablation. Further data is needed to assess the significance of these findings.

Renal Denervation Ameliorates the Activated Inflammatory Response Through JAK2-STAT3 Pathway in a COSA Animal Model

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Objective: The role of STAT3 in the chronic obstructive sleep apnea (COSA) remains unclear. The main objective of the study was to explore the possible mechanisms in rabbit model with COSA and its change after renal artery sympathetic denervation (RDN).

Materials and Methods: Eighteen rabbits were injected at the tongue base under endoscopic guidance with normal saline (sham control) or liquid silicone (COSA and COSA-RDN) one month prior to the experiment, respectively. Combined surgical and chemical RDNs were approached through bilateral retroperitoneal flank incisions in COSA-RDN two months prior to the experiment. Immunoblots and real time PCR were evaluated after experiment.

Results: The expression of p-JAK2 and p-STAT3 was decreased significantly in OSA compared to sham control and the phosphorylation of JAK2 and STAT3 was up-regulated after RDN treatment compared to COSA group. The activation of NF-kB was up-regulated in OSA rabbit model compared to sham control, and after RDN treatment, the expression of NF-kB was reduced and there was no difference between control.

Conclusions: The phosphorylation of both JAK2 and STAT3 decreased in COSA, but up-regulated after RDN in COSA rabbits, suggesting the inflammatory response in sleep disordered breathing is prevented by RDN through the JAK2-STAT3 signaling pathway.

Renal Sympathetic Denervation Downregulates the Inflammatory Response Elicited By Chronic Obstructive Sleep Apnea

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Objective: The inflammatory markers associated with cardiovascular risk have been reported as elevated in patients with chronic obstructive sleep apnea (COSA). The main objective of the study was to explore the effects of RDN on inflammatory factors in an animal model of COSA.

Materials and Methods: Eighteen rabbits were injected at the tongue base under endoscopic guidance with normal saline (sham control) or liquid silicone (COSA and COSA-RDN). Combined surgical and chemical RDNs were approached through bilateral retroperitoneal flank incisions. H&E stain, real time PCR and ELISA were evaluated after experiment.

Results: The immune cell infiltration was found in COSA when compared to control, and it decreased after RDN treatment. The level of anti-inflammatory cytokine (IL-10) was decreased significantly in COSA (13.82 ± 6.56), when compared to sham control (33.12 ± 13.81 , $p < 0.01$), and it up-regulated after RDN (26.47 ± 9.46) treatment, when compared to COSA. The level of pro-inflammatory cytokine IL-6 and TNF- α were increased significantly in OSA (IL-6: 46.62 ± 16.7 , TNF- α : 30.8 ± 6.14) compared to sham control (IL-6: 22.71 ± 6.4 , TNF- α 17.6 ± 4.62 , $p < 0.01$), respectively, those mediates were down-regulated after RDN (IL-6: 37.12 ± 10.39 , TNF- α 23.4 ± 4.35) treatment, when compared to COSA ($P < 0.05$).

Conclusions: Sleep disordered breathing significantly increased the pro-inflammatory cytokines and lead to an inflammatory reaction in atrium and ventricle, and it can be prevented by RDN by decreasing of those inflammatory mediators.

In silico population modelling implicates reduced INaL in abnormal QT adaptation in a LQT2 patient

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Objective: QT adaptation, the heart-rate dependence of ventricular repolarisation, has important implications for both diagnosis of LQTS and development of arrhythmia in response to triggers, e.g., the alarm clock response. We report a case of a 28-year-old female who presented with recurrent syncope and cardiac arrest post-partum who displayed markedly abnormal QT adaptation on standing ECG. A variant was found in KCNH2 which resulted in 51% loss of hERG current measured in vitro. To investigate possible mechanisms underlying failure of QT adaptation in this patient we used an in silico population modelling approach.

Methods: Populations of models were generated by randomly varying the levels of expression of ion channels in the Tomek model of the human ventricular myocyte. Ramp rate simulations started at a cycle length of 1500 ms and decreased in 50 ms increments to 700 ms.

Results: The APD decrease during the ramp protocol varied from 15.9 ms to 32.8 ms for models with moderately prolonged baseline APD. The subgroup of models that showed the least APD adaptation were those with lowest late sodium current expression. Hypokalaemia exacerbated the baseline APD prolongation across the entire population. In the presence of hypokalaemia, the low INaL subgroup still showed the least APD adaptation.

Conclusions: Individuals with LQT2 and low expression of INaL may be more susceptible to QT prolongation during sudden heart rate acceleration, such as occurs in the alarm clock response. Population in silico modelling is an efficient way to identify subgroups of patients susceptible to different arrhythmogenic triggers.

Potential Role of Aquaporin 4 Channel Regulation Related to Atrial Remodeling in Atrial Fibrillation

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Objective: Atrial fibrillation (AF) is the most common persistent arrhythmia in clinical practice. Aquaporins (AQP) are a family of small membrane proteins that transport water and have been implicated in cardiovascular disease. They also found a relation between AQP4 and cardiac edema from increased AQP4 in patients with preserved ejection heart failure. The purpose of this study is to find the relationship between AF and AQP4 expression at in vitro levels, and to investigate the potential of AQP4 as a therapeutic target in AF.

Materials and Methods: The experiment used HL-1 Cell, and each cells were classified contol, AF induced group by treated angiotensin II (Ang II), and Ang II + AQP4 blocker (TGN-020) group (AQP4-B).

Results: In AQP4-B goup, the fibrosis marker (Col I α , Col III α , TGF- β 1) increased (1 ± 0.1 vs. 3.8 ± 0.3 , 1 ± 0.1 vs. 2.1 ± 0.2 , 1 ± 0.1 vs 2.4 ± 0.2 , $P<0.001$), and CaMKII and RyR2 decreased (1 ± 0.1 vs. 2.8 ± 0.1 , 1 ± 0.1 vs. 2.2 ± 0.1 , $P<0.001$) whereas SERCA2a increased. In calcium Release image, it was observed that the AQP4-B group had a low regular intensity. Connexin mRNA expression went down in the Ang II group compared to the control group and recovered in the AQP4-B group. The expression patterns of fibrosis marker, calcium-handling proteins and Connexin 40 and 43 were confirmed by quantitative real-time PCR, respectively.

Conclusions: The findings highlight the importance of calcium handling protein phosphorylation changes in fibrosis-induced AF and support miR-423 detection in human urine as a potential novel approach of AF diagnosis.

Effect of Macrophage Migration Inhibitory Factor on Pulmonary Vein Arrhythmogenesis Through Late Sodium Current

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Objectives: Macrophage migration inhibitory factor (MIF), a pleiotropic inflammatory cytokine, is highly expressed in patients with atrial fibrillation (AF). Inflammation increases the risk of AF and is primarily triggered by pulmonary vein (PV) arrhythmogenesis. This study investigated whether MIF can modulate the electrical activity of the PV and examined the underlying mechanisms of MIF.

Methods: A conventional microelectrode, a whole-cell patch clamp, Western blotting, and immunofluorescent confocal microscopy were used to investigate electrical activity, calcium (Ca²⁺) regulation, ionic currents, and cytosolic reactive oxygen species (ROS) in rabbit PV tissue and isolated single cardiomyocytes with and without MIF incubation (100 ng/mL, treated for 6 h).

Results: The MIF -treated PV tissue (n = 8) demonstrated a faster beating rate, higher incidence of triggered activity, and premature atrial beat than the control PV tissue. Compared with the control PV cardiomyocytes, MIF-treated single PV cardiomyocytes had larger Ca²⁺ transients), sarcoplasmic reticulum Ca²⁺ content, and cytosolic ROS. Moreover, MIF-treated PV cardiomyocytes exhibited larger late sodium currents (I_{Na-Late}), L-type Ca²⁺ currents, and Na⁺/Ca²⁺ exchanger currents than the control PV cardiomyocytes. KN93, ranolazine and N-MPG reduced the beating rates and the incidence of triggered activity and premature captures in the MIF-treated PV tissue.

Conclusions: MIF increased PV arrhythmogenesis through Na⁺ and Ca²⁺ dysregulation through the ROS activation of CaMKII signaling, which may contribute to the genesis of AF during inflammation. Anti-CaMKII treatment may reverse PV arrhythmogenesis. Our results clearly reveal a key link between MIF and AF and offer a viable therapeutic target for AF treatment.

SUPPORTING DOCUMENTS

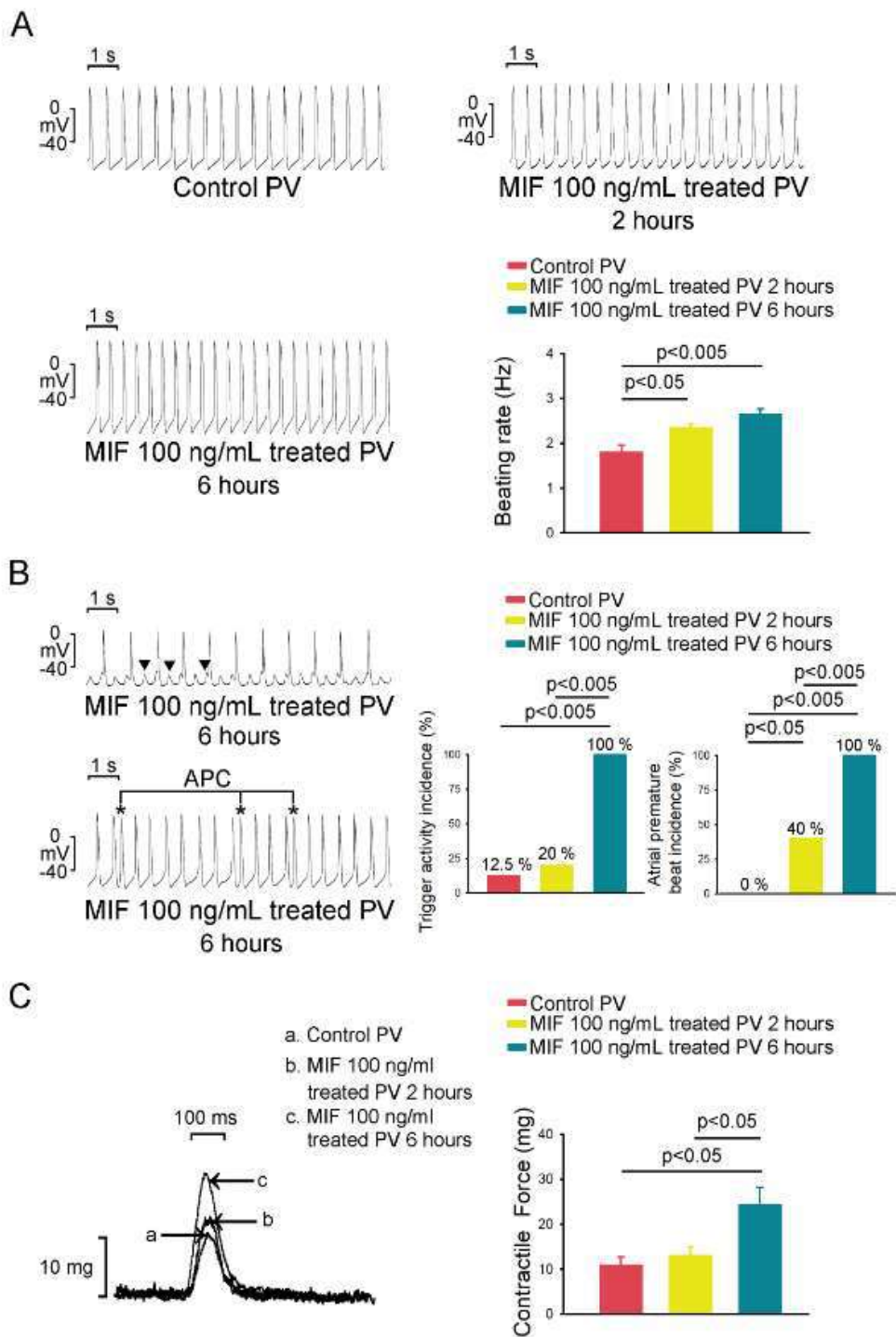


Figure 1

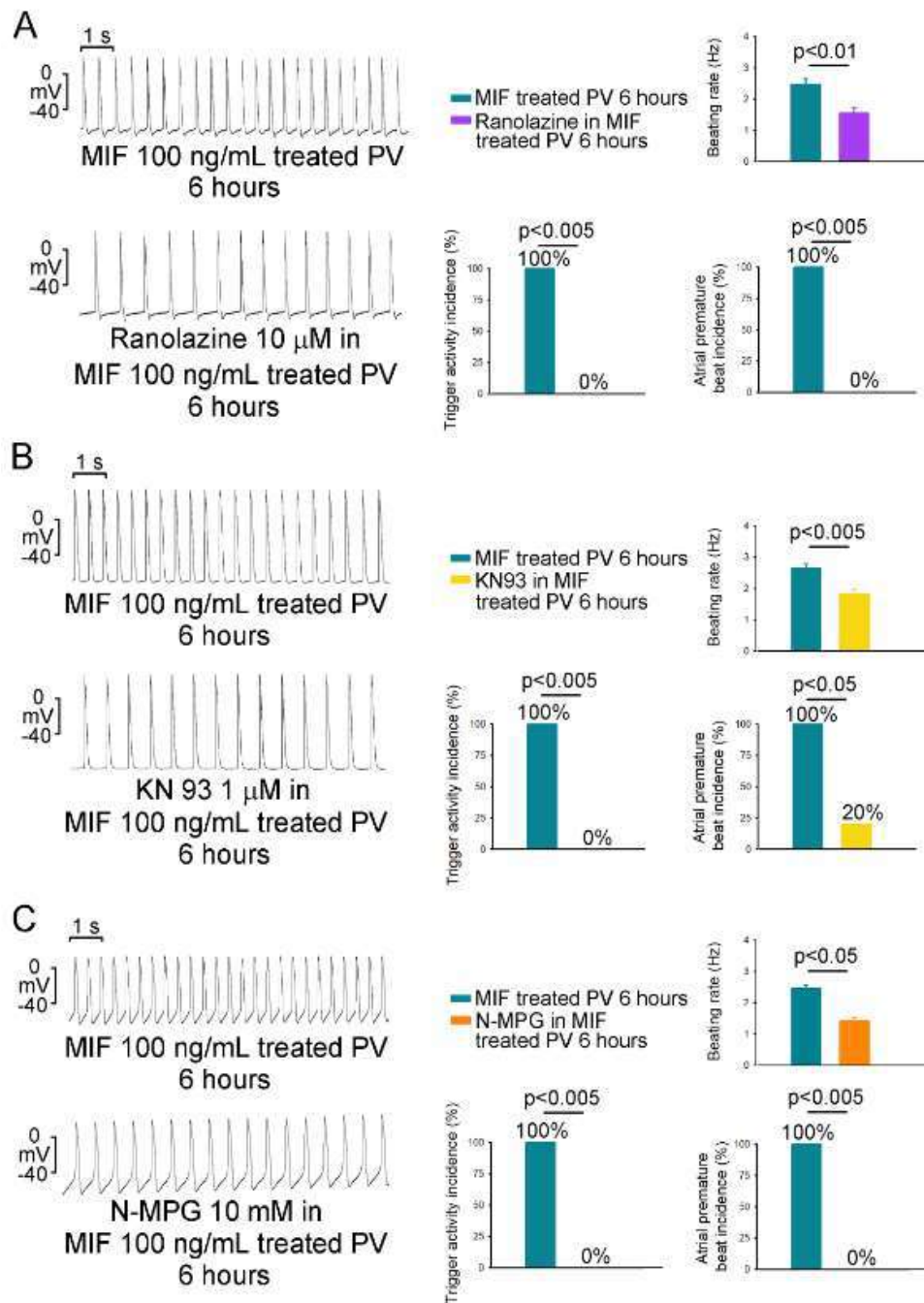


Figure 2

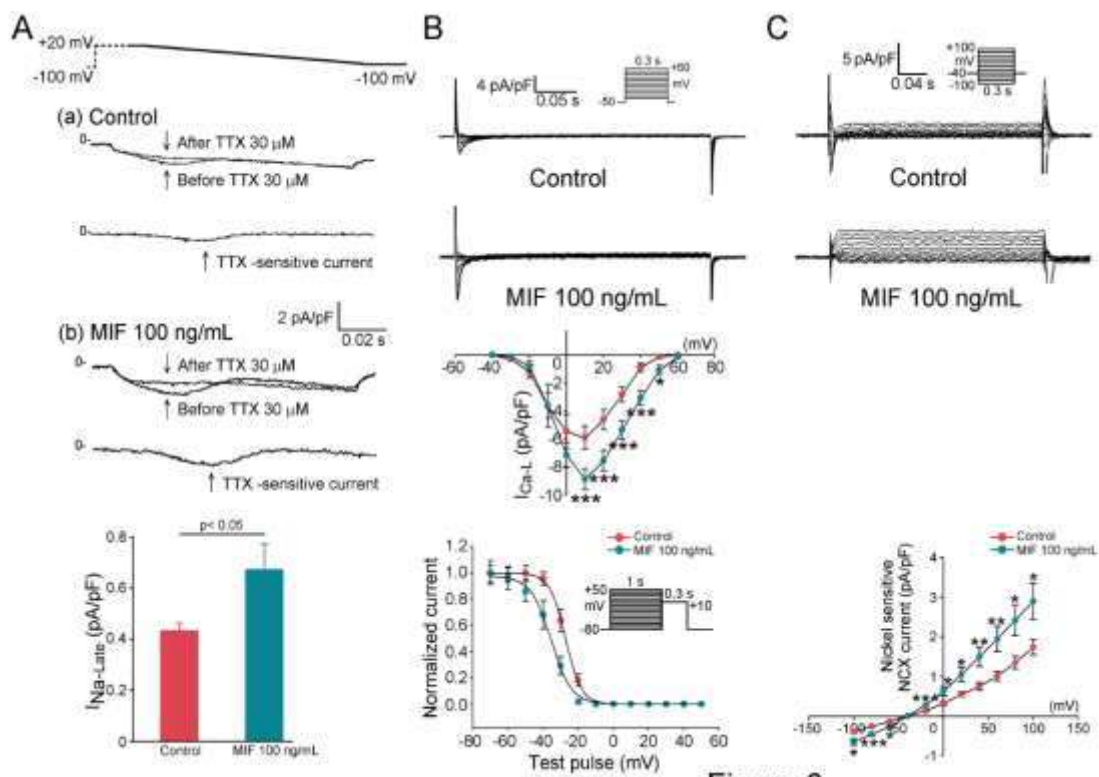


Figure 3

Resveratrol Modulates Intracellular Calcium Handling and Suppresses Ventricular Arrhythmia in Heart Failure Model

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Background: Resveratrol has shown benefits in reducing ventricular remodeling and arrhythmias. However, the potential role of resveratrol in moderating intracellular calcium handling and inhibition of ventricular arrhythmia (VA) has not yet been fully studied.

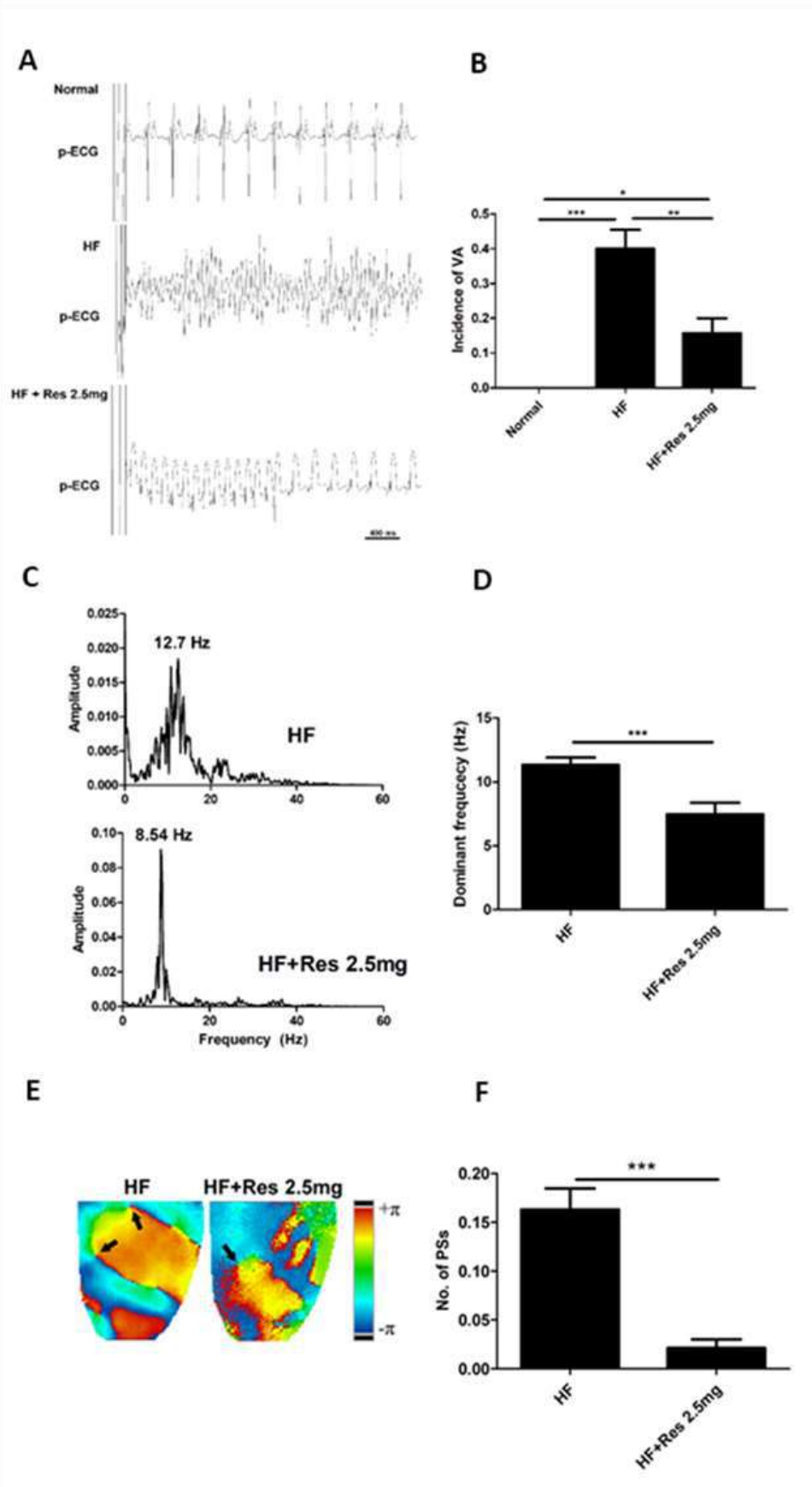
Objective: This study aims to assess the therapeutic efficacy of resveratrol on reducing VA in a heart failure (HF) model and explore the underlying mechanisms.

Methods: HF rabbits were created by 4 weeks after coronary artery ligation. The groups including normal, HF rabbits and HF rabbits treated with intraperitoneal injections of resveratrol 2.5mg/Kg (HF resveratrol group) for 1 week. All rabbits were investigated by using epicardial optical mapping. The action potential duration (APD), calcium transient duration (CaiTD), level of fibrosis and apoptosis, and protein level of ionic channels were measured.

Results: HF group had a longer APD80, CaiTD80 and induction of VA threshold compared with that in normal and HF resveratrol groups. During ventricular fibrillation, the number of phase singularities (PSs) and dominant frequency were both significantly decreased in HF treated with resveratrol compared to that in HF group (Figure). After resveratrol treatment in HF rabbits, the levels of Cav1.2, SERCA2a, RyR, Nav1.5, Kv1.4, Kv1.5, and Kir2.1 were up-regulated, the fibrosis and collagen production were significantly downregulated, and the levels of caspase-3 and NF-κB were significantly downregulated.

Conclusion: In a rabbit model of ischemic HF, VA could be suppressed by resveratrol treatment. This appears to be mediated by reverse remodeling in the cellular electrophysiology, fibrosis, and apoptosis.

SUPPORTING DOCUMENTS



Irisin Modulates Electrical Activity and Calcium Homeostasis in Left Atrial Cardiomyocytes

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Objectives: Irisin is an exercise-induced metabolic hormone secreted primarily by skeletal and cardiac muscle cells. Small amounts of this myokine have been detected in adipose tissue, brain, subcutaneous glands, liver, stomach, spleen, and testis. Several studies demonstrated three therapeutic potentials of irisin, including anti-inflammatory, anti-oxidative, and anti-apoptotic effects. The purpose of the present study was to investigate whether irisin could modulate the left atrium (LA) cardiomyocyte electrical activity and study potential mechanisms.

Materials and Methods: Conventional microelectrode and whole-cell patch clamp were used to investigate the action potentials and ionic currents in isolated rabbit LA tissue preparations or single cardiomyocytes before and after irisin treatment. Calcium transients were used to study intracellular calcium dynamics.

Results: Irisin significantly reduced LA tissue resting membrane potential, action potential duration (APD)₂₀, and APD₅₀ in a dose-dependent response. Acute application of irisin could suppress trigger activities induced by isoproterenol (1 μ M) in LA. In whole-cell patch clamp examinations, irisin (10 ng/ml) significantly decreased late sodium currents (I_{Na-late}), L-type calcium currents (I_{Ca-L}), and sodium-calcium exchanger currents (INCX). Calcium transients were significantly lower in LA treated with irisin (10 ng/ml) than control (0.61 ± 0.08 versus 1.07 ± 0.13 , $p < 0.001$).

Conclusion: Irisin reduced LA arrhythmogenesis through its inhibitory effects on I_{Ca-L}, I_{Na-late}, and INCX currents, which regulate intracellular calcium homeostasis. Irisin suppressed isoproterenol-induced trigger activities in LA and may provide a novel therapeutic strategy for atrial arrhythmogenesis.

LIGHT Promote the Atrial Fibrosis and AF Inducibility by promoting macrophages TGF β 1 secretion

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Objectives: To illustrate the underlying mechanism of LIGHT (TNF superfamily member 14, TNFSF14) promote the atrial fibrosis and AF inducibility.

Methods: The mRNA level of PBMCs in AF patients and healthy controls were detected by PCR array. ELISA and flow cytometry were used to detect protein level of LIGHT and corresponding receptor HVEM (herpesvirus entry mediator) in peripheral blood CD3+ and CD14+ cells respectively. Detecting the morphological, functional, and electrophysiological changes in heart followed by tail intravenous injection of rLIGHT in mice . rLIGHT were used to stimulate BMDMs to prepare the macrophages conditioned medium (MCM), then MCM were used to culture mice atrial fibroblasts.

Results: The PBMCs in AF patients (n=5) have higher mRNA level of LIGHT (Foldchange = 8.96, P = 0.0017) and TNFSF14 (Foldchange = 4.98, P = 0.0089). LIGHT are mainly expressed by CD3+ cells while HVEM expressed by CD14+ cells. The protein level of LIGHT and TNFSF14 in AF patients (n=34) was higher than that of healthy controls (n=19) and closely correlated to left atrial reverse remodeling. In vivo study demonstrated that rLIGHT injection promoted systemic immune responses and increased T-cells and macrophages infiltration in heart (atrial and ventricle). Moreover, rLIGHT injection also promoted atrial fibrosis and AF inducibility detected by MASSON staining and atrial burst pacing. In vitro study demonstrated that MCM rather than rLIGHT alone increased fibroblasts proliferation, collagen synthesis and differentiation into myofibroblasts by promoting macrophages TGF β 1 secretion.

Conclusion: LIGHT promote the atrial fibrosis and AF inducibility by promoting macrophages TGF β 1 secretion.

Night-to-night Variability of Sleep Disturbance Indexes Impedes Accurate Assessment of the Sleep Apnea Severity

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Objective: Sleep-disordered breathing (SDB), one of the most common comorbidities in cardiac electronic implantable device (CIED) patients, is frequently under-diagnosed. A special diagnostic function of CIED can facilitate SDB detection by continuous monitoring. The DEDiCATES study prospectively enrolled patients with CIED possessing this function to evaluate the association between device-detected SDB and cardiovascular risk.

Materials and methods: Baseline severity of SDB was analyzed using the first device interrogation data in 539 patients. Daily respiratory disturbance index (RDI) values, which represents the average number of sleep disturbance events per night, were manually verified and collected.

Results: At the first device interrogation (91 ± 20 days), daily RDI values were always below 30/hr in 23 (4.3%) patients (non-severe SDB group), and the remaining 516 patients (95.7%) were classified into the severe SDB group based on the conventional categorical criteria (RDI ≥ 30 /hr for at least one night). However, only 50 (9.7%) of 516 patients in the severe SDB group always exhibited RDIs ≥ 30 /hr (52.5 ± 8.6 /hr). Therefore, 466 (86.5%) of 539 patients showed RDI values compatible to both severe (≥ 30 /hr) and non-severe (< 30 /hr) SDB criteria. The degree of alteration in RDI values, e.g., minimum to maximum RDI values, was significantly greater in the severe SDB than the non-severe SDB group (37.7 ± 12.3 /hr vs. 12.7 ± 8.4 /hr, $p < 0.001$).

Conclusions:

Majority of CIED patients revealed RDI values compatible to both severe and non-severe SDB criteria. Therefore, discriminating power of single night polysomnography for the presence of severe SDB may be significantly limited.

Relationship Between Lateral Tine Engagement and Non-septal Implantation of Leadless Pacemaker Confirmed by Computed Tomography

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Objective: Implantations of leadless pacemakers in the septum lower the risk of cardiac perforation. However, unexpected non-septal implantation is not uncommon. The locations and numbers of the engaged tines may be affected by the implantation site, but the relationship has not been investigated.

Materials and Methods: A total of 67 patients who underwent leadless pacemaker implantation with postprocedural computed tomography (CT) between September 2017 and November 2020 were enrolled. The actual implantation site was assessed by CT. During the pull-and-hold test, the engagement of all tines was assessed. Tines were categorized into four locations: septal, lateral, superior, and inferior by RAO and LAO fluoroscopic image.

Results: There were 28 septal and 39 non-septal implantations. Implantation to the anterior/posterior edge of septum were included in the non-septal group. The rate of engagement of the lateral tines were significantly higher in the non-septal group compared with septal group (82.1% vs 39.3%, $P<0.001$). However, there were no significant differences in other tine locations between the two groups. The number of engaged tines were significantly higher in the non-septal group compared with septal group (3.2 ± 0.8 vs 2.8 ± 0.8 , $P=0.02$). Cardiac injuries including hematoma, pericardial effusion and cardiac tamponade were observed in four patients, which were all in the non-septal group with engagement of the lateral tines.

Conclusion: The engagement of the lateral tines were significantly more frequently observed in non-septal implantation and may provide a clue in prediction of actual implantation site of leadless pacemaker.

Cavo-tricuspid Isthmus: an Alternative Lead Implantation Site in Sinus Node Dysfunction Due to Pulmonary Hypertension

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¹National Cardiovascular Centre Harapan Kita, Jakarta Barat, Indonesia, ²Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta Barat, Indonesia

Objectives: To report cavo-tricuspid isthmus (CTI) as an alternative atrial pacing site in patient with sinus node dysfunction (SND) complicated with idiopathic pulmonary arterial hypertension (IPAH).

Case Illustration and Discussion: A 59-year-old female came with signs and symptoms of right heart failure (RHF) accompanied by junctional bradycardia, hyperkalemia and metabolic acidosis. Despite well-treated congestion and fully corrected metabolic problem, her junctional bradycardia didn't spontaneously resolve. In fact, alternating episodes of tachycardia and bradycardia were found from her 24-hour-Holter monitoring accompanied by symptoms. We decided to implant PPM AAIR, but we didn't find pacing site with acceptable threshold as we positioned the atrial lead in right atrial appendage (RAA), inter-atrial septum (IAS) and lower atrial septum (LAS) even with a very high output setting. Eventually, a good atrial capture threshold was found at CTI with threshold of 0.8 V at 0.50 ms and impedance of 613 Ω at 5.0 V. Her ECG showed atrial pacing with QRS rate of 60 bpm and QRS duration of 100 ms. Upon clinical follow up, she was clinically stable and finally discharged with furosemide 40 mg o.d., ramipril 5 mg o.d., and warfarin 1 mg o.d. SND in patients with IPAH might occur due to chronic inflammation and interstitial fibrosis across the entire right atrium. Not only in sinus node, it also occurs in RA causing atrial myopathy and subsequently failure to yield appropriate atrial pacing.

Conclusion: In patients with SND and atrial myopathy due to IPAH, CTI might be an alternative atrial pacing site.

Device Malfunction or Normal Behaviour?

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¹*Department Of Cardiology, Serdang Hospital, Malaysia*

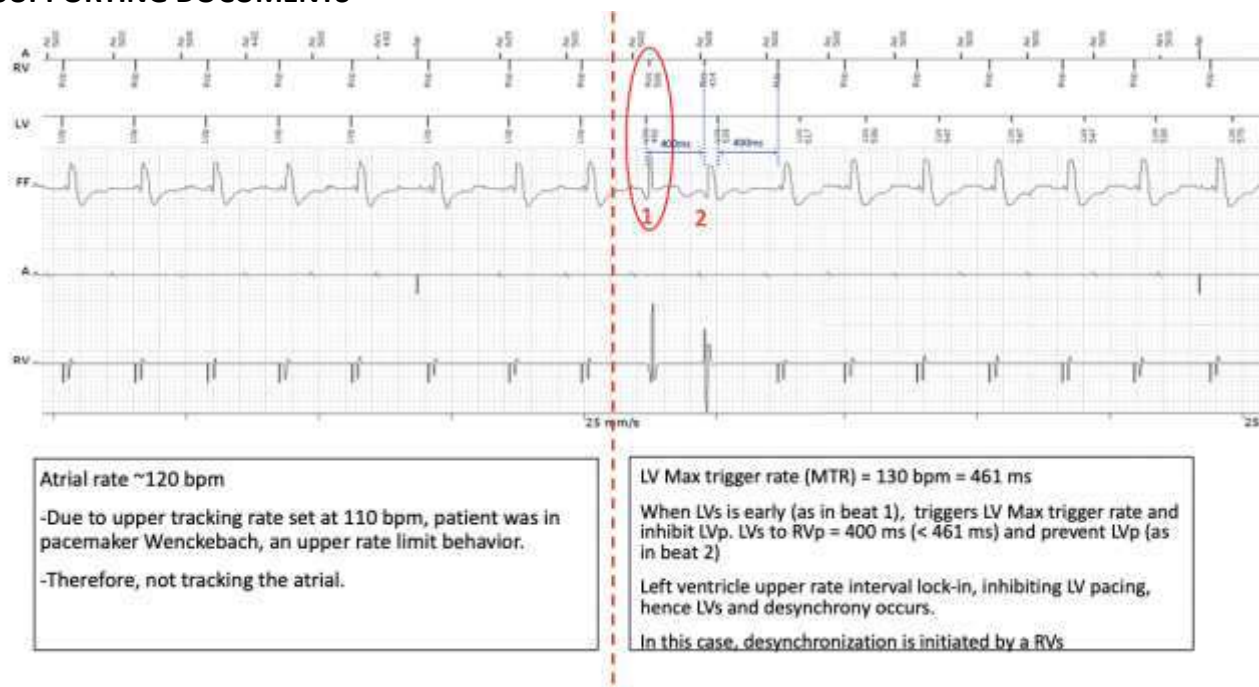
Objective: Aim to demonstrate Left Ventricle Upper Rate Interval lock-in in Cardiac Resynchronization Therapy rather than device malfunction in a patient with 97 percentage of Biventricular pacing.

Materials and Methods: During routine interrogation for his CRTD which was implanted in 2018 for Non Ischemic Dilated Cardiomyopathy we noted loss of biventricular pacing that is followed by RV sensing and then LV sensing after a Premature Ventricular Contraction. With the LV maximal trigger rate (MTR) set as 130 bpm (461 ms), it inhibits the LV pacing as the LVs to RVp is 400 ms which causes the LVURI lock in and thus causing the desynchrony rather than device malfunction.

Results: We increased the upper rate to 130 bpm and AMS rate to 160 bpm to prevent pacemaker wenkebach. When the UTR increased to 130 bpm the LV MTR increased to 150 bpm and thus preventing the lock in. With remote home monitoring, his latest biventricular pacing has increased to 99%.

Conclusions: For those patients with CRT we aim to achieve as high percentage of Biventricular pacing as possible and for this gentleman (at least more than 98.5%) the LVURI lock in contributes to the less than optimal Biventricular pacing.

SUPPORTING DOCUMENTS



Changes made

- Upper rate increased to 130 bpm and mode switch rate increased to 160 bpm to prevent pacemaker Wenckebach
- When upper tracking rate (UTR) is increased to 130 bpm, the max trigger rate (MTR) increase by 20 bpm (setting: UTR + 20 bpm = 150 bpm)
- By doing so, MTR rate is increased and preventing LVURI lock-in

Bradycardia/CRT

	Previous	Current
Upper rate		
Upper rate [bpm]	110	130
Wenckebach response of [bpm]	110-197	130-169
Mode switching		
Intervention rate [bpm]	120	160

Out-smart the Algorithm..

Dr Wei Shen Chee¹, Dr Abd Ghani Abd Raqib¹, Dr Yoon Kee Siow¹, Dr Chin Yung Chea¹, Dr Mat Daud Aimaduddin¹, Dr Gian Singh Sathvinder Singh¹, Dr Habizal Nor Halwani¹, Dr Mohd Yusof Hartini¹, 1 Selvaraj Kamaraj¹, 1 Abdullah Ramaiah Asri Ranga¹, Dr Abd Ghapar Abd Kahar¹

¹*Department Of Cardiology, Serdang Hospital, Malaysia*

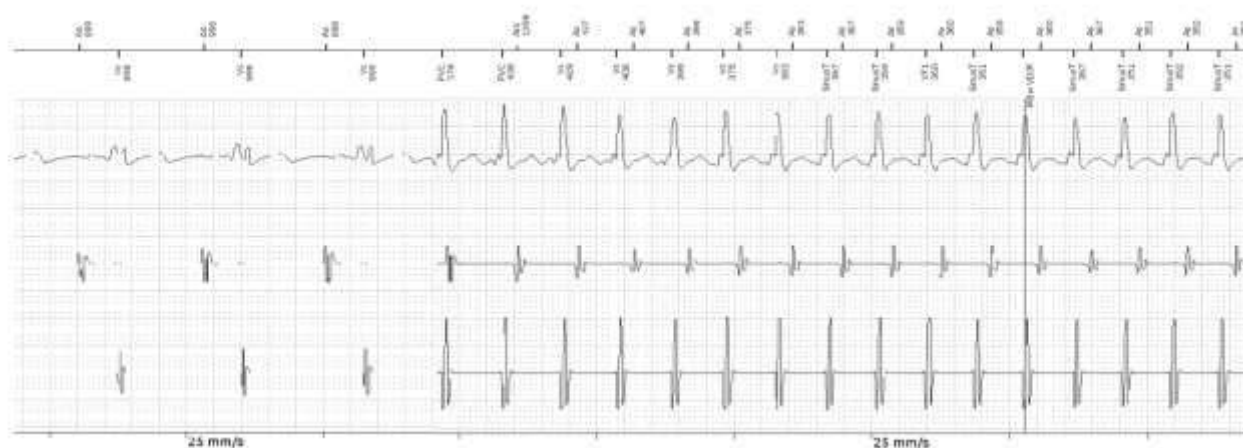
Objective: To demonstrate the potential limitation of SMART algorithm in differentiating Supraventricular Tachycardia (SVT) with aberrancy from Ventricular Tachycardia (VT) with 1:1 VA conduction.

Materials and Methods: Every Implantable Cardioverter- Defibrillator (ICD) have their own algorithms to discriminate SVT from VT with the aim to detect and deliver appropriate therapy. Here we have a middle aged gentleman with Non- Ischemic Dilated Cardiomyopathy (Ejection Fraction of 35-40%), for whom single chamber ICD with atrial dipole was implanted for secondary prevention, noted 21 episodes of non-sustained tachycardia during device interrogation.

Result: Using the SMART algorithm, based on the tachycardia with VA 1:1 conduction with relatively stable A and V, the device will detect the tachycardia as SVT rather than VT. With the obvious change in morphology in the Far Field, we decided to turn off the SMART algorithm to enable the morphology match for better VT discrimination.

Conclusion: Every devices will have their own VT discriminator and is of paramount significance to know the differences for each devices to aid us in discriminating VT from SVT for better detection and delivery of appropriate therapy.

SUPPORTING DOCUMENTS



Recordings - Episodes

No.	Time	Zone	PP [ms]	RR [ms]	Description	PP [ms]	RR [ms]
93	04/12/21 09:52	nsT	***	***	Non-sustained tachycardia	***	***
92	04/11/21 23:55	nsT	***	***	Non-sustained tachycardia	***	***
91	04/11/21 09:26	nsT	***	***	Non-sustained tachycardia	***	***
90	04/06/21 02:41	nsT	***	***	Non-sustained tachycardia	***	***
89	03/29/21 09:23	nsT	***	***	Non-sustained tachycardia	***	***
88	03/25/21 05:14	nsT	***	***	Non-sustained tachycardia	***	***
87	03/14/21 22:41	nsT	***	***	Non-sustained tachycardia	***	***
86	03/05/21 06:51	nsT	***	***	Non-sustained tachycardia	***	***
85	03/03/21 01:32	nsT	***	***	Non-sustained tachycardia	***	***
84	02/02/21 20:12	nsT	***	***	Non-sustained tachycardia	***	***
83	01/30/21 23:32	nsT	***	***	Non-sustained tachycardia	***	***
82	01/13/21 01:39	---	***	***	Periodic IGH	***	***
81	01/06/21 14:30	nsT	***	***	Non-sustained tachycardia	***	***
80	12/31/20 11:32	nsT	***	***	Non-sustained tachycardia	***	***
79	12/23/20 17:09	nsT	***	***	Non-sustained tachycardia	***	***
78	12/17/20 17:19	nsT	***	***	Non-sustained tachycardia	***	***
77	12/02/20 06:38	nsT	***	***	Non-sustained tachycardia	***	***
76	11/27/20 11:25	nsT	***	***	Non-sustained tachycardia	***	***
75	11/24/20 13:53	nsT	***	***	Non-sustained tachycardia	***	***
74	11/23/20 21:43	nsT	***	***	Non-sustained tachycardia	***	***
73	11/13/20 03:41	nsT	***	***	Non-sustained tachycardia	***	***
66	10/14/20 01:39	---	***	***	Periodic IGH	***	***
60	07/15/20 01:39	---	***	***	Periodic IGH	***	***
42	04/15/20 01:39	---	***	***	Periodic IGH	***	***
29	01/15/20 01:39	---	***	***	Periodic IGH	***	***
7	10/16/19 01:39	---	***	***	Periodic IGH	***	***
1	10/03/19 22:06	---	***	***	Start RV pacing	***	***

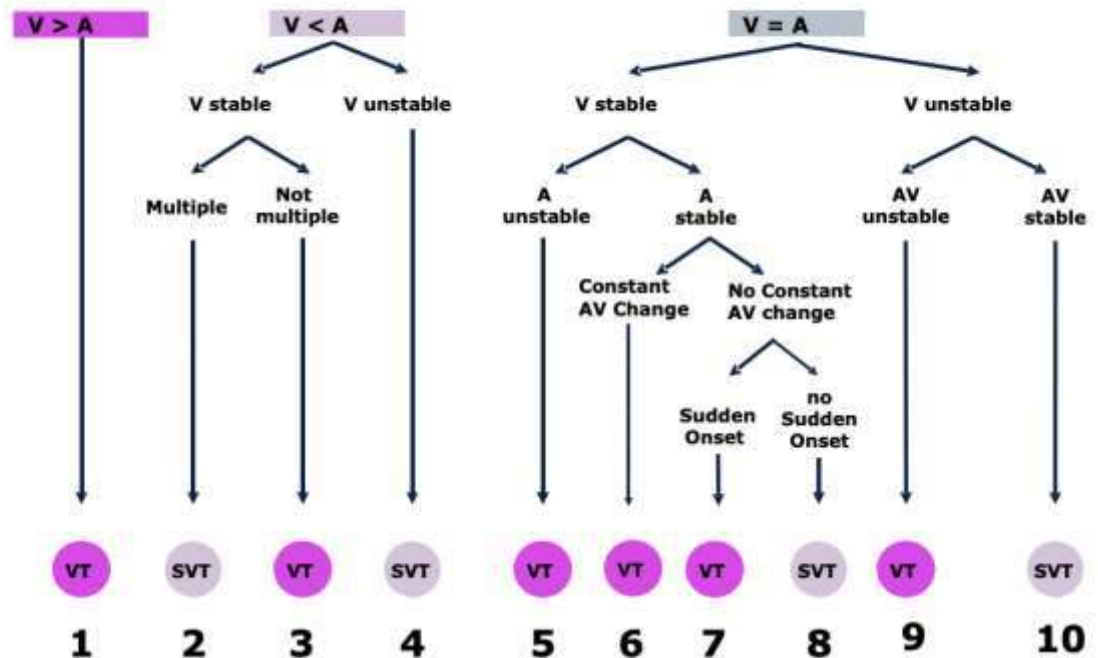
Non-Sustained
Tachycardia

Parameters - Tachycardia

(1st interrog.)

Ventricular detection	VT1	VT2	VF
Rate [bpm]	162	182	200
Detection counter	28	20	18 out of 24
Redetection counter	20	14	8 out of 12
SMART detection	ON	ON	
Onset [%]	20	20	
Stability [%]	12	12	
MorphMatch			
Sustained VT [min]			

SMART Detection Algorithm



Optimal duration of temporary pacing in acute myocardial infarction

Asst Prof Hyung Ki Jeong¹, Doctor Sung Sik Oh², Professor Sung Soo Kim³

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Objectives: It is not uncommon to require a temporary pacemaker (TPM) for bradyarrhythmia during percutaneous coronary intervention (PCI) for acute myocardial infarction (AMI). There have been few studies about temporary pacing in the era of PCI.

Materials and Methods: Among 8274 patients of AMI, 368 patients who had been inserted temporary pacemaker during PCI were enrolled from January 2010 to December 2019. Among them, 253 patients (68.8%) recovered the rhythm just after reperfusion. 115 patients (31.2%) needed TPM until their rhythm restored after procedure. We analyzed the duration of maintaining TPM and the descriptive factors

Results: ST-elevation MI (STEMI) patients were 73 and Non-ST-elevation MI (NSTEMI) patients were 42. The median duration from TPM insertion to rhythm recovery time was 35.3 hours. The most common target lesion was the right coronary artery (n=80, 69.6%) and the most common indication for permanent pacemaker (PPM) implantation was complete AVB (n=64, 55.7%). There was no significant difference in rhythm recovery time between STEMI and NSTEMI (31.6 [17.2 – 47.7] vs. 49.5 [10.7 – 132.5], P = 0.168). There was no significant difference in rhythm recovery time according to each target coronary artery. Most of STEMI patients except 2 patients (2.7%), the rhythm was finally recovered, meanwhile, 9 (21.4%) NSTEMI patients needed permanent pacemaker.

Conclusion: It took 35.3 hours to recover self-rhythm in AMI patients who needed a TPM. Most of STEMI patients recovered cardiac electrical conduction. Our center usually waited for 1 week to decide whether to implant a permanent pacemaker or not.

Table

Table 1. Baseline characteristics of study populations.

	All Patients (N=115)	STEMI (N=73)	NSTEMI (N=42)	P value
Age	77.36 ± 11.2	75.57 ± 12.4	80.48 ± 7.8	0.011
Sex (Male)	75 (65.2%)	51 (64.6%)	28 (35.4%)	0.842
Sx to ER arrival time (Hours)	41.15 ± 65.2	32.66 ± 61.0	55.90 ± 70.3	0.066
ER Door to reperfusion time (Hours)	6.42 ± 16.1	1.46 ± 1.7	15.62 ± 25.0	0.002
Past medical History				
HTN	82 (71.3%)	52 (71.2%)	30 (71.4%)	0.982
DM	42 (36.5%)	22 (30.1%)	20 (47.6%)	0.061
DL	11 (9.6%)	4 (5.5%)	7 (16.7%)	0.050
Smoking	49 (42.6%)	33 (45.2%)	16 (38.1%)	0.458
MI	4 (3.5%)	1 (1.3%)	3 (7.1%)	0.104
Angina	8 (7.0%)	1 (1.3%)	7 (16.7%)	0.002
CVA	7 (6.1%)	5 (6.8%)	2 (4.8%)	0.652
CKD/ESRD	15 (13.0%)	6 (8.2%)	9 (21.4%)	0.043
Target lesion				
LAD	10 (8.7%)	6 (8.2%)	4 (9.5%)	0.811
LCX	8 (7.0%),	2 (2.7%)	6 (14.3%)	0.019
RCA	80 (69.6%)	59 (80.8%)	21 (50.0%)	<0.001
LM	1 (0.9%)	0 (0.0%)	1 (2.4%)	0.185
Multivessel	16 (13.9%)	6 (8.2%)	10 (23.8%)	0.020
Successful PCI/PTCA	104 (90.4%)	69 (94.5%)	35 (83.3%)	0.050
CABG	2 (1.7%)	0 (0%)	2 (4.8%)	0.131
Ejection Fraction (%)	54.34 ± 10.5	53.11 ± 10.9	56.66 ± 10.3	0.096
Significant stenosis at index procedure				
LAD	52 (45.2%)	32 (43.8%)	20 (47.6%)	0.695
LCX	44 (38.3%)	26 (35.6%)	18 (42.9%)	0.442
RCA	79 (68.7%)	51 (69.9%)	28 (66.7%)	0.722
LM	5 (4.3%)	2 (2.7%)	3 (7.1%)	0.265

STEMI; ST-segment elevation myocardial infarction, NSTEMI; non ST-segment elevation myocardial infarction, Sx; Symptom, ER; Emergency room, HTN; Hypertension, DM; Diabetes mellitus, DL; Dyslipidemia, MI; Myocardial infarction, CVA; Cerebrovascular accident, CKD;

Chronic kidney disease, ESRD; End stage renal disease, LAD; Left anterior descending coronary artery, LCX; Left circumflex coronary artery, RCA; Right coronary artery, LM; Left main coronary artery, PCI; Percutaneous coronary intervention, PTCA; Percutaneous transcatheter angioplasty, CABG; Coronary artery bypass graft,

Table 2. Annual number of temporary and permanent pacemaker implantation during AMI procedure.

Year	Total TPM	TPM after procedure	PPM	Total MI	STEMI	NSTEMI
2010	32	9	1	704	334	370
2011	41	14	0	740	349	391
2012	48	15	1	784	332	452
2013	43	15	0	767	320	447
2014	29	10	1	905	364	541
2015	29	11	2	853	344	509
2016	26	2	0	940	404	536
2017	43	12	4	821	354	467
2018	39	13	1	885	335	550
2019	37	14	1	875	335	540

TPM; Temporary pacemaker, PPM; Permanent pacemaker, MI; Myocardial infarction, STEMI; ST-segment elevation myocardial infarction, NSTEMI; non ST-segment elevation myocardial infarction.

Table 3. Temporary pacing indication in the percutaneous coronary intervention in acute myocardial infarction.

TPM Indication	All Patients (N=115)	STEMI (N=73)	NSTEMI (N=42)	P value
Sinus dysfunction	39 (33.9%)	25 (34.2%)	14 (33.3%)	0.921
2nd degree AVB	2 (1.7%)	0 (0.0%)	2 (4.8%)	0.131
2:1 AVB	8 (7.0%)	4 (5.5%)	4 (9.5%)	0.412
High grade AVB	2 (1.7%)	2 (2.7%)	(0.0%)	0.279
CAVB	64 (55.7%)	42 (57.5%)	22 (52.4%)	0.592

TPM; Temporary pacemaker, PPM; Permanent pacemaker, MI; Myocardial infarction, STEMI; ST-segment elevation myocardial infarction, NSTEMI; non ST-segment elevation myocardial infarction. CAVB; Complete atrioventricular block, AVB; Atrioventricular block.

Table 3. Average self-rhythm recovery time as the target coronary lesion.

	LAD (N=10)	LCX (N=8)	RCA(N=80)	LM (N=1)	Multivessel (N=16)	P value
insertion to recovery hours	45.72±26.3	23.83±17.4	35.10±30.0	91.18	55.53±59.6	0.280

LAD; Left anterior descending coronary artery, LCX; Left circumflex coronary artery, RCA; Right coronary artery, LM; Left main coronary artery.

Table 4. The patients who were implanted permanent pacemaker.

No.	Sex	Age	Sx to ER arrival (hours)	Door to Reperfusion (Hours)	Failed PCI	TPM to PPM (hours)	EF (%)	Diagnosis	Target lesion	TPM Indication
1	Male	90	1	26		130	61.6	NSTEMI	LAD	2nd AVB
2	Male	89	6	2		179	42	NSTEMI	LAD	2:1 AVB
3	Female	87	72		Failed	133	56.3	NSTEMI	RCA	CAVB
4	Female	92	168	73		268	40	NSTEMI	LCX	CAVB
5	Male	65	192		Failed	123	30	STEMI	RCA	CAVB
6	Male	88	7	1		146	66.5	NSTEMI	LCX	Sinus dysfunction
7	Male	75	11	127		181	60.8	NSTEMI	LAD, LCX	CAVB
8	Male	84	24	12		159	63.75	NSTEMI	RCA	CAVB
9	Male	89	168		Failed	144	70.8	NSTEMI	LAD	CAVB
10	Female	92	24	1		146	69	STEMI	RCA	CAVB
11	Male	85	1	14		187	40.8	NSTEMI	LAD, LCX	CAVB
Average						163.3hours	54.7(%)			

Sx; Symptom, ER; Emergency room, Sx to ER arrival; Time interval from symptom onset to arrival of emergency room, Door to Reperfusion; Time interval from arrival of emergent room to the moment of coronary reperfusion, TPM to PPM; Time interval from temporary pacemaker insertion to permanent pacemaker, PCI; Percutaneous coronary intervention, TPM; Temporary pacemaker, PPM; Permanent pacemaker, EF; Ejection fraction, STEMI; ST-segment elevation myocardial infarction, NSTEMI; non ST-segment elevation myocardial infarction, LAD; Left anterior descending coronary artery, LCX; Left circumflex coronary artery, RCA; Right coronary artery, LM; Left main coronary artery, CAVB; Complete atrioventricular block, AVB; Atrioventricular block.

Impact of Diastolic Dysfunction in Patients With Preserved Ejection Fraction Undergoing Permanent Cardiac Pacemaker Placement

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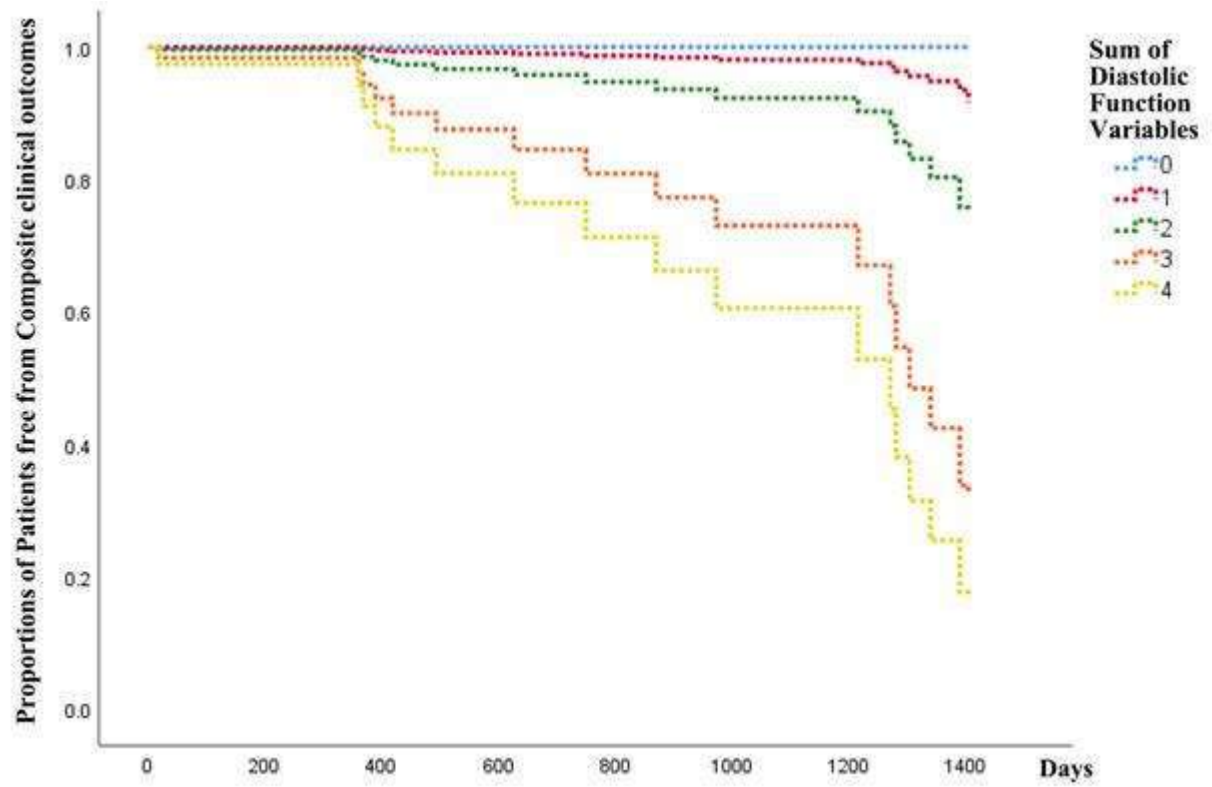
Background: Chronic right-ventricular (RV) pacing can exacerbate heart failure in patients with a low ejection fraction (EF). There is little information on the effects of diastolic dysfunction (DD) in patients with preserved EF undergoing permanent pacemaker (PPM) placement. We aimed to investigate the clinical outcomes in these patients.

Methods: This multicenter, retrospective analysis of PPM use in Chonnam, South Korea, included all patients with preserved EF undergoing transvenous PPM implantation for atrioventricular blockage from 2017 to 2019. Patients were divided into two groups according to DD. Clinical characteristics, 12-lead electrocardiograms, echocardiography, and laboratory parameters were evaluated. Composite outcomes were defined as 1) hospitalization, and 2) cardiac death by heart failure during the 15-month follow-up period.

Results: One hundred sixty-seven patients (66 men; overall mean age, 75.3 ± 11.9 y) were divided into two groups: 125 normal vs 42 DD. Compared with normal subjects, the DD group included older patients (mean age, 79.1 ± 9.9 vs 74.0 ± 12.3 ; $p = 0.016$), and had longer paced QTc interval (pQTc, 168.5 ± 20.1 vs 159.1 ± 16.3 ms; $p < 0.001$). Fifteen patients were hospitalized and two died. In a Cox proportional regression analysis, DD (hazard ratio [HR], 7.343; 95% confidence interval [CI], 2.035–26.494; $p = 0.002$) and pQRSd (HR, 1.046; 95% CI, 1.004–1.091; $p = 0.033$) were independent predictors of composite outcomes.

Conclusions: In patients with DD, RV pacing raised the risk of pacing-induced heart failure despite preserved left-ventricular function. Thus, patients with DD should be monitored intensively.

SUPPORTING DOCUMENTS



Possibility to Achieve Successful VDD Pacing During High Atrial Rate in Patients With Leadless Pacemaker

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Objective: A leadless pacemaker capable of atrioventricular (AV) synchronous pacing is a relatively new cardiac implantable electronic device with the unique feature that it lacks leads but allows for AV synchrony. However, AV synchrony of AV-synchronous leadless pacemakers is somewhat inferior to that of transvenous pacemakers, and this disadvantage is particularly apparent in case of high atrial rate. We report a case with high atrial rate (around 100 beats per minute) but with AV synchrony close to 100% thanks to the ingenious use of settings.

Materials and Methods: An 82-year-old woman with complete AV block received an AV-synchronous leadless pacemaker. After implantation, the pacemaker was programmed to VDD mode and atrial sensing was adjusted. The preoperative atrial rate was just under 100 beats per minute. A high atrial rate persisted thereafter, and the percentage of atrial mechanical sensed-ventricular pacing (AM-VP) was 66.5% at follow-up device interrogation 3 days after implantation.

Result: After adjusting the A3 window end interval and the A4 threshold and turning off rate smoothing, the percentage of AM-VP has remained above 97% for more than a few months despite of sustained high atrial rate. The ECG also showed appropriate AV synchrony.

Conclusion: AV-synchronous leadless pacemakers can achieve adequate AV synchrony with appropriate adjustments even when atrial rate is high in some patients.

Incidence, Risk Factors, and Characteristics of Stress Induced Cardiomyopathy After Permanent Pacemaker Implantation

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Objectives: We aimed to identify the incidence, risk factors, and characteristics of stress induced cardiomyopathy (SCMP) after permanent pacemaker (PPM) implantation.

Materials and methods: Data on 39 consecutive patients with PPM implantation at Dongkang hospital from 2021 to 2022 were retrospectively analyzed. Echocardiography was routinely performed before and after the procedure. Post procedural echocardiography was performed a day after the procedure. SCMP was diagnosed on the basis of echocardiography and coronary angiography. Baseline, procedural, and echocardiographic characteristics were analyzed.

Results: The incidence of SCMP after PPM implantation was 7.7%. Risk factors for SCMP after PPM implantation were intensive care unit (ICU) stay before procedure, diastolic dysfunction, and high peak systolic pressure gradient of tricuspid valve. Among 3 patients with SCMP, 2 patients were older than 85 years old with ICU stay before the procedure. Another patient with SCMP was relatively younger age (59 years old), however she had same day revision of atrial lead because of lead dislodgement. Worsening of ventricular lead measurement was observed in one patient. In this patient, even echocardiography improved a week after the diagnosis of SCMP, ventricular lead measurement improved 2 months after the diagnosis of SCMP.

Conclusion: Incidence of SCMP after PPM implantation can be relatively high, and it can cause temporary worsening of ventricular lead measurements. Risk factors for SCMP after PPM can be old age with prior ICU stay or lead revision, however, it needs further study.

SUPPORTING DOCUMENTS

Table 1. Baseline, procedural, and echocardiographic (pre-procedural) characteristics of patients with and without stress induced cardiomyopathy after permanent pacemaker implantation

Stress induced cardiomyopathy	No (N=36)	Yes (N=3)	P-value
Age (years)	75.2 ± 9.3	77.7 ± 16.2	0.673
Sex (male)	9 (25.0%)	1 (33.3%)	1
BMI (kg/m ²)	23.5 ± 3.4	22.7 ± 2.9	0.671
Diagnosis			0.614
SSS	14 (38.9%)	2 (66.7%)	
AVB	19 (52.8%)	1 (33.3%)	
AF SVR	3 (8.3%)	0 (0.0%)	
Hypertension	23 (63.9%)	2 (66.7%)	1
Diabetes	17 (47.2%)	0 (0.0%)	0.328
Atrial fibrillation	12 (33.3%)	1 (33.3%)	1
History of MI	0 (0.0%)	0 (0.0%)	N-S
PCI	6 (16.7%)	0 (0.0%)	1
Heart failure	0 (0.0%)	0 (0.0%)	N-S
History of stroke	7 (19.4%)	0 (0.0%)	0.952
Open heart surgery	2 (5.6%)	0 (0.0%)	1
Chronic lung disease	0 (0.0%)	1 (33.3%)	0.108
Chronic liver disease	0 (0.0%)	0 (0.0%)	N-S
Hemodialysis	2 (5.6%)	0 (0.0%)	1
Creatinine (mg/dL)	1.2 ± 1.2	0.9 ± 0.0	0.227
ICU stay before procedure	1 (2.8%)	2 (66.7%)	0.004
Temporary pacemaker	4 (11.1%)	0 (0.0%)	1
Number of leads			1
Single chamber	3 (8.3%)	0 (0.0%)	
Dual chamber	33 (91.7%)	3 (100.0%)	
Procedure time (min)	66.2 ± 20.2	50.3 ± 8.0	0.189
Pocket hematoma	1 (2.8%)	0 (0.0%)	1
Lead revision	1 (2.8%)	1 (33.3%)	0.346
Ejection fraction (%)	63.1 ± 4.6	59.7 ± 6.4	0.236
LV end-diastolic dimension (mm)	48.9 ± 4.0	50.3 ± 3.2	0.548
E/E'	15.6 ± 5.9	25.2 ± 6.8	0.037
LA diameter (mm)	40.3 ± 7.6	42.0 ± 7.2	0.712
LAVI (mL/m ²)	52.7 ± 16.9	68.1 ± 24.6	0.157
Any valvular disease *	12 (33.3%)	0 (0.0%)	0.582
TRPG (mmHg)	34.6 ± 10.0	49.8 ± 19.1	0.025

Data are reported as mean ± standard deviation, medians (interquartile range), or numbers (n).

BMI=body mass index; SSS=sick sinus syndrome; AVB=atrioventricular block; AF SVR=atrial fibrillation slow ventricular response; ICU=intensive care unit; MI=myocardial infarction; N-S=non-specified; PCI=percutaneous coronary intervention; LV=left ventricle; LA=left atrium; LAVI=left atrial volume index; TRPG=peak systolic pressure gradient of tricuspid valve

* Any valvular disease = moderate to severe stenosis or regurgitation at any valve

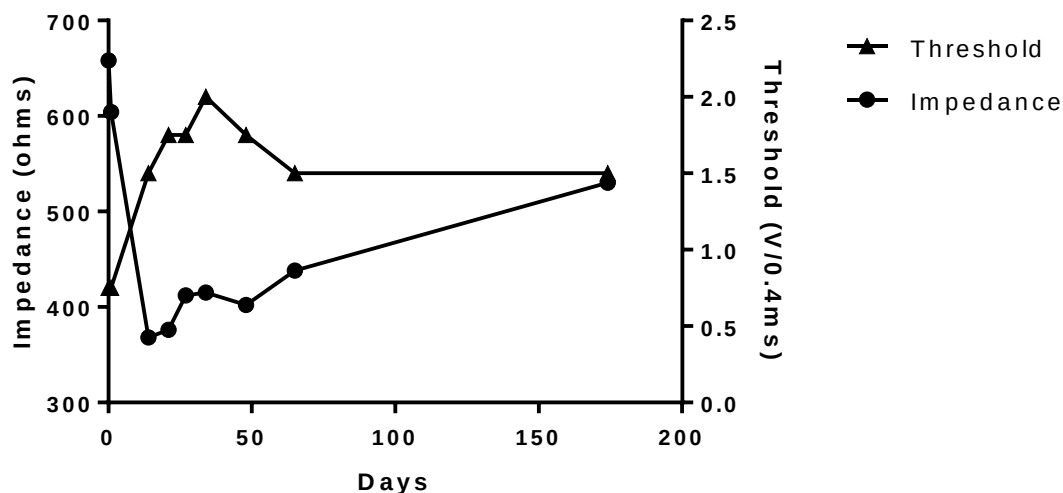


Figure 1. Impedance and threshold of ventricular lead after stress induced cardiomyopathy. In this patient, left ventricular ejection fraction (LVEF) and regional wall motion abnormality (RWMA) improved a week after the diagnosis of stress induced cardiomyopathy. However, improvement of ventricular lead measurements was slower than improvement of LVEF and RWMA.

The Effect of Electrode Location on Battery Longevity During Leadless LV Endocardial Pacing

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Objective: The WiSE-CRT system (EBR Systems, CA, USA) delivers leadless LV endocardial pacing. The conventional location for the electrode is the lateral wall, however a technique to implant on the LV septum has been recently described. In addition to the potential advantages of left bundle branch capture, a septal electrode is closer to the transmitter than a lateral wall electrode. We aimed to assess the differences in estimated battery longevity between a septal and lateral wall electrode location.

Materials and Methods: 8 patients underwent acoustic window screening prior to WiSE-CRT implantation. Target positions for the electrode (septum and lateral wall) were identified on transthoracic echocardiography with the probe positioned in the planned transmitter location. Anterior-posterior distance and angle between the provisional transmitter and electrode locations were measured. The effect of distance and angle on estimated energy requirements and battery longevity were modelled.

Results: The distance from the skin surface to the septum was significantly shorter than the distance to the lateral wall (6.2 ± 1.5 vs 11.9 ± 1.5 cm; $P < 0.001$). There was no difference in angle between the two provisional electrode locations (17.5 ± 9.6 vs 17.5 ± 4.6 degrees; $P > 0.05$). There was a reduced estimated pacing energy requirement for a septal vs lateral wall electrode location (5.56 ± 3.2 vs 12.7 ± 1.6 dB; $P = 0.001$) [figure 1], which would result in a predicted 2.7 fold increase in battery life.

Conclusion: A septal location for the WiSE-CRT electrode is associated with a longer estimated battery longevity compared to the conventional lateral wall location.

SUPPORTING DOCUMENTS

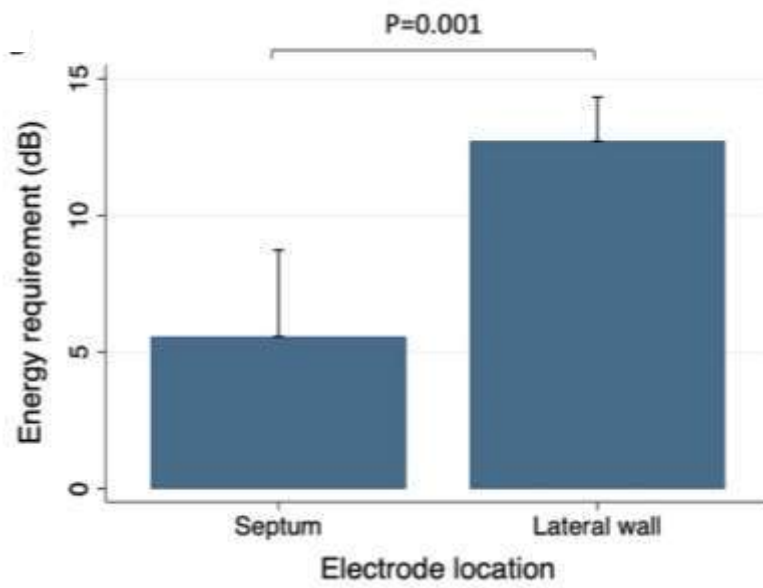


Figure 1.

The Incidence and Outcomes of Atrial High-Rate Episodes (AHRE) in a Single Tertiary Center

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Objectives: Previous studies have shown that patients with AHRE have an elevated risk of stroke and thromboembolism. This study aims to observe the incidence and outcomes of AHRE in our cardiology clinic follow up.

Materials and Methods: This is a retrospective, single-center study of patients who underwent a Cardiovascular Implantable Electronic Device (CIED) with atrial lead/sensing from January 2015 to March 2020. Among 413 of patients, 92 patients fulfilled the inclusion and exclusion criteria. Device electrogram and electrocardiography (ECG) of all eligible patients had been analyzed and their baseline characteristics had been obtained. Chi-squared and independent t-tests in SPSS version 21 had been used to analyze the categorical and quantitative variables, respectively.

Results: The mean duration of follow up was 51.18 (SD 26.37) months. Out of 92 patients, 42 (45.7%) had AHRE. Among the AHRE cohort, 54.8% (n = 23) had subclinical atrial fibrillation (AF) and 45.2% (n = 19) had subclinical atrial flutter (AFL). AHRE more commonly seen in patients with sinus node dysfunction (63.3% vs 36.7%, p value 0.02). There was increase in AHRE frequency per year but none of the patients developed clinical AF and AFL. There was no stroke reported but two major cardiovascular events (MACE) (4.75%, p value 0.46) occurred among AHRE patients.

Conclusion: In our study, the incidence of AHRE among CIED patients was 45.7%, which was similar to various previous publications. However, none of them developed stroke and the MACE were non-significant.

Real-world Effectiveness of Automated Dynamic Optimization and Left Ventricular-only Pacing Algorithm of Cardiac Resynchronization Therapy

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Objectives: Cardiac resynchronization therapy (CRT) device-based algorithm adjusts the atrioventricular and ventriculo-ventricular delays according to dynamic changes of intrinsic conduction. Despite results from the clinical trial showed favorable outcomes of automated optimization algorithm, few real-world data exist. We investigated the efficacy of AdaptivCRT (aCRT) algorithm on clinical and echocardiographic outcomes using a retrospective multicenter registry in Korea.

Materials and methods: Between September 2013 and March 2020, 515 patients implanted with CRT device possessing aCRT algorithm were identified from 25 tertiary hospitals. A total of 367 patients were included for the analysis after excluding those with replaced generator, persistent atrial fibrillation, narrow QRS duration, or follow-up loss. Patients were categorized into 3 groups according to the pacing mode; conventional biventricular pacing (BiV) (n = 122), aCRT with <50% left ventricular-only pacing (LVP) (n = 159), and aCRT with ≥50% LVP (n = 86). The primary outcome was a composite of all-cause death, heart failure hospitalization, and defibrillator therapy for ventricular tachyarrhythmia.

Results: During a median 28-month follow-up, the aCRT with ≥50% LVP group showed a significantly lower incidence of primary outcome (18.6%) compared to the other groups (37.7% in the BiV, and 32.7% in the aCRT with <50% LVP groups; p = 0.01).

Conclusion: Our largest Asian-Pacific real-world data showed that CRT with a higher LV-only pacing percentage (≥50%) showed better clinical outcomes compared to conventional BiV CRT.

SUPPORTING DOCUMENTS

Table 1. Baseline characteristics

Variable	Conventional BiV (n = 122)	Adaptive CRT LVP <50% (n = 159)	Adaptive CRT LVP ≥50% (n = 86)	P value
Demographics				
Age	65.1 ± 12.0	67.8 ± 12.4	65.8 ± 11.7	0.16
Male	79 (64.8)	104 (65.4)	43 (50.0)	0.04
BMI	23.9 ± 3.6	23.7 ± 3.9	23.8 ± 3.9	0.95
NYHA class				
II	24 (19.7)	36 (22.9)	21 (25.0)	0.65
III + IV	98 (80.3)	119 (75.8)	63 (75.0)	0.58
Hypertension	66 (54.1)	98 (61.6)	46 (53.5)	0.33
Diabetes	46 (37.7)	71 (44.7)	46 (53.5)	0.08
Chronic kidney disease	26 (21.3)	40 (25.2)	19 (22.1)	0.72
Cerebrovascular disease	10 (8.2)	20 (12.6)	6 (7.0)	0.28
Ischemic CMP	17 (13.9)	34 (21.4)	16 (18.6)	0.28
Paroxysmal AF	23 (18.9)	31 (19.5)	4 (4.7)	0.005
Medication				
Beta blocker	100 (82.0)	117 (73.6)	68 (79.1)	0.23
RAS blocker	101 (82.8)	144 (90.6)	74 (86.0)	0.15
Aldosterone antagonist	86 (70.5)	109 (68.6)	63 (73.3)	0.74
Diuretics	107 (87.7)	139 (87.4)	70 (81.4)	0.35
Echocardiographic findings				
LVEF, %	24.8 ± 6.7	24.8 ± 5.8	24.1 ± 6.1	0.64
LVEDD, mm	66.6 ± 9.1	66.7 ± 8.4	66.7 ± 9.5	0.99
LVESD, mm	56.7 ± 10.3	57.2 ± 9.3	58.0 ± 10.6	0.62
LVEDV, ml	209.3 ± 75.6	202.3 ± 75.3	213.2 ± 85.7	0.63
LVESV, ml	158.0 ± 69.4	152.8 ± 63.2	159.5 ± 69.3	0.77

Electrocardiographic findings				
LBBB	102 (83.6)	123 (77.4)	84 (97.7)	<0.001
Heart rate, bpm	74 ± 18	72 ± 16	73 ± 13	0.59
PR interval, ms	193.1 ± 40.8	198.6 ± 43.6	182.7 ± 28.7	0.02
QRS duration, ms	169.7 ± 23.2	167.1 ± 23.0	163.3 ± 19.1	0.12
Indication for CRT				
De novo	93 (76.2)	127 (79.9)	84 (97.7)	<0.001
Upgrade	29 (23.8)	32 (20.1)	2 (2.3)	
Type of CRT				
CRT-D	120 (98.4)	153 (96.2)	85 (98.8)	0.35
CRT-P	2 (1.6)	6 (3.8)	1 (1.2)	
LV leads (RAO)				
Non-apical	118 (96.7)	147 (92.5)	84 (97.7)	0.12
LV leads (LAO)				
Lateral	122 (100.0)	153 (96.2)	84 (97.7)	0.10
CRT pacing, %	98.9 ± 5.5	99.4 ± 1.7	99.8 ± 0.3	0.15
Follow-up duration, months	37.7 ± 20.6	33.1 ± 21.7	32.9 ± 20.0	0.13

Values are presented as mean ± SD or number (percentage). P value refers to the difference among the three groups by ANOVA test or chi-squared test.

Post-procedural Complete Heart Block and Left Bundle Branch Area Pacing After Transcatheter Aortic Valve Implantation

Ms Andini Wardhani^{1,2}, Mr Dony Yugo Hermanto^{1,2}, Dr Dicky Armein Hanafy^{1,2}, Dr Sunu Budhi Raharjo^{1,2}, Prof Yoga Yuniadi^{1,2}

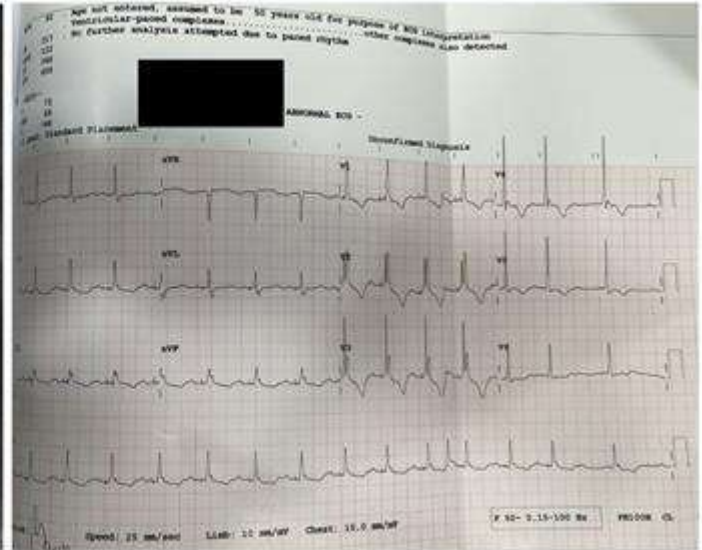
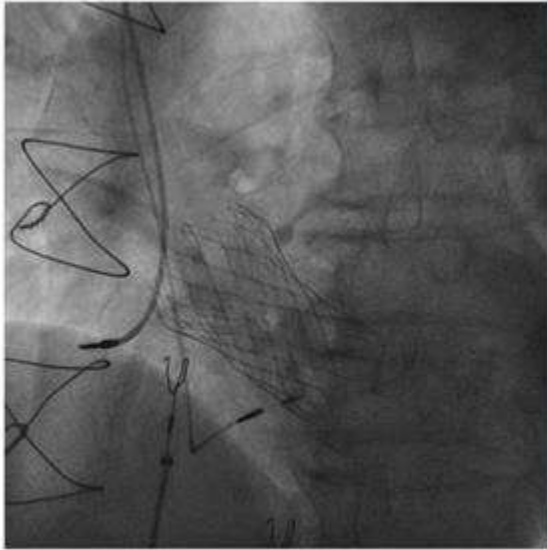
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Objective: To report the single-center clinical experience of new-onset complete heart block (CHB) requiring permanent pacemaker implantation (PPI) after transcatheter aortic valve implantation (TAVI).

Case Illustration: An ECG of 78-year-old man after TAVI procedure showed a CHB with LBBB ventricular escaped rhythm (QRSd of 153 ms). Patient previously had history of revascularized CAD but still having heart failure symptoms without any conduction abnormalities. Echocardiography showed severe aortic stenosis (AS) and decreased LVEF of 44%. A clinical CHB was manifested immediately after TAVI procedure. Dual-chambered PPI with left bundle branch area pacing was implanted successfully (corrected QRSd of 102 ms, LVAT 73 ms, and V1-V6 R-R interval of 33 ms), since infrahisian block was established. Early echocardiography evaluation evinced well-seated low gradient (17 mmHg) prosthetic valve and restoration of LVEF (49%). Patient was discharged with an improved symptom.

Conclusion: TAVI has become an accepted treatment option for patient with high-risk severe AS. New onset CHB due to mechanical compression of large prostheses after TAVI is not uncommon and associated with higher incidence of PPI. Decreased LVEF becomes consequence since this conduction abnormality leads to ventricular dyssynchrony and adverse cardiac remodeling. Although occurrence of new CHB was inevitable and remains a vexing issue, PPI showed good outcome with narrower QRSd and recover LVEF after procedure. PPI on CHB post TAVI procedure could be an alternative to preserve functional physiological LV conduction.

SUPPORTING DOCUMENTS



Cardiac Physiologist Led Micra AV Clinic - Experience From a Tertiary Hospital

Mr David Yun¹, Dr Elizabeth Woollard¹, Dr Vincent Paul¹

¹*Fiona Stanley Hospital, Perth, Australia*

Objectives: Fiona Stanley Hospital is the only site in Australasia that is independent of industry support in the implantation of Micra Ventricular (VR) and Micra Atrio-ventricular (AV) devices. Ninety-three Micra devices have been implanted, including 76 VR and 17 AV devices.

The Micra AV uses the mechanical activity of the atrium to determine AV synchrony (AVS) and poses unique challenges in programming. We report the experience of a dedicated cardiac physiologist (CP) led Micra AV clinic.

Materials and Methods: Standard outpatient pacemaker clinic setting in tertiary hospital for patients with Micra AV looking at programming issues and success in achieving AVS.

Results: For the AV devices, a median follow-up time of 12 months was observed (range: 1-26 months). AVS (>75%) was achieved by one month for all 17 patients.

AVS was difficult in patients with marked first degree heart block and patients requiring intermittent pacing. This was able to be programmed around with manipulation of timing windows. AVS was lost in patients with a higher or lower sinus rate and the bradycardic events were able to be programmed around.

A single patient did not have AVS at outset due, this improved over time as atrial function improved after valvular intervention.

Conclusion: Micra AV poses new challenges as it relies on both mechanical and electrical parameters. With advancing technology in leadless pacing, there is a growing potential for cardiac physiologists to broaden practice. Understanding the concepts and challenges has allowed us to achieve AVS in a high proportion of our patients.

Mortality Outcomes, incidence of Shocks in Patients implanted With AICD: a Single-center Experience Over Two Decades

Dr Harsh Pandey¹, Dr Narayanan Namboodiri¹, Dr Krishna Kumar Mohanan Nair¹, Dr Ajit Kumar VK¹

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Objectives: To assess appropriate shock & inappropriate shocks in patients who underwent ICD therapy in primary & secondary prevention group.

Materials and Methods: This is a descriptive single-center study with retrospective case enrolment and prospective follow-up. Patients who underwent ICD/CRT-D implantation from January 1997 to June 2020 were identified by searching an institutional database. The study population was grouped by type of prevention (secondary or primary) for sudden cardiac death. Device interrogation was checked for appropriate and inappropriate shocks.

Results: A total of 428 (81% male, mean age 55+/-11 years) ICD recipients were included. Of these, 290 (67.7%) patients received an ICD for secondary prevention of sudden cardiac death and 138 (32.3%) patients for primary prevention. During a 1913 patients year follow up (mean of 4.4+/-2.7 years), Secondary prevention patients exhibited a 33% increased risk for an appropriate shock compared with primary prevention patients. The incidence of appropriate shock was 14% in the primary prevention group & 30% in the secondary prevention group. On multivariate analysis, LV dysfunction (<50%) was a significant predictor for appropriate shock.

Conclusion: During long-term follow-up, the secondary prevention AICD recipient group compared to the primary prevention group exhibited a higher risk of appropriate therapy. Both groups showed lower & similar occurrences of inappropriate shocks.

Low Infection Rate of 3-incision Technique During Long-term S-ICD Follow Up

Dr Robert Puchalski¹, Dr Stuart Healy¹, Dr David Adam¹, Dr Logan Bittinger¹, Dr Jeff Alison¹, Dr Emily Kotschet¹

¹*Monash Heart, Melbourne, Australia*

Objectives: To assess long-term complication rate, particularly infection, in consecutive patients at a single site, Monash Health.

Materials and Methods: We performed retrospective analysis of 33 consecutive S-ICD procedures performed at Monash Health from 31/08/2015 to 24/03/2022. All procedures were performed under general anaesthetic, using the 3-incision technique. All patients underwent peroxide pocket washout before closing. DFTs were performed at the conclusion of all cases. Follow-up analysis was performed by assessing procedural notes, device checks, and clinic letters. We collected information regarding indication and disease aetiology, infection, premature battery depletion, time-to-generator change, inappropriate shocks, lead failure, lead replacement, and requirement for trans-venous device.

Results: Follow up was complete for 31/33 (94%) patients. Mean follow up time was (3.3 years $\pm$ 1.8years). Twenty-five (76%) patients were male. The indication was primary prevention in 11 patients (33%), and there were 8 patients (24%) with HOCM. DFT was successful in 32/33 patients (97%), and only unsuccessful in one patient because VF could not be induced. There was one infection during follow up (3%). This lead was extracted and replaced on right parasternal position. There were four premature battery depletions (12%), five patients (15%) suffered inappropriate shocks. There was one lead replacement for failure. One patient (3%) required the addition of a trans-venous system for a pacing indication.

Conclusion: S-ICD implantation can be performed with a low complication rate. Literature suggests up to 10% infection rate for 3-incision technique. Our infection rate compares favourably to published data.

Adopting Ultrasound-guided Axillary Vein Access for CIED Lead Implantation

Asst Prof Jongmin Hwang¹, Associate professor Hyoung-Seob Park¹, Professor Seongwook Han¹

¹*Keimyung University Dongsan Hospital, Daegu, South Korea*

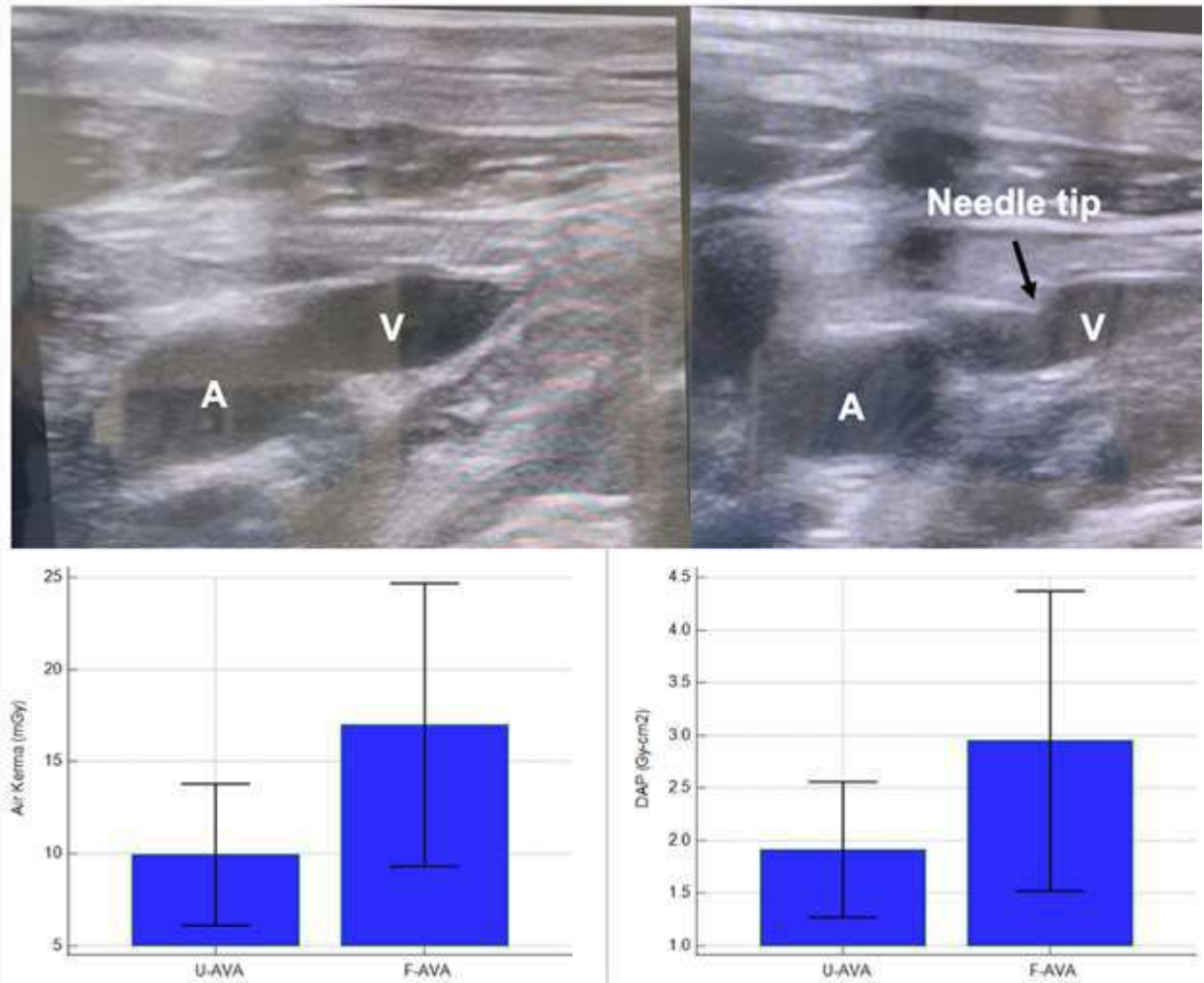
Objective: There are many reports that US-guided axillary vein access (U-AVA) is a safe and effective method. Nevertheless, U-AVA has not been adopted universally in cardiac implantable electronic devices (CIED) lead implantation procedures, especially in Korea.

Materials and Methods: This is a single center, prospective study of patients undergoing new CIED implantation from May 2021 to July 2022. Patients' baseline demographic and procedural data were collected, and it was compared with January 2019 to April 2021 fluoroscopy-guided axillary vein access (F-AVA) patients' data.

Results: Total 198 patients underwent the U-AVA and 230 patients underwent the F-AVA approach. The U-AVA was successful in 93.4% of patients (185/198) and the most common reason for failed U-AVA was ≥ 3 cm subcutaneous tissue thickness. Compared to conventional F-AVA procedure, U-AVA showed significantly shorter Air-Kerma, Dose-Area Product (9.96 ± 6.35 mGy vs. 17.0 ± 12.1 mGy, $P = .037$; 1.91 ± 1.02 Gy-cm² vs. 2.95 ± 2.24 Gy-cm², $P = .014$). There were no significant differences between the two groups in mean implant procedure time (57.54 ± 12.8 min vs. 65.91 ± 12.21 min, $P = .89$). However, complications related to axillary venous approach were dramatically decreased in U-AVA patients' group (one pneumothorax in U-AVA group vs. two pneumothorax, two severe hematoma due to axillary artery puncture).

Conclusion: The U-AVA for CIED lead implantation is a feasible and safe alternative approach and offers a significant reduction in radiation doses without increasing procedural time. Also, venous approach related complication was decreased.

SUPPORTING DOCUMENTS



Conduction system pacing in the Post AVR patients and atrioventricular conduction disturbance: A single-center experience

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¹*The Madras Medical Mission, Chennai, India*

Objectives: To study the feasibility and safety of conduction system pacing in patients with Post aortic valve replacement and high degree of atrioventricular conduction block.

Methods: Consecutive patients who qualify for pacemaker implantation post aortic valve replacement either by transcatheter (TAVR) or surgical (SAVR) were enrolled. Procedural success and outcomes were assessed and analyzed. CSP was performed using the Select Secure (3830; Medtronic) pacing lead, delivered through a fixed curve (C315HIS; Medtronic)

Results: Total of twelve patients required permanent pacemaker after aortic valve replacement (age 64+7 Years, 40% female, QRSd: 153+11 milliseconds). Eleven patients (91%) successfully underwent CSP. Seven had surgical and four had a transcatheter aortic valve replacement. His bundle pacing (HBP) was achieved in 5 patients and six underwent left bundle branch area pacing (LBBAP). One patient in the HBP group had lead dislodgement and later lead was repositioned in the RV apex. Mean QRSd at baseline and post-procedure between HBP and LBBAP groups was not significantly different. Mean thresholds in HBP 2.5+0.8V at 1.0 milliseconds and LBBAP 1.3+0.6 V at 1.0 milliseconds. R wave amplitude in HBP is 5.1+3.2 mV and LBBAP is 12.7+6 mV. During the 12-month follow up one patient in the HBP group had increased thresholds and none in the LBBAP group.

Conclusions: Conduction system pacing in post aortic valve replacement (TAVR/SAVR) patients with pacing requirements is feasible and Safe. LBBAP had a higher implant success rate and stable lead parameters than HBP

Conduction system Pacing (CSP) Feasibility in Routine Clinical Practice: Experience from an Indian Center

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Objectives: To assess the feasibility and outcomes of CSP in patients eligible for cardiac resynchronization therapy (CRT) and pacing indication.

Methods: CSP has been attempted in patients with left ventricular ejection fraction <50% and indications for CRT or pacing. Procedural outcomes, His bundle or left bundle branch capture, NYHA class, QRS duration, and echocardiographic data were recorded. Clinical and echocardiographic responses were assessed.

Results: CSP was attempted in 189 patients and failed in 10 cases. LBBAP was attempted in 137 patients and his bundle pacing in 42 patients. CSP was attempted in 68% of patients with bradyarrhythmia and SSS patients. In HBP, selective HBP was achieved in 14 patients, there was a significant improvement in LVEF (49.3 ± 9.3 vs. 36.7 ± 9.2) in the LV dysfunction subgroup. Out of 137 LBBA pacing, selective LBB pacing was achieved in 18 patients. LBBAP threshold and R-wave amplitudes were 0.7 ± 0.3 V at 0.6 ms and 10.6 ± 6 mV at implantation and remained stable during a mean follow-up of 6 ± 5 months. LBBAP resulted in significant QRS narrowing from 148 ± 19 to 123 ± 14 ms ($p < 0.01$) in CRT indication patient. LVEF improved from $36 \pm 11\%$ to $48 \pm 9\%$ ($p < 0.01$) in LV dysfunction group. Clinical and echocardiographic responses were observed in 85% of CRT indication patients.

Conclusions: Conduction system pacing is feasible and safe and provides an alternative option for CRT and bradyarrhythmia. LBBAP provides remarkably low and stable pacing thresholds.

Electrical Synchrony Improvement With a Programmable Dynamic Atrioventricular Delay Algorithm

Dr. Bernard Thibault², Dr. Anthony Chow³, Mr Jan Mangual¹, Dr. Nima Badie¹, Dr. Peter Waddingham³, **Dr Luke McSpadden¹**, Dr Tim Betts⁴, Dr Leonardo Calo⁵, Dr. Francisco Leyva⁶
¹Abbott, Sylmar, United States, ²Montreal Heart Institute, Montreal, Canada, ³Barts Heart Centre, London, UK, ⁴Oxford University, UK, ⁵Policlinico Casilino, Italy, ⁶Aston Medical School, UK

Intro: Dynamic atrioventricular delay (AVD) with SyncAV have been shown to improve electrical synchrony with biventricular (BiV) and left ventricular (LV) only pacing. However, it is unknown if algorithms with fixed AV offsets provide the same benefit as a dynamic algorithm with programmable offsets.

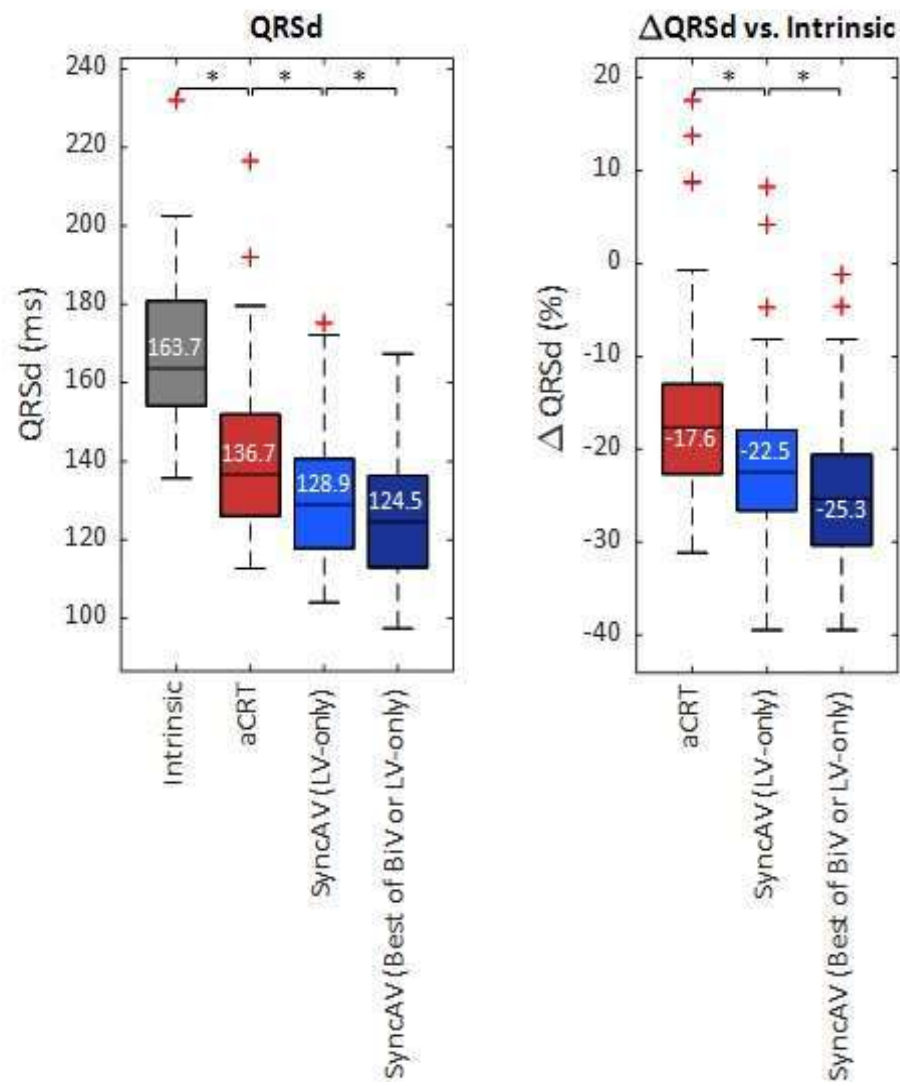
Objective: Compare QRS duration (QRSd) reduction of LV-only pacing with dynamic AVD fixed at 70% of the intrinsic AV interval vs. dynamic AVD with a patient-tailored AV offset (SyncAV).

Method: CRT implants (LBBB, QRSd $\geq$ 150 ms) were prospectively enrolled. Blinded QRSd was measured from 12-lead ECG during intrinsic, LV-only pacing 70% AVD, and BiV and LV-only pacing with SyncAV enabled and optimized (10-70% offset) to minimize QRSd.

Results: 50 patients were evaluated (66.6 yr, 41.9% male, 18.9% ischemic, 26.0% EF, 163.7 ms intrinsic QRSd). LV-only 70% AVD reduced QRSd by 17.4% vs. intrinsic to 137.2 ms ($p < 0.005$ vs. intrinsic). LV-only with optimal SyncAV offset reduced QRSd by 22.0% vs. intrinsic to 129.4 ms ($p < 0.005$ vs. intrinsic and LV-only 70% AVD). In this cohort, activating BiV pacing with optimal SyncAV programming resulted in a further narrowing of QRSd (25.3%) vs. intrinsic to 124.5 ms ($p < 0.005$ vs. intrinsic, LV-only 70% AVD, and LV-only SyncAV). BiV with SyncAV resulted in narrower QRSd compared to LV-only SyncAV in 70% (35/50) of patients.

Conclusion: LV-only pacing with optimized dynamic AVD offset with SyncAV yielded a narrower QRSd compared to fixed 70% AVD. BiV pacing with SyncAV resulted in a greater reduction of QRSd than LV-only in the majority of patients..

SUPPORTING DOCUMENTS



QRS Duration After Biventricular Pacemaker Implantation - Whether There Is Any Impact Of Electrical Axis

Dr Rahul Singhal¹

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Background: Common indication for Biventricular (BiV) pacing is treating HF with interventricular or intraventricular dyssynchrony and LBBB. Clinical improvements are expected with shortening of QRS duration after BiV. I aimed at observing differences in changes of QRS morphology, duration, electrical axis before and during simultaneous, LV and RV pacing.

Objective: Study was initiated to ascertain correlation between these parameters.

Methods: 53 patients with mean age 51 yrs with 67% males were studied. Correlation was evaluated between axis and duration of QRS complex by calculating electrical axis of the heart (QRS vector) using mathematical formula $\tan\theta = (I+2III)/(I+V+3)$ before BiV implantation, during LV, RV and simultaneous BiV pacing.

Results: Duration of QRS complex changed in all but 7 patients with statistically significant ($P < 0.01$) mean difference 38.7 ± 9.1 ms. Our study found correlation between QRS complex duration during BiV pacing and following parameters: 1 Electrical axis of preoperative QRS complex (correlation coefficient was -0.76), 2 Preoperative duration of QRS complex (correlation coefficient was $+0.98$), 3 Duration of QRS complex during LV pacing (correlation coefficient was $+0.96$). Best results (narrowing of QRS) were achieved when QRS axis before implantation was between 66° and 86° normal or slightly to the right axis (42.5% of patients) then the QRS with LBBB and left axis deviation.

Conclusion: This study indicates that LBBB morphology and normal axis of preoperative QRS complex showed greater predisposition for narrowing of QRS after implantation of biventricular pacemaker. Duration of preoperative and LV pacing QRS depends on ventricular conduction properties and has influence for postoperative QRS duration.

MICRA Implantation via the Right Internal Jugular Vein Access in a young patient: Case Report

Dr Muhammad Izzad Johari¹, Dr Rohith Stanislus¹, Zunida Ali¹, Noor Asyikin Sahat¹, Amirzua Ahmad Said¹, Azlina Daud¹, Gina Dayang Mani¹, Mohamad Halmy Aziman¹, Dr Low Ming Yoong¹, Dr Suraya Hani Kamsani¹, Dr Surinder Kaur Khelae Atma Singh¹, Dr Azlan Hussin¹
¹*National Heart Institute, Jalan Tun Razak, Malaysia*

Objective: To report safety and feasibility of MICRA implantation via right internal jugular vein (IJV)

Materials and Methods: We report the successful implantation of Micra™ TPS via right IJV in a young patient who required a leadless pacing system as a bridge due to a transvenous pacemaker infection.

Result: A 15 year old male patient was referred for an infected transvenous pacemaker 6 months after he was implanted with a dual chamber pacemaker for symptomatic congenital complete heart block. Blood culture grew *Staphylococcus Aureus*. The transvenous pacemaker system was subsequently explanted. A temporary wire was inserted.

As the infection was systemic, the patient was young and dependent on pacing, a decision to implant a leadless pacemaker system as a bridge was made. Femoral angiograms showed that the calibre of the femoral veins were small. Right internal jugular vein was angiographically able to accommodate the size of the sheath.

The right internal jugular vein was accessed with ultrasound guidance and 8F dilator was inserted. Right jugular vein was successively dilated before the insertion of the 27F leadless pacemaker sheath. The sheath was advanced with into the mid right atrium. The Micra pacemaker delivery catheter was advanced where it was then deployed at the mid right ventricle. Parameters were within acceptable parameters. The sheaths were then removed, and the skin was closed. Pacing parameter tested the next day and on 1 month follow up demonstrated stable electrical pacing parameters.

Conclusion: MICRA implantation via the right IJV is a safe and feasible alternative.

MICRA AV Leadless Pacemaker: Real world experience of 100 consecutive patients in National Heart Institute

Dr Muhammad Izzad Johari¹, Dr Suraya Hani Kamsani¹, Dr Rohith Stanislus¹, Zunida Ali¹, Noor Asyikin Sahat¹, Amirzua Ahmad Said¹, Azlina Daud¹, Gina Dayang Mani¹, Mohamad Halmy Aziman¹, Low Ming Yong¹, Dr Surinder Kaur Khelae Atma Singh¹, Dr Azlan Hussin¹

¹*National Heart Institute, Jalan Tun Razak, Malaysia*

Background: MICRA have been shown to be safe and effective. Recently, a new leadless pacemaker capable of maintaining atrioventricular synchronous pacing, the MICRA AV, was introduced. We report our clinical experience using the MICRA AV Transcatheter Pacing System (Medtronic, Minneapolis, MN, USA) in 100 patients over a period of 2 years

Methods: A retrospective review of all MICRA AV implanted between July 2020 and July 2022 was performed. Patients' demographic data, indication for pacing, pacing parameter performance up to a median follow up period of 2 years follow up were analysed

Results: A total of 101 patients who underwent the MICRA AV implantation were analyzed. 60 patients (60%) were male, and the mean age of the patients were 72 years old (range 35 - 92 years). The MICRA AV were successfully implanted in all of the patients (100 %). The mean P and R wave was 3.0 and 10.1mV respectively. The mean capture threshold at implant was 0.57 V@0.24ms (0.24 - 1.63V@0.24ms) and the implanting impedance were 610 ohms (430-1350 ohms). The P and R wave sensing, thresholds and impedances were noted to be stable at intermediate and long term follow up. There was no cardiac perforation, device dislodgement, infection or need for re-intervention immediate post implant or during the follow-up period of 2 years.

Conclusion: The MICRA AV implantation is safe and effective in a wide cohort of patient with an AV block pacing indication. The leadless pacemakers' clinical performances were stable during a median follow-up of 2 years.

Implantation of a Leadless Pacemaker in a Patient with an Inferior Vena Cava Filter

Dr Rohith Stanislaus¹, Dr Suraya Kamsani¹, Dr Jayakanthan Kolanthai Velu¹, Dr Yee Sin Tey¹, Dr Azlan Hussin¹, Dr. Surinder Kaur Khelae¹, Dr Muhammad Izzad Johari¹, Amirzua Ahmad Said¹, Azlina Daud¹, Mohd Halmy Aziman¹, Gina Dayang Mani¹, Zunida Ali¹, Noor Asyikin Sahat¹
¹*National Heart Institute, Kuala Lumpur, Malaysia*

Objective: To demonstrate the feasibility of implanting a leadless pacemaker in the setting of a IVC filter in a patient with vascular access issues

Material/Methods: An 80-year old female with ESRF and CHB was implanted with a conventional dual-chamber pacemaker 2 months prior. Recent admission for sepsis, intracranial/GIT bleed. During her recovery period, she developed a Left Common Femoral DVT. In view of her risk of Pulmonary Embolism an IVC filter was implanted. 2 weeks post IVC filter, she developed a PPM pocket infection necessitating explantation of the device.

However she was on dialysis via a Right IJV, an AVF had not been created yet. Her Right IJV catheter was exchanged with an 11F sheath, a 9F retrieval sheath with a 20mm loop snare was inserted and hooked onto the IVC, the sheath was advanced and the filter was partially collapsed.

This assembly was left in-situ while a second operator obtained right transfemoral venous access for the leadless pacemaker delivery sheath insertion. The delivery sheath successfully negotiated past the partially captured/collapsed IVC filter. A MICRA was then deployed as per standard procedure at right ventricular septal location. Device parameter were all within limits (R-wave 6.5mV, Impedance 560ohms, Threshold 0.38mV at 0.4ms).

The IVC filter was then re-deployed with femoral venogram guidance. The patient was stable throughout the procedure.

Conclusion: This case demonstrated that a leadless pacemaker implantation is feasible and safe in the presence of an IVC filter, without the risk of potentially damaging/compromising the IVC filter or pacemaker.

Clinical Implication of Fat Biopsy Among Patients With Requiring Cardiac Implantable Electronic Devices

Assoc Prof Jin-Kyu Park¹, Songyi Han¹, Asso Prof Ki-Seok Jang

¹*Hanyang University, Seoul, South Korea*

Objective: Transthyretin amyloidosis is an under-recognized cause of cardiomyopathy which associated cardiac arrhythmia and heart failure. Fat biopsy is one of supportive method to diagnosis of cardiac amyloidosis. We aimed to assess the clinical implication of amyloid deposit via fat biopsy in subjects with cardiac arrhythmia and heart failure.

Materials and Methods: We enrolled consecutive patients requiring cardiac implantable electronic devices during 2 years in single center. Thoracic subcutaneous fat was obtained during procedures and stained with Congo Red. Congo red staining was analyzed by two pathologists. 99mTc-3,3-disphosphono-1,2-propanodicarboxylic acid scintigraphy (99mTc-DPD) scintigraphy was also performed.

Results: Among total 73 patients (50.6% male), 58 (79.4%) patients received procedures of permanent pacemaker and 15 (20.6) patients did procedure of implantable cardioverter defibrillator and cardiac resynchronization therapy. Congo red was positive in 17 (23.3%) patients (16 bradyarrhythmia and 1 heart failure). In findings of 99mTc-DPD scintigraphy, there were positive in 5 (6.8%) patients (3 bradyarrhythmia and 2 heart failure). Only 1 case was finally diagnosed as hereditary cardiac amyloidosis. No serious complication was noticed in pocket site.

Conclusion: Fat biopsy with Congo red during procedure for cardiac implantable electronic device was suboptimal as first-screening tool for cardiac amyloidosis. However, this can be useful and safe method in case of clinically suspected cardiac amyloidosis.

Leadless Pacemaker Implantation With Absent Right Superior Vena Cava

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¹*Juntendo Nerima hospital, Nerima-ku, Japan*

Objective: To report a successful leadless (LP) pacemaker implantation in patient who had been implanted with an atrial single-chamber (AAI) pacemaker lead through persistent left superior vena cava (PLSVC).

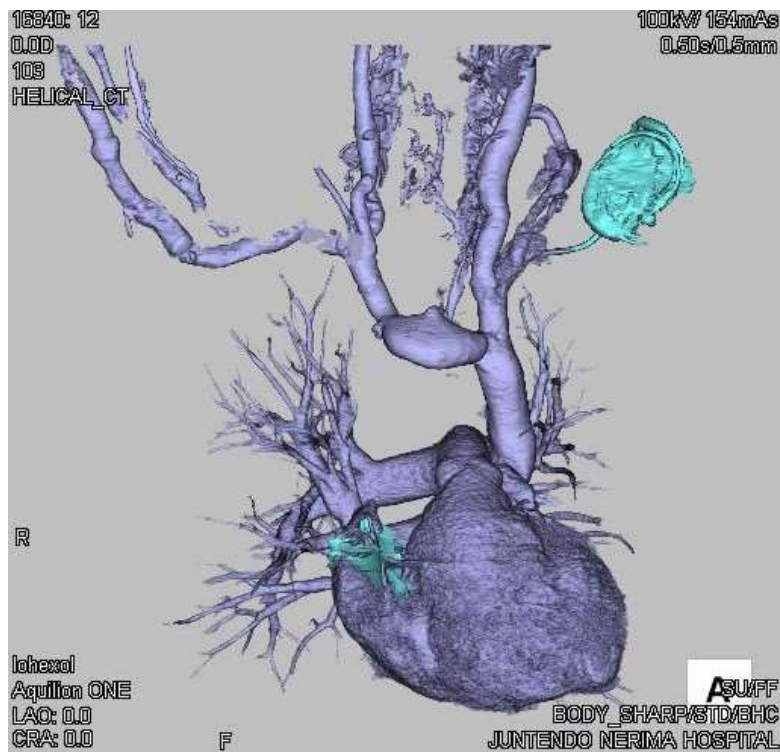
Materials and Methods: In our case, a 75-year-old man underwent pacemaker implantation because of symptomatic sick sinus syndrome (SSS). Preoperative venography confirmed an absent right superior vena cava (ARSVC) and a PLSVC. Right ventricular pacing was considered difficult, and he was implanted with an atrial single-chamber (AAI) pacemaker lead through PLSVC for SSS. Two years after operation, he was admitted to our hospital for symptomatic complete atrioventricular block (c-AVB). Three-dimensional CT scan also revealed an ARSVC (Panel A) and a PLSVC and we implanted a LP in right ventricle via the right femoral vein (Panel B, arrow).

Result: LP could follow not only the autologous atrial wave, but also the wave triggered by atrial pacing, indicating combination of AAI pacemaker and LP can work as dual chamber pacing system in our patient (Panel C).

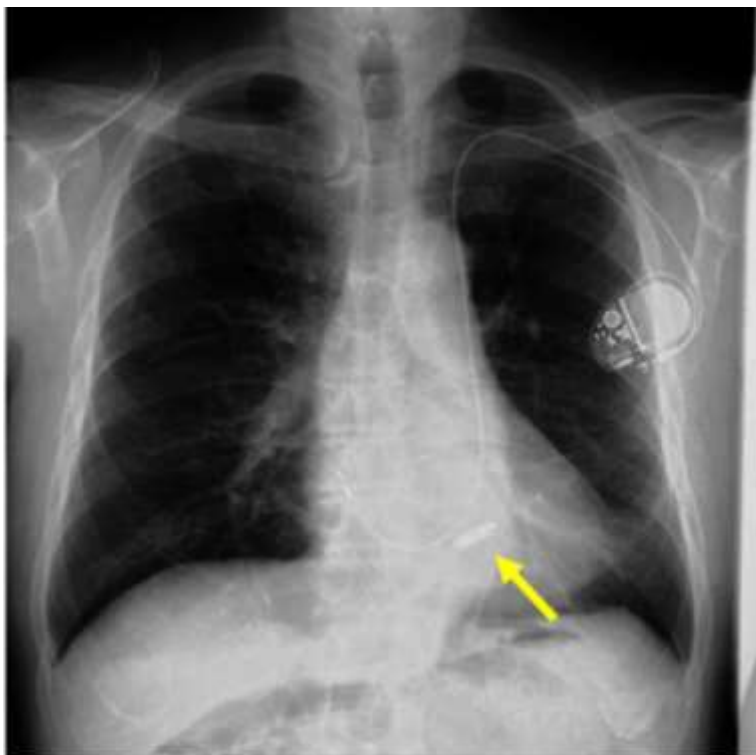
Conclusion: We reported a rare case in which c-AVB was detected in a patient with PLSVC who had been implanted with an atrial single chamber pacemaker lead. We managed a patient successfully by implantation of an LP.

SUPPORTING DOCUMENTS

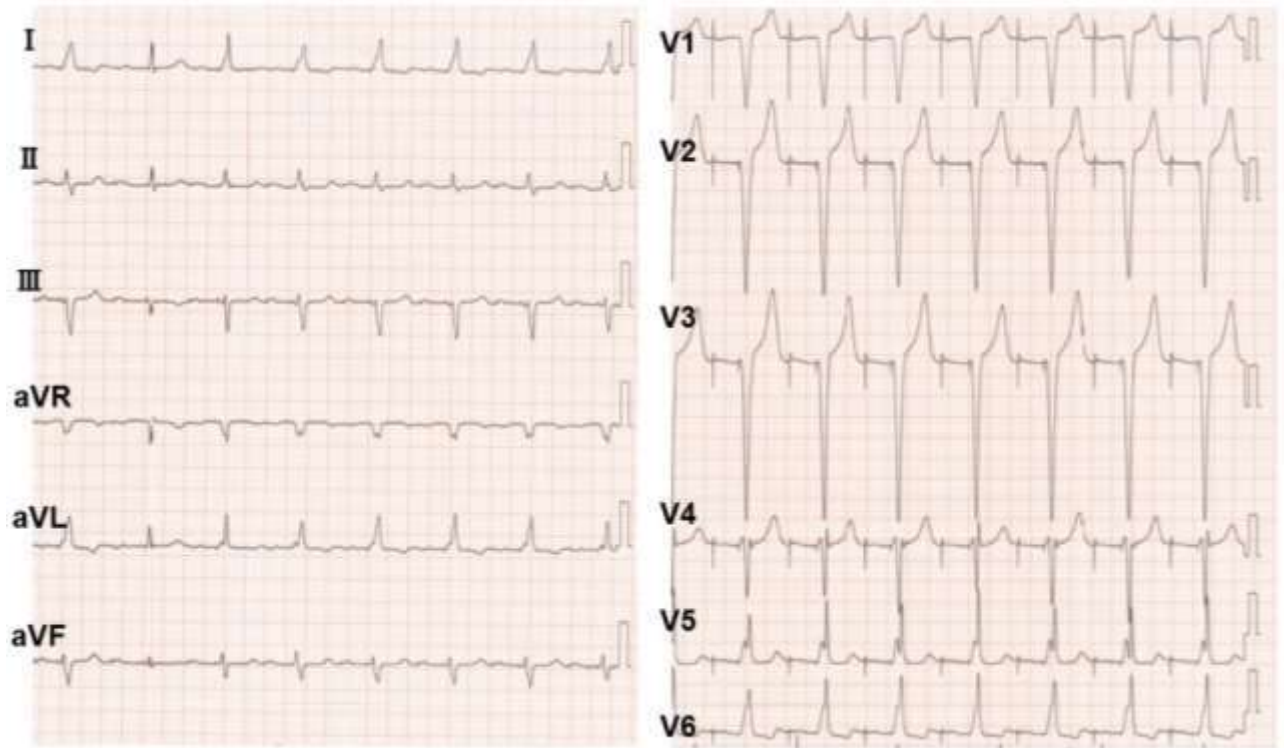
Panel A



Panel B



Panel C



Learning Curve for Physiological Pacing

Dr Friska Anggraini Helena Silitonga¹, Dr Muhammad Yamin¹, Dr Simon Salim¹, Dr Angga Pramudita¹, Dr Rubiana Sukardi², Ms Catur Wulanningsari², Mr Rohmad Widiyanto²

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Objectives: Physiological pacing has been found to have many advantages because this procedure can mimic human physiology so that it will be very beneficial for the patient. His bundle pacing (HBP) and Left bundle branch pacing (LBBP) are physiological pacing techniques that aim to capture the His bundle-Purkinje- system or the left bundle branch area and synchronously activate both ventricles. We present our initial experience and learning curve with physiological pacing procedure.

Materials and Methods: This study is a retrospective observational study of patients undergoing physiological pacing. Pacing indication, fluoroscopy time, pacing capture thresholds, sensing and impedance were recorded.

Results: HBP and LBBP was attempted in a total of 39 patients, during the study period (2019-2022). Permanent Physiologic pacing was successfully achieved in 33 of these patients. Failure to implant occur in about 20 % of patients. In patients whose physiologic pacing has failed, the RV lead is placed in the RV septal. A high threshold can be seen in about 10% of patients, especially in the first 10 cases. Over time, the fluoroscopy duration shortened, almost the same as the conventional non-physiological pacing.

Conclusion: HBP and LBBP are pacing techniques that are feasible and have the potential to overcome non-physiologic RV pacing limits with a high success rate. In this study we showed that there was evidence of a learning curve, although not statistically significant, there was a decrease in the duration of fluoroscopy and pacing capture threshold. The learning curve is quick, and the uptake is fast.

Impact of Atrial Fibrillation Detected by Cardiac Implantable Electronic Devices on Stroke in Cancer Patients

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Background and Objective: Cancer may increase the risk of embolic stroke events. Little is known about the incidence of atrial fibrillation (AF) and embolic stroke events, in cancer patients with cardiac implantable electronic devices (CIEDs) in Asia, and the appropriate treatment guideline in cancer patients with AF has not established yet. The purpose of this study is to identify the incidence of embolic stroke events in cancer patients with CIEDs and to examine the risk factors of embolic stroke events.

Methods: We retrospectively analyzed the database of our CIEDs clinic. We examined the characteristics and incidence of embolic stroke events and investigated the relationship between new-onset AF detected by CIEDs and the incidence of embolic stroke events.

Results: We enrolled 138 consecutive cancer patients with CIEDs who had no prior AF and took no anticoagulant in this study (follow-up period, 76±58 months; age, 73±16 years; male, 76%; defibrillator, 48%). The mean CHA₂DS₂-VASc and HAS-BLED scores were 3.2±1.5 points and 2.3±1.6 points, respectively. During the follow-up period, 13 patients (9.4%) had embolic stroke events. In the multivariate logistic regression analysis, independent predictors for embolic stroke events were new-onset AF episode ≥20 seconds (odd ratio [OR] 4.2, 95% confidence interval [CI] 2.1-9.5, P = 0.0082) and an enlarged left atrium ≥40mm (OR 3.3, 95% CI 1.2-8.2, P = 0.018).

Conclusions: AF episodes lasting for ≥ 20 seconds and enlarged left atrium were risk factors of embolic stroke events. We should examine AF burden carefully in this population.

Risk Factors of Embolic Stroke

(i) Univariate analysis (unpaired t test or Fisher's exact test)

	Embolic Stroke group (n=13)	Non-Embolic Stroke group (n=125)	P value
Age ≥ 70 , n (%)	11 (85)	89 (71)	0.25
Follow-up period (months)	79 $\pm$ 62	75 $\pm$ 58	0.58
Male, n (%)	10 (77)	92 (74)	0.55
Congestive heart failure, n (%)	8 (62)	60 (48)	0.26
Hypertension, n (%)	7 (54)	49 (40)	0.23
DM, n (%)	3 (23)	26 (21)	0.54
COPD, n (%)	2 (15)	23 (18)	0.57
Coronary artery disease, n (%)	4 (31)	28 (22)	0.35
LAD ≥ 40 mm, n (%)	9 (69)	45 (36)	0.022 *
Left ventricular ejection fraction $\leq 60\%$, n (%)	7 (54)	85 (68)	0.23
ICD, n (%)	6 (46)	62 (50)	0.52
Sick sinus syndrome, n (%)	5 (38)	32 (26)	0.24
Atrioventricular block, n (%)	5 (38)	64 (51)	0.28
Antiplatelet agent, n (%)	3 (23)	27 (22)	0.57
CHA ₂ DS ₂ -VASc score ≥ 3 , n (%)	7 (54)	40 (32)	0.10 *
AF episode ≥ 20 seconds, n (%)	8 (62)	38 (30)	0.028 *

(ii) Multivariate analysis (logistic regression)

	Odds Ratio	95% Confidence interval	P value
CHA ₂ DS ₂ -VASc score ≥ 3	2.4	0.84-7.1	0.095
LAD ≥ 40 mm	3.3	1.2-8.2	0.018 *
AF episode ≥ 20 seconds	4.2	2.1-9.5	0.0082 *

DM; diabetes mellitus, COPD; chronic obstructive pulmonary disease, LAD; left atrial diameter, ICD; implantable cardioverter defibrillator, AF; atrial fibrillation

* statistically significant

Acute Success, Stability and Safety of LBBP With Agilis Hispro Steerable Catheter: Single Centre Experience

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Objectives: His-bundle pacing adverse sequelae includes lead dislodgement and elevated pacing thresholds. Left bundle branch pacing (LBBP) is an alternative for conduction system pacing. We aim to study acute success rates, short-term stability and safety of LBBP with Agilis HisPro steerable catheter and extendable-retractable stylet-based (SB) leads.

Materials and Methods: 31 patients who underwent LBBP with HisPro catheter and SB leads were included in this series. Patients' demographics, pacing indications, baseline QRS morphologies and duration and left ventricular ejection fraction (LVEF) were analyzed. Acute success was defined as achieving stimulation to LV activation time (Stim-LVAT) ≤ 75 ms or incomplete right bundle branch paced morphology in V1. We also reported LBB potential (if present) and V6-V1 interpeak interval. All lead parameters and complications in the immediate (1 day) and short-term (1 week and 3-6 months) timeframe were evaluated.

Results: 31 patients (mean age 73), gender (female 55%), and LVEF (mean 47%) were analyzed. Pacing indications included sinus nodal dysfunction (26%), atrioventricular block (71%) and heart failure (3%). We achieved an acute success rate of 87% (6.5% with LVSP, 6.5% converted to CRT). 44% of successful LBBP patients had LBB potential and/or interpeak interval > 33 ms. Immediate and short-term lead parameters were stable and acceptable in all cases. There were no complications (such as lead dislodgement) reported during the acute and short-term follow-up.

Conclusion: LBBP is successful in 87% of cases with HisPro catheter and extendable-retractable SB leads and proven to be safe and feasible. Incremental experience with delivery tools will improve success implantation.

Cross-cultural Validation Into Filipino of the Aquarel Questionnaire Among Post-pacemaker Patients in UST Hospital

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Arrhythmias have greatly contributed to most of the total morbidity and mortality of cases worldwide. With this, the advent of pacemaker devices greatly influenced its treatment. Having implanted devices demands lifelong therapy and aims to offer better quality of life. The Assessment of QUALity of life and RELated events (AQUAREL) questionnaire was developed as the first disease-specific tool to measure quality of life in these patients; however it is only available in English. To measure quality of life among Filipinos who have undergone pacemaker insertion, a culturally appropriate version should be validated. A five-step cross-cultural validation study was done to create a Filipino version of the AQUAREL questionnaire. Forward translation, back translation and panel reconciliation were done by language experts. Pretesting and content validation were done with the help of field experts in Cardiology. Field testing involved 31 post-pacemaker patients who completed the 24-item questionnaire. All items were retained with minimal modifications and yielded an item constant validity index (I-CVI) of 1.00. Descriptive statistics and Bland-Altman plots of the items exhibited good linguistic equivalence. Correlation coefficients of both versions were ≥ 0.30 indicating good conceptual equivalence. The Cronbach's alpha values for both Filipino and English versions were 0.775 and 0.771 showing good internal consistency. Thus, the Filipino version of the AQUAREL questionnaire is a valid and culturally appropriate instrument in measuring quality of life among Filipino patients after pacemaker insertion.

THE IMPACT OF SHORTER DURATION INTRAVENOUS ANTIBIOTIC FOLLOWING CARDIAC IMPLANTABLE ELECTRONIC DEVICES (CIED) IMPLANTATION

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Objectives: Intravenous (IV) antibiotics before and a few days after cardiac implantable electronic device (CIED) implantation are generally administered in our hospital resulting in an extended hospital stay. This study investigates the effects of a shorter duration of IV antibiotics after CIED implantation.

Materials and Methods: An observational retrospective study was conducted using CIED registry in Sardjito General Hospital, Yogyakarta, Indonesia, between Jan 2017 to Aug 2021. Adults with CIED implantation who fulfilled the inclusion and exclusion criteria were recruited. All subjects received 1.5-gram Ampicillin-Sulbactam IV before the procedure. There were two groups of subjects: Group 1 obtained IV Ampicillin-Sulbactam bid $\geq$ four-six times and Group 2 received IV Ampicillin-Sulbactam bid two times after the implantation. Follow-up of CIED infection was done a minimum of 6 months after implantation.

Results: A total of 453 patients were included in this study, 153 and 300 in group 1 and 2, respectively. The mean age was 65.8 ± 13.2 yo and 67.1 ± 13.1 yo in group 1 and 2. A permanent pacemaker (PPM) was the most common CIED type implanted in both groups (97.3% and 98%). The atrioventricular node dysfunction was the most frequent indication for PPM procedure (58.6% and 61.4%). The rate of CIED-related infections was 4.6% (7) and 1.0% (3) in group 1 and 2, respectively ($p=0.02$). The median length of stay (LOS) in group 1 and 2 were 7 and 4 days, respectively ($p=0.000$).

Conclusion: The CIED-related infection and LOS were significantly lower in the group with a shorter duration of antibiotic administration.

Case Series of Late Permanent Pacemaker Pocket Infection

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Objective: To demonstrate characteristics of patients with late PPM pocket infections in our center.

Materials and Methods: The data in this case series was obtained retrospectively from medical records. There was a total of 3 patients with late PPM pocket infection with illustration of each case.

Results: All 3 patients presented with late onset of local inflammation at the pocket surface without fever. Blood culture samples in case 2 and 3 patients were drawn after antibiotics were administered. The third patient's blood culture result was positive for MRSA. Pocket swab and tissue culture results were negative in all patients.

In terms of host-related risk factors, the second patient had undiagnosed diabetes with history of previous CIED related infections. The first patient also had previous CIED related infections and were only treated conservatively. The third patient had chronic renal insufficiency. There was no procedure related or device characteristic risk factors in all patients.

All patients received empirical antibiotics, complete PPM explantation. One patient underwent reimplantation.

Conclusion: CIED infections could be localized or systemic. Late onset of local inflammatory changes at generator pocket site is most likely a pocket infection, and could supported by culture, commonly caused by *Streptococcus*. Negative culture often found in late pocket infections as in the two patients. It's important to screen for risk factors after implantation. Two patients had previous CIED infections which should have had the PPM removed in the first place. The treatment to CIED infections is antibiotics, explantation and reimplantation of a new device.

SUPPORTING DOCUMENTS

Case Illustration:

Case 1

77-year-old male presented to cardiology clinic complained about a lump appeared on skin over the PPM implantation site with tenderness and slightly erythematous skin for the past 1 week. Two months prior, patient had similar complaints and was treated in hospital with antibiotics. Patient had history of total AV block, for which the PPM was implanted 11 months prior, and history of coronary angioplasty and hypertension. There were no systemic signs of infection including fever, and complete blood count results came out within normal range. The lump was aspirated, and the sample was sent to laboratory for culture with blood culture samples, and antibiotics (cefazoline and clindamycin) were administered empirically upon admission. Echocardiography study showed no signs of vegetations on the lead as well as the valves. We decided to remove the PPM and its lead and do debridement of the PPM generator pocket on the next day. After PPM extraction, holter ECG was done to decide whether it was necessary to implant another PPM. The holter result was second degree type 1 AV block, so we decided to withhold PPM reimplantation in this admission. The blood and pus culture results came out negative. Patient was discharged after completed antibiotic treatment.

Case 2

67-year-old female patient presented to cardiology clinic with complaints of pus discharge from the skin surface of the generator pocket site for the last 2 days, with red discoloration, tenderness, and being warm on palpation. There were no systemic symptoms including fever. Patient had history of PPM implantation procedure 2 years prior, and two months after the initial implantation, patient had similar complaints but was only treated with antibiotics. Patient denied history of diabetes mellitus or routine use of antidiabetic agents. On physical examinations, the skin surrounding the incision site was slightly erythematous, a small erosion wound just under the incision site with pus discharge. Late pacemaker pocket infection was then suspected, and patient was admitted to the hospital. Pus discharge sample was sent to the lab for culture. Echocardiography evaluation showed no signs of vegetations on lead or heart valves. Laboratory test results showed no elevated white blood cells, 218 mg/dL of random blood glucose, HbA1c was 11.1%. Antibiotics were administered empirically (ceftriaxone and clindamycin), and insulin therapy was given along with patient's routine medications. Blood sample was taken for microbiological culture, which unfortunately was taken after administration of antibiotics. Patient underwent generator pocket debridement and extraction of PPM lead and generator, and temporary pacemaker was placed. Pocket and device swab, as well as pocket tissue samples were taken for microbiological culture, which all came out negative. Patient then underwent reimplantation of PPM at the opposite site after completed the antibiotics therapy.



Figure 1. Pacemaker site case 2

Case 3

81-year-old male presented to cardiology emergency department with skin lesion and tenderness at the PPM implantation site for the last 1 week followed by pus discharge at the PPM pocket skin surface for the past 3 months. Patient has dextrocardia and had PPM implanted 3 years prior. Physical examination on admission showed red discoloration with pus discharge on the PPM implantation site, patient was also icteric. On laboratory findings, WBC was 12,200/ μ L, hemoglobin 14.0 g/dL, platelet count 244,000/ μ L, ureum 81 mg/dL, creatinine 2.0 mg/dL, SGOT 58 U/L, other laboratory findings were unremarkable. Patient was suspected to have late pacemaker pocket infection, and antibiotic (cefazoline) was administered. Echocardiography study showed no signs of vegetation on lead and heart valves. Blood and pus culture were taken the next day. Patient underwent complete explantation of the PPM unit and generator pocket debridement. Tissue sample and pocket swab sample were sent to the lab for culture. During hospital admission, patient developed fever and abdominal tenderness. Laboratory results were WBC 22,800/ μ L, SGOT 33 U/L, ureum 98 mg/dL, creatinine 1.9 mg/dL, total bilirubin 6.37 mg/dL, direct bilirubin 6.12 mg/dL, SGOT 107 U/L, SGPT 33 U/L. Patient was then diagnosed with acute cholangitis. Antibiotic was switched to a broader spectrum (vancomycin). The blood culture result came out methicillin-resistant *Staphylococcus aureus* (MRSA) sensitive to vancomycin, therefore the antibiotic treatment was continued. The tissue and pocket swab culture on the other hand came out negative. Patient was then discharged and was planned for reimplantation later.



Figure 2. Pacemaker site case 3

Discussion:

Permanent pacemaker implantation is relatively safe with minimal risk of complications. However, there is a risk of infections with incidence about <2%.¹ Early infections usually are caused by wound contamination during surgery, while late infections usually are secondary infections due to bloodstream infections. This case series demonstrated late infections in PPM pocket with successful management by antibiotic administration, complete removal of PPM and debridement.

All 3 patients presented with signs of local inflammation at the generator pocket site late after initial implantations, with the third case being the most obvious one with clear erosion and purulent discharge. In late presentation of local inflammatory changes at generator pocket site, the diagnosis would almost be certain of pocket infections. If the onset of inflammatory changes was early, it is important to distinguish between superficial skin infections, or allergic reactions to the device or dressing and pocket infections.³ There was no fever observed in any of these patients at initial presentation, which is common in CIED related infections, the third case patient developed fever later during admission, due to acute cholangitis.

Although it is recommended to draw blood samples before starting antibiotics, the blood culture samples in case 2 and 3 patients were drawn after antibiotics were administered, which could have interfered with the negative results of second patient. The decision to start the antibiotics before blood culture samples were drawn in these patients was unfortunately solely due to our center's limitations. Our laboratory does not provide blood culture samples processing outside of office hours, making it difficult to draw blood culture samples after office hours. Therefore, it was more appropriate to start antibiotics as soon as possible rather than delaying it for the next day. The third patient's blood culture result was positive for MRSA. The majority pathogen causing CIED related infection is *Staphylococcus*, and MRSA was responsible in about one third of CIED related infections. Positive blood cultures due to *Staphylococcus* is highly suggestive that the clinical syndrome is due to CIED infection. Bloodstream infections from remote source could potentially cause pocket infections. However, this patient developed acute cholangitis during hospital admission, and the pathogen causing acute cholangitis are usually gram-negative and anaerobic

organisms, therefore it was unlikely that this pocket infection was due to remote source bloodstream infections, and these two conditions could be unrelated.⁴ In terms of pocket swab and tissue culture, all results came out negative. Previous study reported culture negative CIED related infections found in 13.2%, and were more likely seen in late pocket infections.⁵

Several risk factors have been attributed to CIED related infections including host-related, procedure-related and device characteristics. In a meta-analysis, diabetes mellitus, renal disease, COPD, corticosteroid use, malignancy, heart failure, and anticoagulant use are the most significant host-related risk factors.⁶ The second patient denied history of diabetes but was diagnosed during hospital admission with high level of HbA1C, meaning the patient had undiagnosed diabetes with poor glycemic control. Patient with diabetes were two times more likely to get CIED related infections.⁶ This patient also had similar symptoms previously about 2 months after the initial implantation. Whilst it was unclear whether that was just a superficial skin infection or just irritation or allergic reaction to the dressings or topical antibiotics because the onset was still considered early. However, previous device infections could possibly be a contributing risk factor in this patient. The first patient also had similar symptoms just 2 months before presenting at the cardiology clinic and was treated with antibiotics before. Unlike the second patient, the first symptoms that appeared 2 months prior were highly suggestive of PPM pocket infection due to its late onset, but conservative approach was taken without long-term suppressive antibiotics which eventually led to recurrency. Conservative approach to salvage the device is recommended only if the device removal is not possible, and should be followed by long-term suppressive antibiotic therapy.⁷ Patients with renal insufficiency are three times more likely prone to CIED related infections,⁶ and the third patient presented with elevated creatinine level suggesting chronic renal insufficiency. Regarding procedure related risk factors, all three patients seemed to have none. There was no recorded history of non-infectious post-operative complications especially hematoma or lead dislodgement, none of these patients underwent replacement/revision procedures before, and antibiotics prophylaxis have always been our standard care before PPM implantation. As to device characteristics, all patients used single chamber, and were all placed in pectoral pockets.

As recommended by consensus, antibiotics administration and complete removal of the device unit including the leads is the key to successful treatments of CIED related infections, whether it was just a localized pocket infections or systemic infections.⁷ All patients received empirical antibiotics, underwent complete PPM explantation procedure, followed by debridement of the PPM pocket.

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Factors Associated With Pacemaker Induced Cardiomyopathy, a Single-center Experience

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Background: Some patients implanted with permanent pacemaker (PPM) developed LV dysfunction that will cause heart failure symptoms, indicating an upgrade to a cardiac resynchronization therapy (CRT).

Objective: To establish the predictors and associated factors of Pacemaker induced cardiomyopathy (PICM) in patient underwent pacemaker implantation.

Methods: We conducted a retrospective chart review of patients in cardiac device clinic who underwent pacemaker implantation then later upgraded to CRT at Siriraj Hospital, Thailand from January 2013 through December 2019. The patients were classified into PICM and non-PICM groups, each possible associated factor was analyzed. Patients who were implanted with CRT from other indications were excluded.

Results: Among 564 PPM patients, 43 (7.6%) were detected as PICM with a median onset of 6.68 ± 5.2 years post-implantation, mean post-PPM LVEF $34.94 \pm 7.67\%$, mean change in LVEF $30.64 \pm 11.25\%$. We found these factors include ventricular pacing (VP) $> 70\%$ ($P = 0.003$), younger age at implantation (Mean age of PICM compared to non-PICM 60-year-old vs 70-year-old, $P = 0.002$) were significantly showed association with PICM. Other factors included baseline characteristics, baseline ECG (rhythm, QRS morphology, and duration), and lead position showed statistically nonsignificant between 2 groups.

Conclusions: Patients who underwent PPM implantation and required ventricular pacing $> 70\%$ or younger age group at implantation are at a higher risk of developing pacemaker-induced cardiomyopathy.

The Usefulness of a 20-degree Caudal View to Guide Axillary Venous Access During Device Implantation.

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Background: For cardiovascular implantable electronic device implantation, axillary venous access is recommended. The procedure is often done in an anteroposterior (A-P) view under fluoroscopic guidance. However, this view lacks the depth of perception with a fear of creating complications. To alleviate this problem, caudal fluoroscopy (adding 20°- caudal angulation to the A-P view) has been proposed.

Objectives: This study's objective was to elucidate the benefits and safety of caudal fluoroscopy (adding 20° caudal angulation to A-P view) in guiding axillary venous access.

Materials and Methods: The fluoroscopic images and contrast venograms were acquired in the A-P and 20° caudal views. The described technique has been a routine practice for operators at our center. In the period from 2020 to 2022, there were 410 cases requiring central venous access: 230 pacemaker implants, 64 CRTs, 109 implantable cardioverter defibrillators, and 7 lead revisions/device upgrades. The caudal view was used in 95 % of cases, the cephalic vein cut down in 3% of cases, and standard A-P fluoroscopy in 2% of cases. There was no pneumothorax or hemothorax in our data set.

Conclusion: Combining A-P and caudal fluoroscopic views while obtaining venous access for the cardiovascular electronic device was associated with high safety.

A Challenging Case of Contralateral Pneumothorax After Dual-Chamber Permanent Pacemaker Implantation

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Objective: We report a case of right-sided pneumothorax after dual-chamber permanent pacemaker implantation via a left subclavian vein approach.

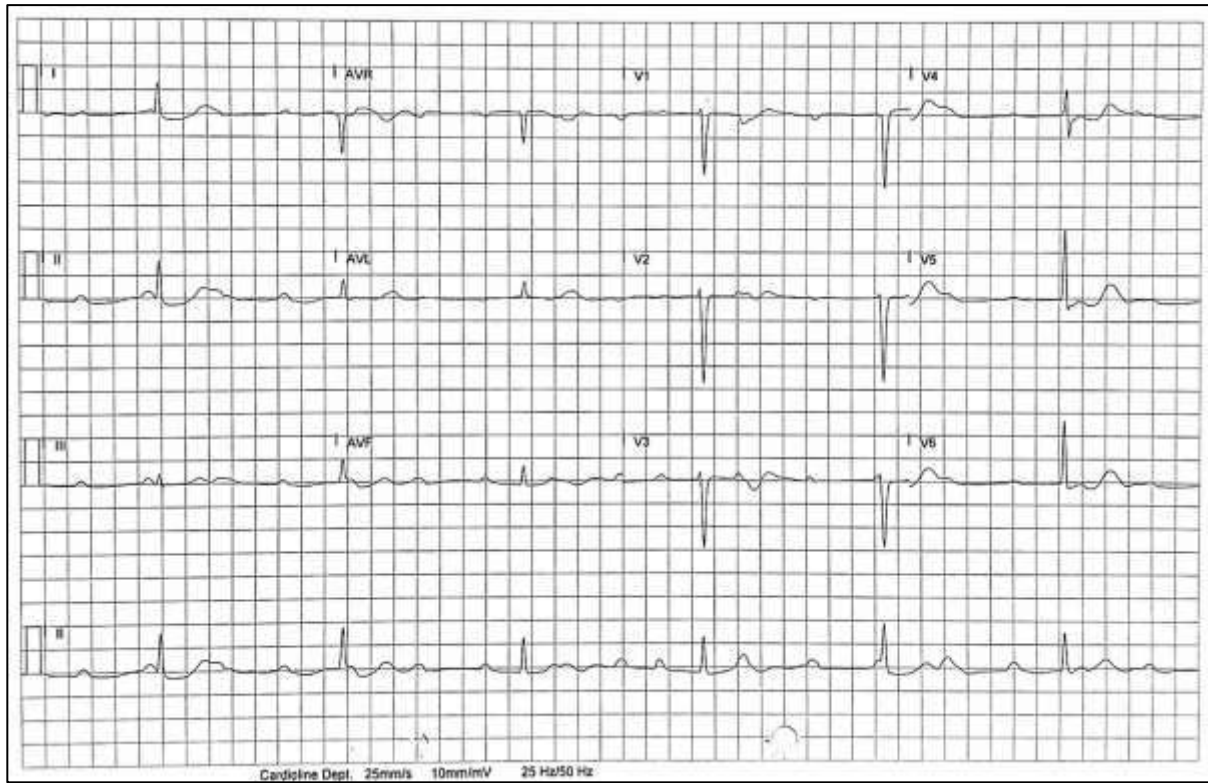
Materials and Methods: A 77-year-old woman without history of lung disease was referred to our institution for complete atrioventricular block (FIGURE 1). Left subclavian venous access was done under fluoroscopic guidance using contrast venogram on the ipsilateral arm. There was no air leak during an attempt to gain vascular entry. Active fixation leads were successfully implanted at the anterolateral wall of the right atrium and right ventricular apical septum with optimal pacing threshold, sensing and impedance. Nine hours after implantation, patient developed sudden onset of dyspnea. Chest radiograph revealed right-sided pneumothorax. Emergent pleural chest tube insertion was performed (FIGURE 2). Echocardiogram did not show pericardial effusion. Device interrogation yielded unchanged lead parameters. Complete resolution of pneumothorax was achieved in the next couple of days.

Results: Computed tomography revealed that atrial and ventricular leads were not perforated but the tip of atrial lead abutted anterolateral wall lying in close proximity to subpleural blebs in the right middle lobe (FIGURE 3 AND 4). Anterolateral right atrial wall comprises pectinate muscle and the paper-thin part. Tip of the helical screw at this site possibly injured adjacent subpleural blebs causing rupture, resulting in pneumothorax.

Conclusion: Contralateral pneumothorax after dual-chamber permanent pacemaker implantation is extremely rare but possible, even without lead perforation. It can be prevented by avoiding atrial lead implantation at the anterolateral free wall especially in the patient with history of chronic lung disease.

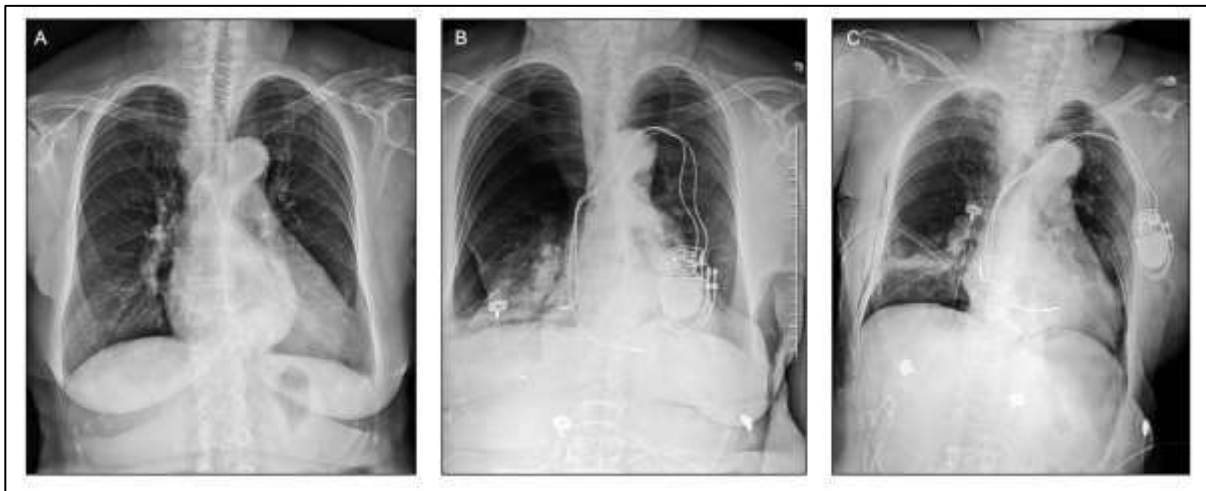
SUPPORTING DOCUMENTS

FIGURE 1



12-lead electrocardiogram showed sinus tachycardia (cycle length = 560 milliseconds) and narrow QRS complex junctional escape rhythm (cycle length = 1560 milliseconds) with complete atrioventricular block.

FIGURE 2



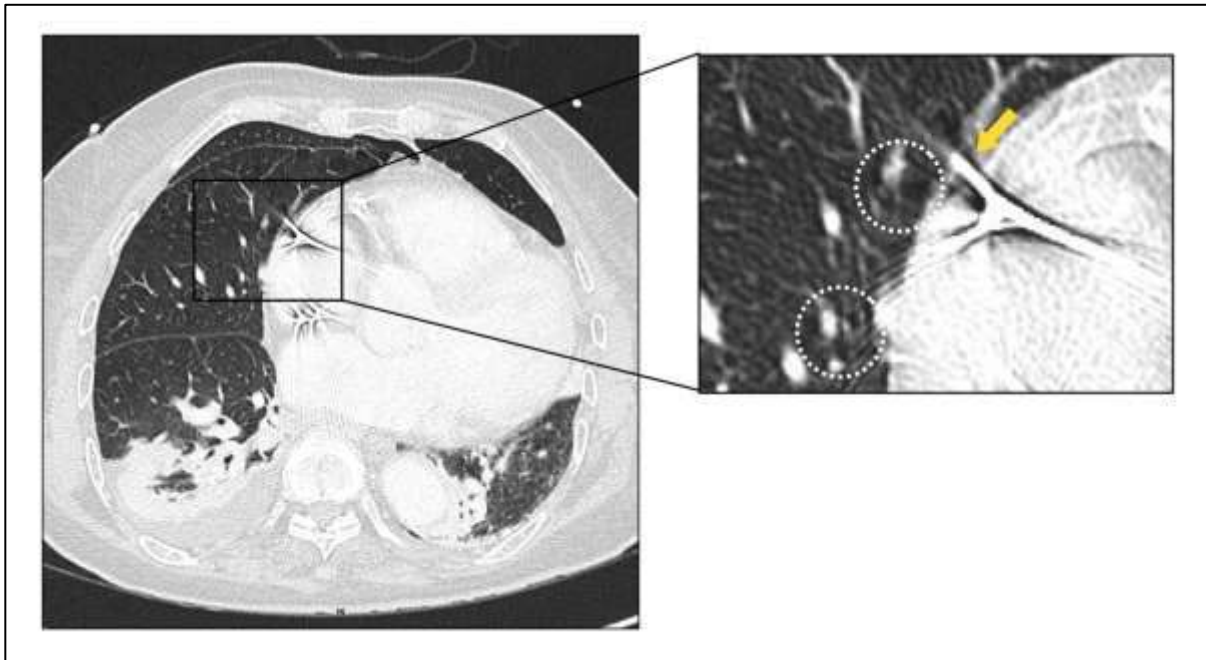
Chest radiographs in anteroposterior view before device implantation (A). Moderate right-sided pneumothorax with right lung collapse nine hours after dual-chamber pacemaker implantation via left subclavian vein approach. No evidence of left-sided pneumothorax, tip of atrial and ventricular leads were placed at the anterolateral free wall of the right atrium and right ventricular apical septum respectively without lead dislodgement (B). Resolution of right-sided pneumothorax after emergent pleural chest tube insertion (C).

FIGURE 3



Computed tomography in coronal view demonstrated that tip of the atrial active fixation lead abutted anterolateral free wall of the right atrium (white arrow). There was 1 mm protrusion of the lead tip beyond outline of the atrial wall without evidence of lead perforation. Pericardial effusion or pneumopericardium was not seen.

FIGURE 4



Computed tomography in axial view lung window demonstrated paraseptal emphysema and small subpleural blebs in the right middle lobe (white circle dotted line) lying in close anatomical proximity to the tip of the atrial lead helical screw (yellow arrow).

Device-detected Sleep-disordered Breathing and Risk of New-onset Atrial Fibrillation: Result of the DEDiCATES Study

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Objective: Recent cardiac implantable electronic devices have diagnostic function to monitor sleep-disordered breathing (SDB) which is comparable to polysomnography. Patient enrollment is completed for the DEDiCATES study, a multicenter prospective study, aiming to evaluate the association between device-detected SDB and atrial fibrillation (AF).

Materials and methods: Baseline characteristics and the first device interrogation data (post-implant 3±1 months) were analyzed. Daily Respiratory Disturbance Index (RDI) values were collected to assess SDB burden. New-onset AF was defined as 1) no previous history of AF, and 2) atrial high-rate episodes with stored electrogram compatible with AF and cumulative duration ≥1hr/day.

Results: Among a total of 539 patients with available RDI reports during the first interrogation. The mean value of average, maximal, and minimal RDI of total patients was 32.9, 53.5, and 17.0, respectively, and 74 patients (13.7%) had previous AF. Patients with previous AF were older, more likely to be female, and had a lower prevalence of heart failure compared to those without, while average and maximal RDI values did not differ. Among 465 patients without previous AF, new-onset AF was detected in 39 (8.4%) patients. The mean average RDI was higher in patients with new-onset AF than those without (37.3 vs. 32.5, $p = 0.01$), and higher average RDI was associated with new-onset AF in multivariate analysis (OR 1.302, 95% CI 1.002 - 1.062, $p = 0.04$).

Conclusions:

New-onset AF was associated with higher average RDI. Further analysis of longer-term data is needed to confirm the relationship between AF and SDB burden.

Incidence and Prognosis of Pacing induced cardiomyopathy in Patients with Pacemaker: A Nationwide Study

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Objective: Patients with pacemakers develop heart failure for various reasons. However, prognosis and incidence are unclear in patients with new-onset heart failure. Therefore, this study aimed to evaluate risk factors, and prognosis of PaHF using the Korean nationwide cohort database.

Methods: We aimed to evaluate the incidence and prognosis of new-onset heart failure in patient with permanent pacemaker (PPM) using a nationwide database from the Health Insurance Review and Assessment Service in South Korea. **Methods:** A total of 21,545 participants who underwent PPM from 2010 to 2017 were included. Participants who were diagnosed with HF before the PPM implantation were excluded. New-onset heart failure is determined by one admission event due to heart failure by taking heart failure medication. The primary outcome was new-onset HF. Secondary outcomes were new-onset HF, cardiac resynchronization therapy (CRT), death.

Results: New-onset heart failure was developed in 6.59% (1,446) of participants at baseline. Compared to the non-heart failure group, heart failure group was likely to be older and had higher comorbidities. The incidence of new-onset heart failure was similar in the Sick sinus syndrome (SSS) group and AV block (AVB) group. After PS-matching, patients with PaHF had a higher risk of all-cause death than patients non-PaHF [HR 1.42 [95% CI, 1.20–1.69] [P < 0.001]]. In PaHF patients, CRT upgrade patients showed better prognosis compared without CRT upgrade. [HR 0.42 [95% CI, 0.38–1.69] [P < 0.001]].

Conclusion: New-onset heart failure is associated increased mortality. CRT upgrade is associated with lower mortality.

New Insight & Perspective of Pediatric PPM Implantation in CHD

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Introduction: Pediatric PPM is underrated in postoperative CHD. In children, the cardiac output is mainly dependent to heart rate. That is why CHD with immediate postoperative bradyarrhythmia is very unstable. Moreover, most of postoperative CHBs are the consequence of procedures involving the closure of VSD. If CHB persists after at least two weeks of temporary pacing, permanent pacing is needed in order to improve the quality of life and avoid the risk of asystole or DCM.

Objectives: The aims of this study to show the importance of PPM implantation on morbidity, mortality of children with CHB (+/-postoperative).

Materials and Methods: Age under 15years

All CHBs

The study population consists of 10 children with CHB diagnosed by pediatric cardiologist in Kantha Bopha Children's Hospital, Heart corner, Phnom Penh, Cambodia

Results: The age is varied from 08 months to 14y which 02 cases are 10y. 06 patients with postoperative CHD (60%), 04 patients with non-postoperative CHD (40%). 05 cases are paced via transvenous (50%).

Conclusions: Pediatric PPM is very crucial either early or late postoperative CHB. The possibility of an associated myocarditis or congenital CHB cannot be over looked. Echocardiographic monitoring and pacemaker programming are also vital following implantation.

SUPPORTING DOCUMENTS



Substernal Extravascular ICD System Infection in Large Animals

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¹*Medtronic, United States*

Background: The Extravascular ICD (EV ICD) with substernal lead placement may provide clinical advantages to transvenous and subcutaneous systems. An understanding of substernal infection manifestation and treatment is required.

Methods: The EV ICD system was implanted in 13 large animals (canine, porcine, ovine), and porcine were co-implanted with a transvenous CRT-D system. Animals were monitored for clinical presentation of infection over 12-18 weeks of follow-up, and cultures were collected to confirm infection. Treatment was bifurcated, with some animals receiving antibiotics while EV ICD leads remained in situ, and other animals treated with system removal and antibiotics. Histopathology was conducted at the end of study.

Results: Five infections were confirmed over the course of study, 4 of which involved infection of the EV ICD system and 1 of which involved infection of only the concomitantly implanted CRT-D system without infection of the EV ICD system. Two of the EV ICD-related infections were treated with system removal and antibiotic course, and both infections resolved. Two additional EV ICD-related infections were treated with antibiotics alone without explant of the EV ICD leads; histology showed that neither infection resolved. The transvenous CRT-D system infection progressed to septicemia and endocarditis, requiring early study end. No EV ICD-related infection progressed to blood stream infection, and the sternal bone did not become infected when infection was present in the substernal tissues.

Conclusions: Study findings suggest that EV ICD-related infections are treatable with system removal and antibiotic therapy.

Left Bundle Branch Area Pacing in Patients with CRT Indication: Short-term results & 1-year Follow-up

Dr Vikas Kataria¹, Ms Ishita Yaduvanshi, Dr. Mohit Bhagwati¹, Dr. Amitabh Yaduvanshi¹

¹HOLY FAMILY HOSPITAL, New Delhi, India

Background: Cardiac resynchronization therapy (CRT) using bi-ventricular pacing is class I recommendation for symptomatic patients with heart failure (LVEF $\leq 35\%$), QRS duration ≥ 150 msec and LBBB QRS morphology. Left bundle branch area pacing (LBBAP) has been reported as an alternative option for CRT.

Objectives: The aim of this study was to assess the feasibility and outcomes of LBBAP in patients eligible for CRT.

Methods: Patients with CRT indications were subjected to LBBAP. Peri-procedural outcomes & QRS duration were recorded. Changes in New York Heart Association (NYHA) class, need for HF hospitalization, echocardiographic data, lead-device parameters were evaluated at follow-up. HF status was assessed by clinical (no HF hospitalization and improvement in NYHA class) and echocardiographic response ($\geq 5\%$ improvement in LVEF).

Results: LBBAP was attempted in 15 patients (mean age 68 ± 10 years, 38% women, ischemic cardiomyopathy in 47%). All patients had baseline LBB. LBBAP threshold and R-wave amplitudes were 0.8 ± 0.2 V at 0.5 ms and 11.4 ± 5 mV at implantation and remained stable during mean follow-up of 12 ± 4 months. LBBAP resulted in significant QRS narrowing from 154 ± 34 to 118 ± 34 ms ($p < 0.01$). LVEF improved from $33 \pm 9\%$ to $44 \pm 12\%$ ($p < 0.01$). Clinical and echocardiographic improvement was observed in 77% and 74% of patients, respectively.

Conclusions: LBBAP is feasible, safe and provides an alternative option for CRT. LBBAP provides low and stable pacing thresholds and is associated with improved clinical and echocardiographic outcomes.

Therapy Optimization in Patients With Heart Failure Using a Multiparametric ICD Algorithm

Dr Federica Giordano¹, Dr Laura Striuli¹, Dr Svetlana Zadorozhnaya², Dr Cinzia Franzosi¹, **Dr Domenico Patrizio Spaziani¹**

¹1, *Magenta Hospital, Italy*, ²2, *UZA Antwerpen University Hospital, Belgium*

Objective: to evaluate the effect of Sacubitril/Valsartan on a device based algorithm to predict heart failure (HeartLogic) in patients with reduced ejection fraction (HFrEF) an implantable cardioverter-defibrillator (ICD).

Materials and Methods: ICD patients with HFrEF treated with S/V on top of medical therapy were enrolled in this single-centre prospective observational study. All patients underwent device interrogation at baseline, before S/V administration, and at 12 months follow-up. Serum levels of NT-proBNP (pg/mL) were measured at baseline and at follow-up. The primary endpoint was the number of HeartLogic alerts after 12 months from the beginning of S/V. The secondary endpoint was the total number of ventricular arrhythmias recorded on the ICD controls.

Results: 36 ICD patients (83% male, age 69±6) with HFrEF (LVEF≤35%) due to idiopathic (22%) and ischemic (78%) dilated cardiomyopathy (DCM) were consecutively enrolled. At 12 months follow-up HeartLogic alerts were significantly reduced (HL 38 vs 24; p =0,024) consistently with the reduction in NT-proBNP serum levels (2358 vs 1134 pg/mL; p =0,019). Both sustained and nonsustained ventricular tachycardia episodes decreased (3 vs 0.7 p =0,05 and 15.7 vs 2.2 p=0,04) irrespective of S/V dose.

Conclusion: The administration of S/V effectively reduced HeartLogic index and NT-proBNP values supporting the favourable impact of this drug in HFrEF patients. The results confirm the reliability of HeartLogic algorithm for heart failure monitoring.

Utilization of a 3-Dimensional Accelerometer in Medical Devices For Accurate Physiologic State Monitoring

Prof Roy Gardner¹, Prof TIm Betts, Prof Fabio Quartieri, Dr Paul Ryu, Dr Fady Dawoud, Dr John Gill, Prof Jag Singh

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Objectives: To demonstrate the feasibility of using 3-D accelerometer (AXL) data to quantify activity, posture, and sleep duration.

Materials and Methods: A custom-made wearable-data-collection-system was used to collect 3-D AXL data for activity, posture, and sleep detection algorithm development. Activity data were collected while subjects underwent treadmill usage at speeds of 1/2/3/4/5 miles/hour. Posture data were collected with subjects in supine, left-sided, right-sided, upright and reclined posture. Sleep data were collected while subjects wore the wearable system overnight. Activity monitoring algorithm development was based on determining the thresholds for 2 mph and 3 mph of treadmill speed to predict low(< 2 mph), moderate(2-3 mph), and intense(> 3mph) activity zones. Posture detection algorithm was developed using the 5 postures, with data collected during supine and standing postures used for a calibration. Sleep detection used the output from both activity and posture algorithms to determine the duration of sleep.

Results: AXL data were collected from 9, 14, and 6 healthy subjects for activity, posture, and sleep feature development, respectively. Activity algorithm successfully predicted low, moderate, and intense activities with thresholds between 2 (± 0.2) mph and 3 (± 0.5) mph treadmill speeds. Posture algorithm demonstrated the accuracy of 99.4% with high correlation ($R^2 = 0.9991$) in detecting 5 postures. For sleep detection, overnight activity and posture data led to 95% accuracy with when compared to the manually adjudicated sleep onset and offset from activity/posture trends.

Conclusion: Highly accurate physiologic state monitoring (i.e. sleep, activity and posture) is feasible from 3-D based AXL.

Long-Term Effects of Ventricular High Septal Pacing in Pacemaker Dependent Patients

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Background: Long-term RV apical pacing (RVAP) has been shown to have negative effects on ventricular function and hemodynamics as a result of ventricular dyssynchrony.

Objective: To evaluate whether high septal pacing (HSP) is superior to RVAP in preventing deterioration of left ventricular systolic function and cardiac remodeling in pacemaker dependent patients.

Method: A total of 407 patients with atrioventricular block and atrial fibrillation with slow ventricular response were included in the study. All patients received a permanent pacemaker and were assigned into 2 groups (RVAP: n=288, HSP: n=119). After implantation, patients underwent an echocardiographic study during 3 years. Left ventricular ejection fraction (LVEF), Left ventricular end diastolic diameter (LVEDD), pro-BNP level and clinical data were analyzed retrospectively.

Result: Baseline LVEF, LVEDD and pro-BNP level were not different between two groups. At 36 months, the incidence of pacemaker induced cardiomyopathy was significantly lower in the HSP group than in the RVAP group (1.7 % vs. 6.9%, p=0.033). The mean LVEDD was significantly lower in the HSP group than in the RVAP group (50.2 ± 5.3 mm vs. 52.1 ± 6.1 mm, P=0.025), whereas HSP group had a trend toward a better LVEF than RVAP group (54.2 ± 6.3 % vs. 52.2 ± 9.3 %, P=0.076). Four patients in the RVAP group were hospitalized for heart failure (p=0.196).

Conclusion: RV high septum can be an alternative pacing site to reduce deterioration of left ventricular systolic function and cardiac remodeling in pacemaker dependent patients.

SUPPORTING DOCUMENTS

Figure 1. Study design and population.

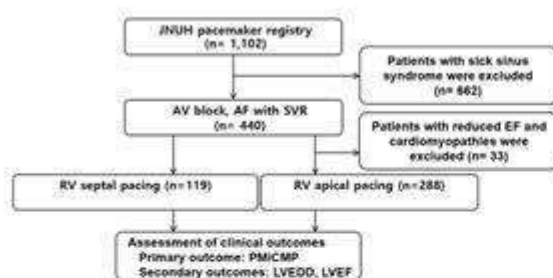


Figure 2. Kaplan-Meier survival curves for pacemaker induced cardiomyopathy (Log-rank p value = 0.038).

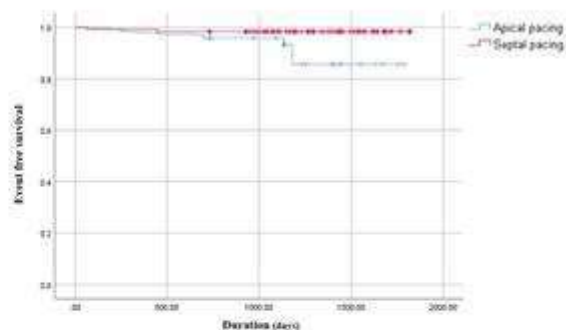


Table 1. Clinical outcomes and echocardiographic parameters

	RV high septum (n=119)	RV apex (n=288)	P value
PM induced CMP, n(%)	2 (1.7%)	20 (6.9%)	0.033*
Hospitalization for HF	0	4 (1.4%)	0.196
Baseline LVEDD (mm)	49.3 ± 6.4	50.5 ± 6.0	0.089
Baseline EF (%)	59.1 ± 7.4	58.3 ± 8.9	0.324
Baseline proBNP (pg/mL)	3099.9 ± 6044.0	3306.9 ± 5968.8	0.811
24 months LVEDD (mm)	50.2 ± 5.3	52.1 ± 6.1	0.025*
24 months EF (%)	54.2 ± 6.3	52.2 ± 9.3	0.076

Septal hematoma and coronary vein infringement during left bundle branch area pacing

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Objectives: While septal branch of coronary artery perforation has been previously reported during left bundle branch area pacing (LBBAP), septal hematoma and coronary venous infringement has not yet been well described. Here we describe two cases.

Case report:

Case 1

LBBAP was performed for treatment of complete atrioventricular block (CAVB) in a 58-year-old male. The Selectra 3D 55-M curve (Biotronik) was utilized to support the Solia S 60 lead (Biotronik). From the right ventricle (RV), in a mid-septal area of the interventricular septum (IVS), the lead was inserted into the septum with 7-8 clockwise turns. After penetration of the lead, contrast was injected, filling the IVS and perforator branch vein, and the coronary sinus was visualized. The lead was removed with no complication and repositioned.

Case 2

LBBAP was performed for treatment of CAVB in a 51-year-old male. The Selectra 3D 65-M curve (Biotronik) was utilized to support the Solia S 60 lead (Biotronik). From the RV, in a mid-septal area of the IVS, the lead was inserted into the septum with 5-6 clockwise turns. After penetration of the lead, contrast was injected, filling the IVS and perforator branch vein, and the coronary sinus was visualized. The lead was removed with no complication and repositioned.

Conclusion: LBBAP is generally feasible and safe, but the incidence of the septal hematoma and coronary vein infringement may be underestimated. Although there are no established recommendations about the management, the replacement of the lead allowed with no complications in the follow-up.

SUPPORTING DOCUMENTS

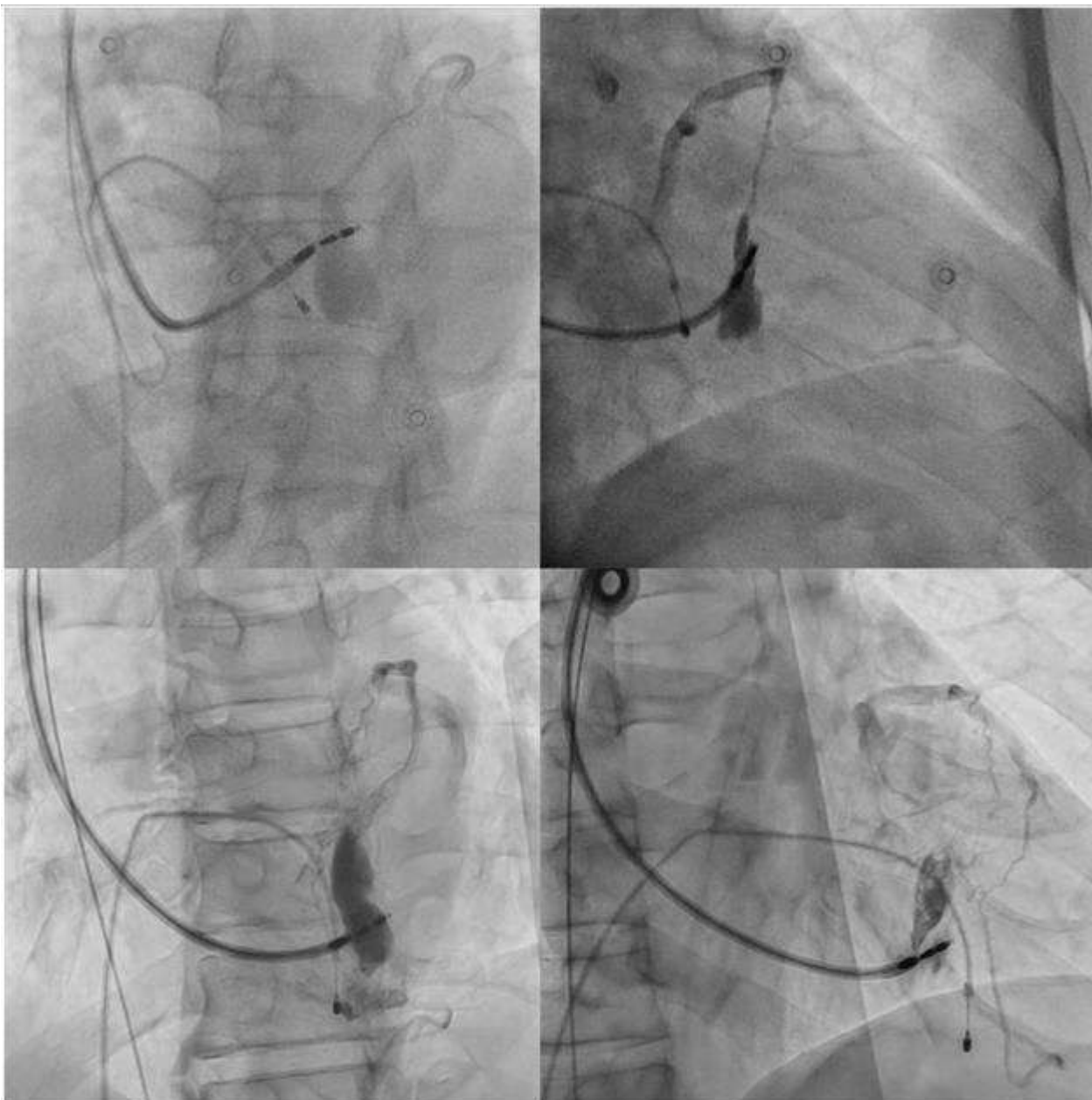


Figure 1. A and B; Left anterior oblique (LAO) and Right anterior oblique (RAO) fluoroscopy projection of case 1. C and D; LAO and RAO fluoroscopy projection of case 2. Pacemaker lead penetrate the interventricular septum. The panel shows the septal hematoma and perforator branch vein and the coronary sinus contrasted by flow from sheath.

A Case of CRT Optimization using SyncAV™ for Bifascicular Blocks.

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Objective: To optimize CRT setting using SyncAV™ for bifascicular blocks.

Materials and Methods: A 60s man underwent CRT-D implantation for reduced left ventricular ejection fraction, chronic heart failure, non-sustained ventricular tachycardia, and bifascicular blocks (QRS 166 ms) which were right bundle branch block(RBBB) and left anterior hemiblock(LAH) associated with ischemic cardiomyopathy (post CABG).

Result: The RA lead was implanted in the right atrial appendage, the RV lead in the right ventricular apex and the LV lead in the anterolateral branch of the coronary sinus because of LAH. The QRS during RV pacing was 206 msec and the longest RV pacing-LV sensing time was 201 msec in the LV lead proximal section. For CRT optimization, SyncAV™ Delta was adjusted under RV pacing only so that the QRS of the fusion waveform of RV pacing and RBBB self-conduction was narrowest which was 132 ms when SyncAV™ Delta was -80 ms. Next the VV interval was adjusted using QRS axis as a reference. Eventually, the QRS was narrowest at 122ms when SyncAV™ Delta -80 ms and the VV interval 0 ms. Before and after CRT-D implantation, LVEDV went from 249 ml to 210 ml and LVESV went from 176 ml to 141 ml, resulting in a Volume Responder and no hospitalization for heart failure over the next 2 years.

Conclusion: This case shows a patient with RBBB who became a Responder by optimizing CRT settings using SyncAV™. We report this relatively simple adjustment method, which is useful for optimizing CRT in patients with RBBB.

Hypertrophic Cardiomyopathy Increases the Risks of Bradyarrhythmia and Pacemaker Implantation

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³Department of Medical Research, Taichung Veterans General Hospital, Taichung, Taiwan, ⁴Heart Rhythm Center and Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan,

Objective: Previous studies of bradycardia complicating hypertrophic cardiomyopathy (HCM) have reported rare patients. Whether HCM is associated with bradyarrhythmia, leading to permanent pacemaker (PPM) implantations remains unclear. This study was to explore the risks of bradyarrhythmia and subsequent PPM implantation in patients with HCM.

Method: Patients with newly diagnosed HCM were identified from the Taiwan National Health Insurance Research Database from 2012 to 2017. A control cohort was selected by matching age and gender in a 1:1 ratio to the study cohort. The primary outcomes were the occurrence of bradyarrhythmia or PPM implantation. A multivariate Cox hazards regression model was used to evaluate the hazard ratio (HR) for outcomes.

Result: A total of 12,094 (n=6,047 in each group) patients with a mean age of 63.1±14.8 years were analyzed. During the follow-up period, the percentage of patients with bradyarrhythmia was higher in the HCM group (3.3%) than that in the control group (0.5%) (p<0.001). The percentage of patients receiving PPM implantation was also higher in the HCM group (4.6%) than that in the controls (0.3%) (p<0.001). HCM was associated with increased risks of bradyarrhythmia (adjusted HR: 5.66, p<0.001) and PPM implantation (adjusted HR: 15.06, p<0.001). The presence of atrial fibrillation (AF) was independently associated with increased risks of bradyarrhythmia (adjusted HR: 1.64, p=0.029) and PPM implantation (adjusted HR: 1.71, p=0.008).

Conclusion: Patients with HCM was associated with increased risks of bradyarrhythmia and subsequent PPM implantation. The presence AF in patients with HCM increased the risks of bradyarrhythmia and PPM implantation.

Characteristics and Clinical Outcomes of Patients Who Underwent CRT Implantation in a New Zealand Hospital

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¹*Te Whatu Ora Health NZ, Waikato, Hamilton, New Zealand*, ²*Waikato Clinical School, University of Auckland, Hamilton, New Zealand*

Objectives: Cardiac resynchronisation therapy (CRT) is recommended for symptomatic patients with left bundle branch block and left ventricular (LV) ejection fraction (EF) <35% despite optimal medical therapy. We aimed to describe the characteristics and outcomes of CRT patients at Waikato Hospital, and evaluate potential predictors of clinical response.

Materials and methods: Of 183 patients (71% male) receiving CRT between 19/3/2004 and 27/10/2021, two-thirds had a defibrillation-capable device. Ethnicity was 74% European and 14% Maori. 72% of patients had a diagnosis of non-ischaemic cardiomyopathy (NICM).

Results: Post-implantation public cardiology follow up occurred for 158 (86%) patients plus 4 patients had an echocardiogram. Of 162 patients who had cardiology follow up and/or echocardiogram post CRT, 118 (73%) and 116 (63%) patients recorded improvement in NYHA class or in EF post-CRT, respectively.

Overall, 123 (67%) patients were classified as responders, 39 (21%) were non-responders and 21 (11%) unclear. Of these responders, 85 (69%) patients were male. Predictors associated with response were smaller pre-implant LV internal diastolic diameter ($p=0.038$) and LV internal systolic diameter ($p=0.026$) but not sex, non-ischaemic aetiology or ejection fraction.

Conclusion: Small LV dimensions were identified as predictors of favourable response to CRT. A significant proportion of patients did not receive public follow up and repeat echocardiograms which has been identified as an area for improvement. Some patients are non-responders which underscores the importance of further research and patient selection.

His-bundle Pacing Experience Targeting an RV His Approach Using a Stylet-driven System in Non-EP Lab

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Objectives: To review short to mid-term electrical lead performance of HBp (His-bundle pacing) with a stylet driven technique, aiming for an RV His approach.

Materials and methods: All patients undergoing pacemaker implantation or His cardiac resynchronization therapy with a Biotronik system (Solia S leads/Selectra-3D 40, 55 and 65 catheters) at Khoo Teck Puat Hospital from 11/8/20 to 24/6/22 were evaluated.

Results: Permanent HBp was attempted in 70 cases, 53 cases were successful (75.7%). Indications for implant were: sinus node dysfunction (26), AV block (18), binodal disease (7) and His CRT-D (2). Three cases required lead revision – 2 for dislodgements and 1 for inadvertent atrial pacing. One case lost His capture on the third month follow up but maintained acceptable RV septal pacing (RVSP) thresholds. The average His threshold at implant was 1.82V@1ms, 1.73V@1ms at 3 months, 1.5V@1ms at 6 months and 1.88V@1ms at 12 months. Targeting a RV His lead position, good RVSP thresholds were achieved – average RVSP threshold at implant was 0.91V@1ms, 1.0V@1ms at 3 months, 1.1V@1ms at 6 months and 1.08V@1ms at 12 months.

Conclusion: HBp using a stylet-driven approach allows for greater precision in targeting an RV His position, this usually results in a nonselective HBp to RVSP to loss of capture transition sequence. Majority of the HBp leads implanted appeared to achieve a durable performance over 12 month. Good RVSP thresholds provide backup in cases of AV block with loss of His capture and remain stable over time.

Conduction System Pacing After TAVR: a Systematic Review and Meta-analysis

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¹*Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China*

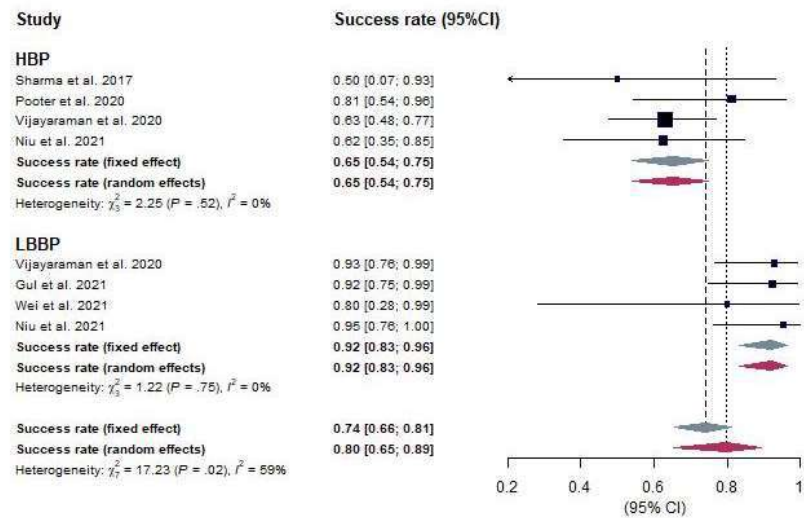
Objectives: Roughly 15% of patients require permanent pacemaker implantation within 30 days following transcatheter aortic valve replacement (TAVR) due to complete heart block¹. And His-Purkinje conduction system pacing (CSP) including his-bundle pacing (HBP) and left bundle branch pacing (LBBB) could establish normal myocardial activation. However, the feasibility of CSP in patients requiring pacemaker implantation after TAVR remains unclear. The aim of this study is to evaluate the feasibility of CSP in patients requiring pacemaker implantation after TAVR.

Materials and Methods: We searched the MEDLINE, Embase, Web of Science, and ClinicalTrials until March 5th, 2022. The primary endpoint was the success rate of CSP. We used the fixed model to investigate the success rate in HBP and LBBP, respectively. And we reported the success rate of CSP using random-effect model. All statistics were performed using R 4.1.2.

Results: We included 6 studies with a total number of 162 patients. Among these, 2 studies included both HBP and LBBP after TAVR. Success rates ranged from 50% to 81% in HBP and 80% to 95% in LBBP. For patients requiring pacemaker implantation after TAVR, HBP was successful in 65% of patients (95%CI 54%-75%), while LBBP was successful in 92% of patients (95%CI 83%-95%). Overall, CSP could be achieved in 80% of patients (95CI 65%-89%).

Conclusion: Our study demonstrated that CSP, especially LBBP was feasible in patients requiring pacemaker after TAVR. And LBBP had a higher success rate than HBP.

SUPPORTING DOCUMENTS



The Prognostic Value of Albumin-bilirubin Score in Patients With CRT or CRTD

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¹*Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China*

Objectives: The aim of this study was to investigate the prognostic value of the albumin-bilirubin (ALBI) score in patients with cardiac resynchronization therapy (CRT) with or without defibrillator (CRTD).

Materials and methods: We retrospectively enrolled patients implanted CRT or CRTD between November 2008 and June 2021. ALBI score was calculated as the formula: $\log_{10} \text{total bilirubin } [\mu\text{mol/L}] \times 0.66 + \text{albumin } [\text{g/L}] \times -0.085$. The primary endpoint was the composite of all-cause mortality and heart failure rehospitalization (HFH). Cox regression was adjusted for age, sex, BMI, Atrial fibrillation, CRTD, ischemia cardiomyopathy, baseline LVEF, NT-proBNP, creatinine, NYHA class, and use of medication.

Results: Nine hundred patients were included for analysis. During a median follow-up period of 866 days, 249 (27.7%) patients met the primary endpoint. In Cox-regression analysis, ALBI score was independently associated with the composite endpoint (HR 1.07 [1.03-1.11] per 0.1 increase; $P=0.001$). Moreover, PRD was significantly associated with the composite endpoint in the CRTD group (HR 1.09 [1.03-1.14]; $P=0.001$), but not in the CRT group (HR 1.04 [0.98-1.11]; $P=0.176$), although there was only a trend for the interaction between the ALBI score and the effect of CRTD compared with CRT ($P=0.14$).

Conclusion: Increased ALBI score was associated with risk of the composite of all-cause mortality and HFH. Large trials are warranted to investigate the value of ALBI score to identify CRTD responders compared with CRT.

Using Insertable Cardiac Monitor Signal Processing as a Surrogate Marker for QT Interval

Dr. Antony Chu¹, **Mr Gautham Rajagopal**², Dr. Shantanu Sarkar²

¹*Brown University, Providence, United States*, ²*Medtronic, Mounds View, United States*

Objective: To evaluate the accuracy of QT intervals determined by insertable cardiac monitor (ICM) ECG-based automated QT detection software when compared with expert validated manually calculated QT intervals acquired by Holter ECGs in a dataset where surface ECG and ICM ECGs are obtained simultaneously.

Methods: We utilized a previously described QT detection algorithm optimized for T-wave sensing in ICMs to calculate a beat-by-beat QT interval. Continuously uplinked LINQ ICM ECG and 24-hour Holter recordings utilizing 2-leads from 25 patients were analyzed. One-minute ECG data of both Holter ECG and ICM were randomly extracted from each patient and manually annotated to determine QT for every beat. Statistical analysis was performed using Pearson's correlation coefficient.

Results: The data consisted of both surface ECG and ICM ECG for 25 patients, providing over 1,500 beats for analysis. The manually annotated QT from surface ECG were highly correlated with the manually annotated QT from ICM ECG with a Pearson's correlation coefficient of 0.85($p < 0.001$). The mean of difference between manually annotated surface ECG and ICM ECG QT intervals was 6.3ms. The algorithm QT were highly correlated with the manually annotated QT from ICM ECG (correlation coefficient of 0.96, $p < 0.001$; mean difference of 7.4ms) as well as manually annotated QT from surface ECG (correlation coefficient of 0.71, $p < 0.001$; mean difference of 16.3ms).

Conclusion: Absolute values of QT interval calculated by an automated algorithm designed for longitudinal long-term monitoring of QT interval in an ICM are accurate and highly correlative with manually annotated QT intervals.

Continuous Long-term QT Interval Monitoring Using Insertable Cardiac Monitors for Dynamic QT Analytics

Dr. Antony Chu¹, Mr Gautham Rajagopal², Dr. Shantanu Sarkar²

¹*Brown University, Providence, United States*, ²*Medtronic, Mounds View, United States*

Objective: To analyze proof of concept longitudinal QTc intervals in patients detected by a QT monitoring algorithm optimized for monitoring absolute and dynamic QT intervals on Insertable Cardiac Monitor(ICM) ECG data.

Methods: We developed a unique ICM QT detection algorithm based on T-wave signal processing. The algorithm determines the QT interval for every beat thus providing long-term QT trends. The QT algorithm was performed nightly and ICM ECG transmitted episodes were obtained from a de-identified Medtronic CareLink™ database. These data represent long-term QTc trends from real-world patients with a history of diabetes and long QT.

Results: Figures 1 and 2 include various examples of long-term QTc trends that were obtained by processing ICM ECG through the developed QT detection algorithm. The QT intervals were determined using ICM ECG transmitted nightly from patients with implanted ICM with both diabetes and long QT. The QTc intervals in Figure 1 show a lot of day-to-day variability with QTc intervals varying over 100msec in these patients having both diabetes and long QT. Conversely, figure 2(a), and (b) depict examples from patients showing lesser variability and a more stable QT over long-term. This type of long-term QT trends may be clinically essential in correlating QT changes with arrhythmias and adverse clinical events.

Conclusion: ICM QT monitoring performed utilizing a unique QT detection algorithm can provide longitudinal and long-term dynamic QT trends in patients implanted with ICM. Dynamic changes in continuously monitored QT may affect risk for arrhythmias or cardio-vascular hospitalizations and requires further investigation.

SUPPORTING DOCUMENTS

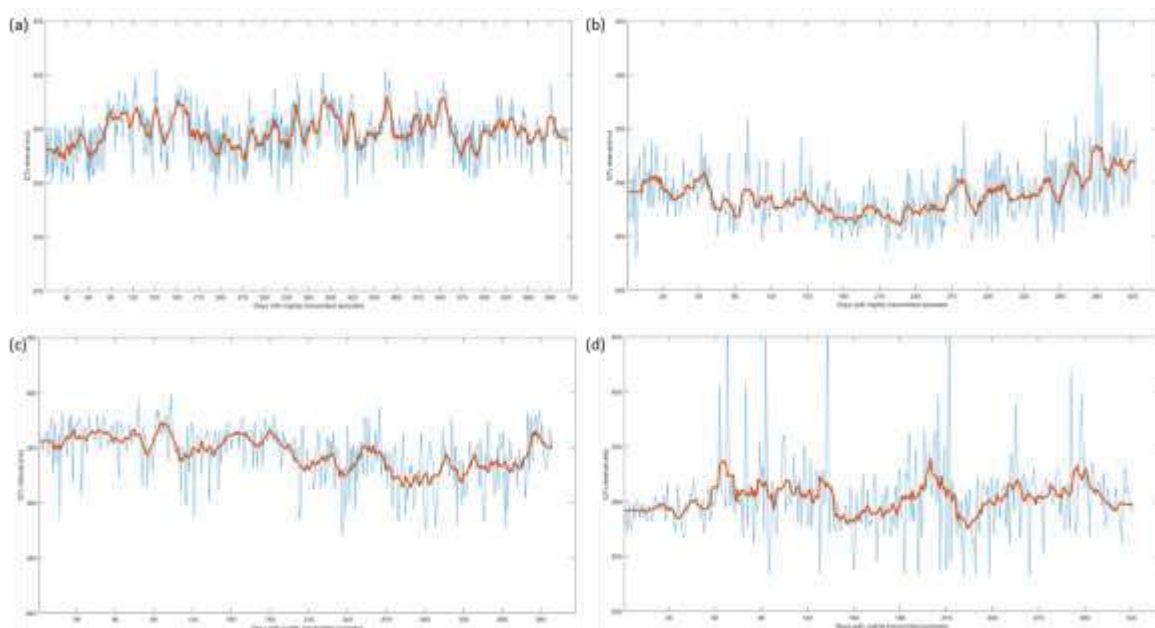


Figure 1: Examples of continuous long-term monitoring QTc trends in patients with (a) 714; (b) 423; (c) 399; (d) 330 days of nightly transmitted ICM ECG episodes. The red plot depicts the 10-day moving average QTc interval.

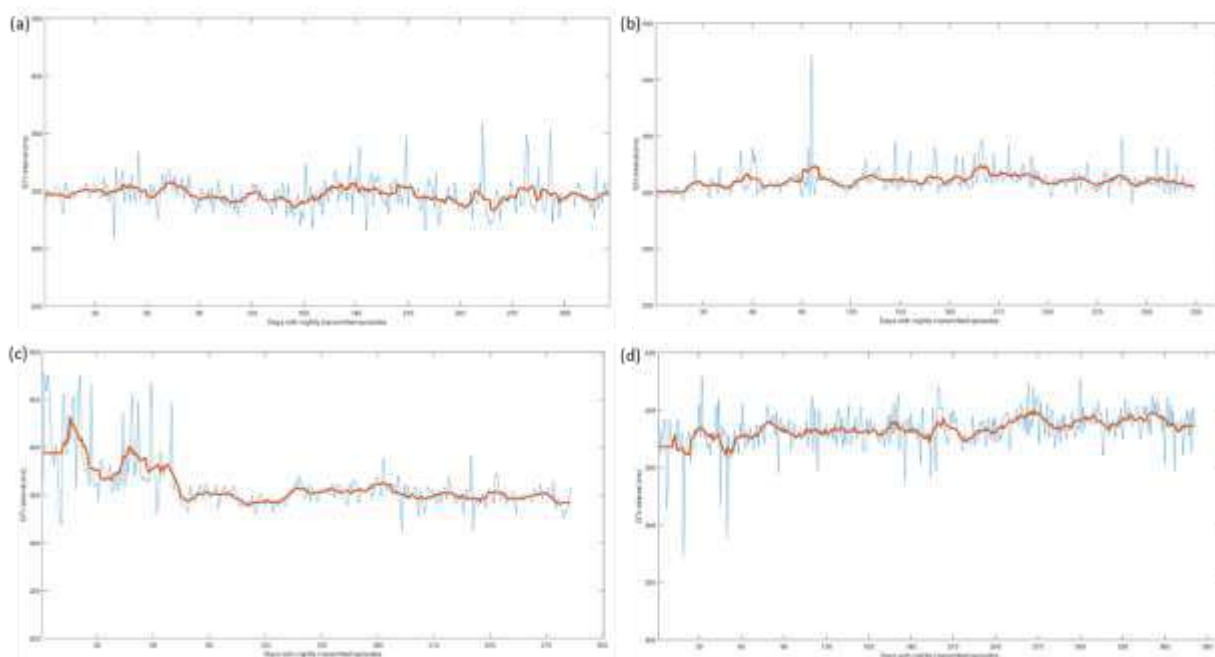


Figure 2: Examples of continuous long-term monitoring QTc trends in patients with (a) 313; (b) 329; (c) 283; (d) 381 days of nightly transmitted ICM ECG episodes. The red plot depicts the 10-day moving average QTc interval.

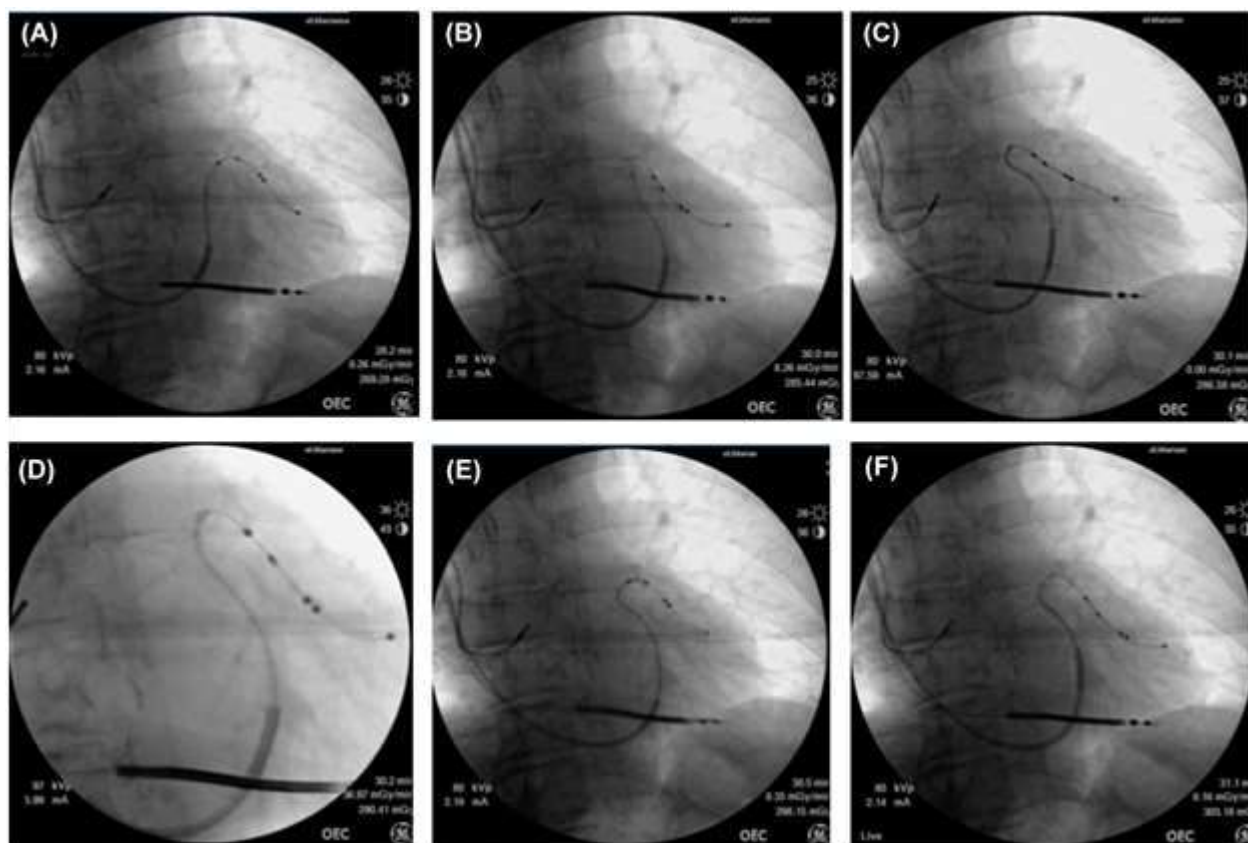
A New Method for Left Ventricular Lead Delivery: Side Helix Overcome the Tortuous Lateral Vein

Dr Makoto Takano¹

¹St. Marianna University, Yokohama City, Japan

This study highlights the case of a 75-year-old man who presented with non-ischemic cardiomyopathy. Computed tomography coronary angiography revealed coronary artery stenosis and the presence of a lateral branch. Cardiac resynchronization therapy (CRT) was performed. We believe that our study makes a significant contribution to the literature because it presents a novel methodology of using an Attain Stability Quad 4798 (ASQ) with a side-helix to overcome the limitation of lead positioning in CRT. The study showed that ASQ lead overcame the anatomical disorder of the CS, enabling LV pacing from a more optimal site

SUPPORTING DOCUMENTS



Year 4 & 5 Extraction Experience of a Novel Extravascular Defibrillation Lead in Sheep

Mr Mark Marshall¹, Dr Hector Mazzetti, Dr Sergio Ferraris, Mr Gonzalo Martinez

¹*Medtronic, Saint Paul, United States*

Background: Extravascular (EV) ICDs are a valuable alternative to transvenous ICDs. A novel ICD system is in clinical study placing an EV lead under the sternum in the substernal space for defibrillation and ATP therapy. Chronic substernal lead removal is unknown.

Objective: Assess EV ICD lead removal in a sheep model out to 5 years.

Methods: 24 sheep were implanted with two EV leads implanted via subxiphoid incision and tunneled cranially right and left of midline over the cardiac silhouette. Lead removal was performed using a direct traction protocol recording force applied, advancing to the use of extraction tools if unsuccessful.

Results: 3 sheep were extracted at each of years 4 and 5. Traction alone succeeded in 0/6 leads at year 4 and 3/6 leads at 5 years. When extraction tool where used the Cook Medical (CM) Bulldog® lead extender (BDLE) was effective, two leads experienced slipping of the cable through the wire loop and cable breakage. CM SS Byrd® sheaths were effective at dissecting proximal scarring at the diaphragmatic attachments but too short for distal adhesions. The Evolution® was effective at removing scarred leads with both distal and proximal scar. One lead was abandoned due to cable breakage by the BDLE.

Conclusions: Chronic removal of EV ICD leads from the EV space was performed safely using traction and currently available extraction tools through 5 years of implant in sheep. Care must be taken when utilizing the CM BDLE to avoid cable breakage and slipping.

SUPPORTING DOCUMENTS

Years of Implant	Animal#		Order of removal	Maximum traction (Kgf)	Traction success	Extraction Tools			Extraction Successful
						Bulldog Lead Extender	SS Byrd Sheath	Evolution	
4	350	Right	1	>3	No	Yes	Yes	Yes	Yes
		Left	2	>3	No	Yes	Yes	Yes	Yes
4	362	Right	1	>3	No	Yes	Yes	Yes	Yes
		Left	2	>3	No	Yes	Yes	Yes	Failed
4	363	Right	1	>3	No	Yes	Yes	Yes	Yes
		Left	2	>3	No	Yes	Yes	Yes	Yes
5	304	Right	2	2	Yes	Yes	NA	NA	Yes
		Left	1	1	Yes	Yes	NA	NA	Yes
5	312	Right	1	2	Yes	Yes	NA	NA	Yes
		Left	2	>3	No	Yes	No	Yes	Yes
5	326	Right	1	>3	No	Yes	No	Yes	Yes
		Left	2	>3	No	Yes	No	Yes	Yes

Insertable Cardiac Monitoring Results in Greater Atrial Fibrillation Diagnosis and Oral Anticoagulation after Cryptogenic Stroke

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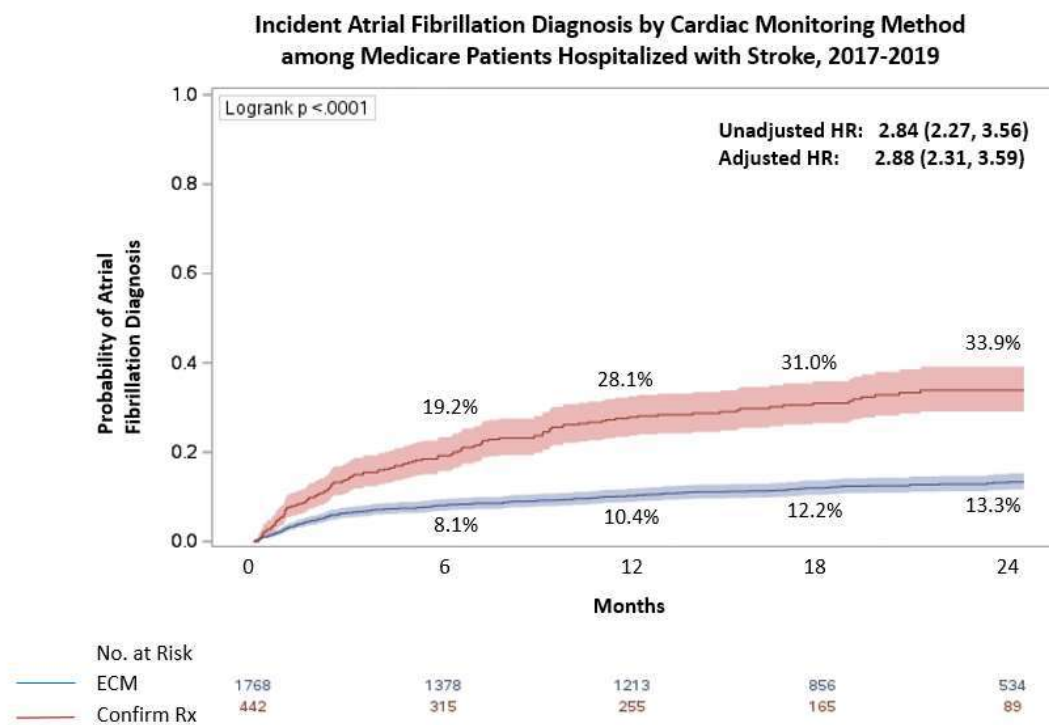
Objective: To compare the detection of atrial fibrillation (AF) and initiation of oral anticoagulation after cryptogenic stroke in those monitored with external cardiac monitors (ECM) versus insertable cardiac monitors (ICM; Confirm Rx™).

Materials and Methods: Using Medicare Fee-for-Service (FFS) insurance claims and Abbott Labs device registration data, we identified patients hospitalized with a stroke in 2017-2019 who received an ICM or ECM within 3 months of stroke. Patients were included if in the year prior to cardiac monitoring (index), they had continuous FFS insurance and Part D prescription drug enrollment. Patients with a history of AF, atrial flutter, cardiac rhythm management devices, or OAC were excluded. The outcomes of interest were AF detection and OAC initiation. ICM and ECM patients were propensity score matched 1:4 on demographics, comorbidities, and stroke hospitalization characteristics. Kaplan-Meier and Cox Proportional Hazard regression analyses were used to compare outcomes between the groups.

Results: Prior to matching, patients with ICMs had higher rates of ischemic heart disease, patent foramen ovale, prior stroke, and longer stroke hospitalizations than patients with ECM only. After matching, all covariates were balanced (standardized mean difference <0.10). In the matched cohort, ICM patients had significantly higher probability of AF detection (hazard ratio (HR) 2.88, 95% confidence interval (CI) [2.31,3.59]) and OAC initiation (HR 1.90, 95% CI [1.52,2.37]) compared with ECM alone.

Conclusion: Patients with ICM were almost 3 times more likely to be diagnosed with AF and 2 times more likely to be prescribed OAC compared with patients who received ECM only.

SUPPORTING DOCUMENTS



Prediction of Pacing Threshold Increase After Implantation of Leadless Pacemaker Due to Patient Age

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Objectives: Elevated thresholds are often a setback in patients with postleadless pacemaker implants. We examined whether predicting an increase in the pacing threshold value was possible.

Materials and Methods: This was a retrospective study. Patients (n = 43) who received implantation of leadless pacemaker Micra™ at Eastern Chiba Medical Center from January 2020 to May 2022 were enrolled. The correlation between the pacing threshold at the time of implantation and one month later and the patient's characteristics were analyzed.

Results: Of the 43 patients, seven (16.3%) were excluded because the pacing threshold could not be described 1 month later. Thirty-six patients (83.7%) were included. We categorized them into two groups depending on whether they were younger than 84 (younger group) or not (older group). Seventeen patients were male, and the median age was 84 ± 6.4 . Twenty patients (55.6%) were 84 or older. The pacing threshold at the time of implantation was higher in the younger group than the older group: 0.91 ± 0.31 V and 0.52 ± 0.28 V, $P < 0.01$, respectively. The difference between the pacing threshold at the time of implantation and 1 month after implantation significantly decreased in the younger group: -0.35 ± 0.38 V and 0.03 ± 0.43 V, $P = 0.01$, respectively.

Conclusion: The pacing threshold in younger patients was high at the time of implantation but then it reduced afterward.

3830 Lead Deployment Use Conditions and Simulated Fracture Rate in Left Bundle Branch Area Pacing

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Background and Objective: Left bundle branch area pacing (LBBAP) is achieved by advancing the lead tip deep in the septum. Most LBBAP implants are performed using the Medtronic SelectSecure™ MRI SecureScan™ Model 3830 (the 3830 lead) featuring a unique 4-Fr fixed-helix lumenless design. Details of lead use conditions and the long-term reliability have not been reported. The objective was to quantify the mechanical use conditions for the 3830 lead during and after implant in the LBBAP position and to evaluate the reliability using bench testing and simulation.

Materials and Methods: Fifty bradycardia patients with the 3830 lead implanted for LBBAP were enrolled. Use conditions of lead deployment at implantation were collected and CT scans were performed at 3-month follow-up. The curvature amplitude along the pacing lead was determined with CT images. Fatigue bending was performed using accelerated life testing in a more severe environment than the routine clinical use conditions of the lead deployment. Conductor fracture rate in a simulated patient population was estimated based on clinical use conditions and fatigue test results.

Results: The number of attempts to place the 3830 lead for LBBAP was 2.1 ± 1.3 (range 1-7) with 13 ± 6 lead rotations at the final attempt. Extreme implant conditions were simulated in bench testing with 5 applications of 20 turns followed by 400 million fatigue bending cycles. Reliability modeling predicted a fracture rate of 0.02% at 10 years.

Conclusion: LBBAP implant requires more lead rotations. The result in freedom from conductor fracture is similar to traditional RV lead placement.

Performance of Ventricular Capture Management in Pacemaker Patients with Left Bundle Branch Area Pacing

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Objectives: Automated right ventricular capture threshold algorithms have been widely used in pacemaker patients to provide optimal battery use while maintaining a desired safety margin of pacing and enabling remote patient follow-up. We evaluated the accuracy of Medtronic's Ventricular Capture Management (VCM) feature, in pacemaker patients with left bundle branch area pacing (LBBAP).

Materials and methods: Ventricular pacing capture thresholds were analyzed in 31 bradycardia patients implanted with Medtronic 3830 leads and pacemakers for LBBAP at follow-ups. The VCM threshold measurements from the nightly measurement prior to the follow-up visit were compared with manual measurements. A difference within +/- 0.25 Volt (automatic vs. manual) was deemed equivalent.

Results: The automatic vs. manual measurements were equivalent in all 31 patients (17 males; age 68 ± 11 yrs old; EF = 63 ± 3 %; 28 unipolar/3 bipolar; pacing pulse width 0.4 ms to 0.5 ms; Figure 1). The average manual pacing capture thresholds (0.73 ± 0.21 V) were not different from automatic measurements (0.76 ± 0.21 V; P = 0.3). At follow-ups (mean duration = 128 ± 60 days), the average manual ventricular pacing thresholds (n=31) were low in both bipolar (0.83 ± 0.23 V) and unipolar (0.71 ± 0.21 V) settings.

Conclusion: The Ventricular Capture Management algorithm was accurate in bradycardia patients with left bundle branch area pacing therapy. This adaptive algorithm can potentially be used to enable remote follow up, assure pacing safety and optimize device longevity.

SUPPORTING DOCUMENTS

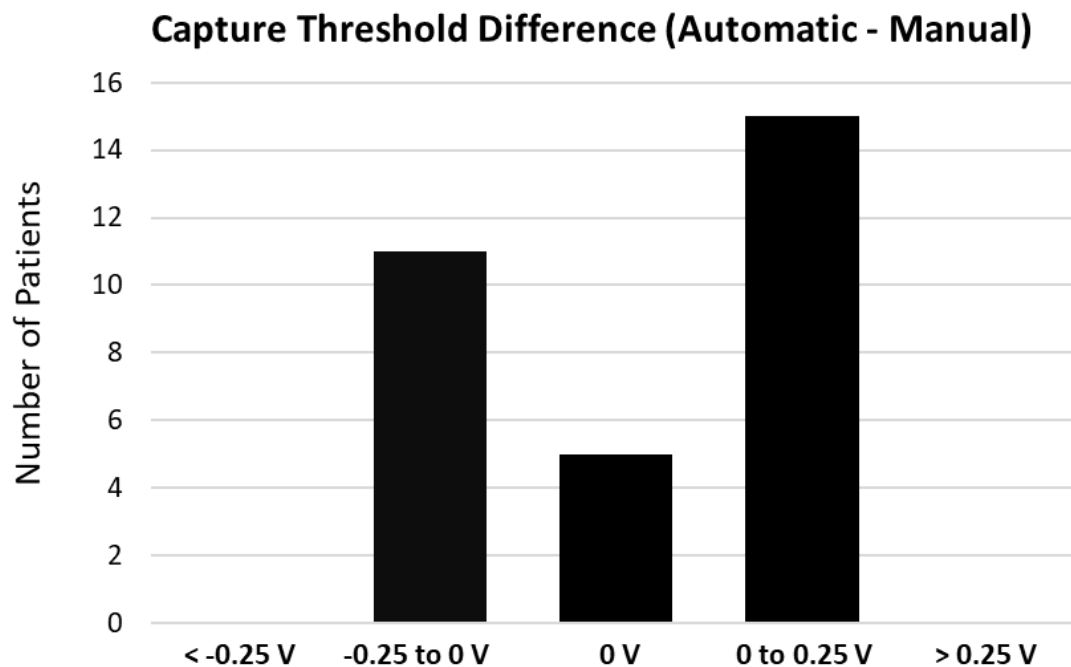


Figure 1. Comparison of Pacing Capture Thresholds at Follow-ups (automatic vs. manual)

Insertable Cardiac Monitor P-wave Visibility in a New Clinical Report

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Objectives: Adequate P-wave visibility in electrograms (EGMs) recorded by insertable cardiac monitors (ICMs) is important for rhythm interpretation. The visibility of P-waves in Abbott ICMs using a new PDF report with improved display resolution was evaluated.

Methods: A data query conducted on the Merlin.net™ patient care network in December 2021 identified 101 sequential patients with remote transmissions at 30, 60, and 90 days after ICM implant. The presenting rhythm EGMs from these transmissions were displayed in vector-graphic PDF reports and reviewed by two independent reviewers to count the beats with P-waves visible in each EGM. Premature ventricular complexes were excluded.

Results: Of 303 EGMs, 17 were excluded from adjudication due to atrial fibrillation or noise interruption. In the remaining EGMs, P-waves were visible in 89.8% of analyzed beats. P-wave visibility was consistent across days (day-30: 89.1%; day-60: 90.8%; day-90: 89.4%). In addition, 90.9% of EGMs reviewed had P-waves visible in >50% of heart beats. At a patient level, 86.3% had P-waves visible in >50% of heart beats on all 3 days. No patient had zero P-wave visibility in all 3 days.

Conclusion: EGM signals recorded by Abbott ICMs and displayed in vector-graphic clinical reports showed consistent P-wave visibility across all patients. Adequate P-wave visibility may facilitate rhythm interpretation and increase confidence in rhythm diagnosis. The new clinical report will be available in the next generation Abbott ICM system.

SUPPORTING DOCUMENTS

Post-implant time	Total beats analyzed (n)	Beats with visible P-wave (%)	EGMs with visible P-wave in >50% of beats (%)
Day 30	1429	89.1%	90.4%
Day 60	1459	90.8%	92.0%
Day 90	1500	89.4%	90.3%

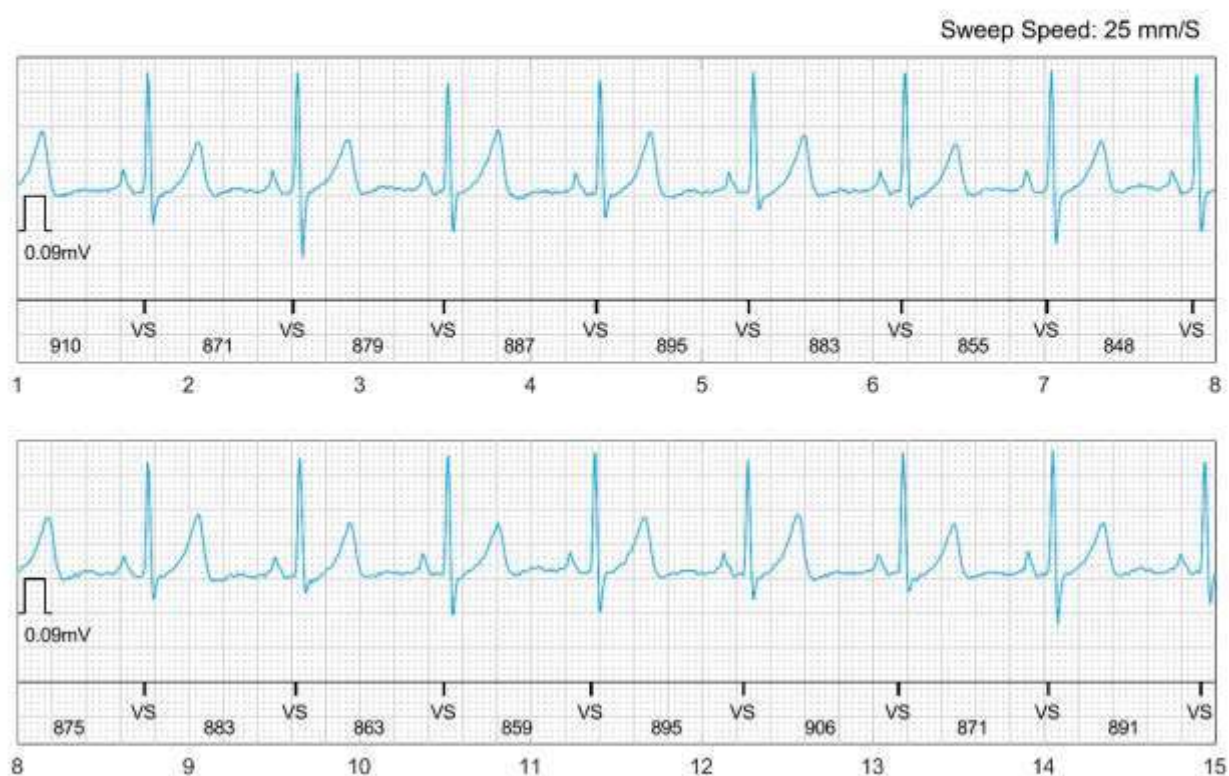


Figure: P-wave visibility summary and an EGM example with clearly visible P-waves

Evaluating the Impact of New Arrhythmia Detection Algorithms in an Insertable Cardiac Monitor

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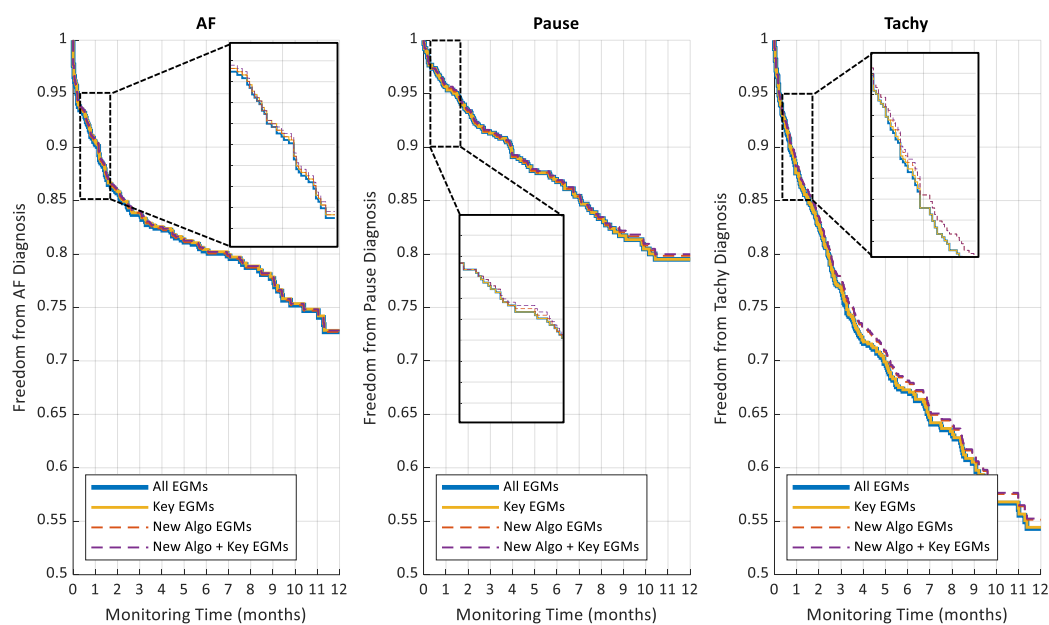
Objectives: Insertable cardiac monitors (ICMs) are commonly used to diagnose cardiac arrhythmias. Due to increased use of these devices and prolonged monitoring duration, minimizing data burden and false detection has become more critical. A set of new discrimination algorithms has been developed to improve the specificity of atrial fibrillation (AF), pause, and tachycardia detection by better identifying sensed events and patterns in ICM electrogram (EGM). The impact of these algorithms on episode review burden and time-to-diagnosis was evaluated using data from existing ICMs.

Methods: Retrospective analyses of randomly-selected Abbott ICM devices with >90 days of remote transmission history were performed, with each EGM episode adjudicated as true or false. The reduction in EGM review burden and potential diagnosis delay introduced by the new algorithms were compared to the results in existing ICMs, with the Key Episodes feature on or off (existing cloud-based feature to reduce EGM burden without delaying diagnosis).

Results: In 821 ICMs over a total of 469 patient-year remote follow-up duration, a total of 60,156 EGMs (35,723 AF, 12,194 pause, and 12,239 tachycardia) was transmitted by 644 ICMs. The new algorithms reduced total EGMs by 35.6%. False positives were specifically reduced by 36.0%, 77.2%, and 72.1% for AF, pause, and tachycardia, respectively. As shown in the figure, the new algorithms achieved nearly identical time-to-diagnosis as the existing ICMs.

Conclusion: The newly developed algorithms substantially reduced false AF, pause, and tachycardia episodes while maintaining the time-to-diagnosis by the existing Abbott ICMs.

SUPPORTING DOCUMENTS



Kaplan-Meier curves show freedom from arrhythmia diagnosis up to 12 months post-implant when using All EGMs (solid blue), Key EGMs (solid yellow, selected by Key Episodes Feature), New Algo EGMs (dashed red, detected by new algorithms), and New Algo + Key EGMs (dashed purple, detected by new algorithms and sub-selected by Key Episodes Feature). Insets highlight overlap of all 4 scenarios.

Comparison of Delivery Catheter- and Stylet-based Right Ventricular Lead Placement at the Right Ventricular Septum

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Background: Although the delivery catheter system is a new alternative to the stylet system, no randomized controlled trial has addressed right ventricular (RV) lead placement accuracy on the RV septum using a stylet or delivery catheter system. This multicenter prospective randomized controlled trial aimed to prove the efficacy of the delivery catheter system for accurate RV lead anchoring on the RV septum.

Methods: In this trial, 70 patients (mean age 78±11 years; 30 men) with atrioventricular block were randomized to either the delivery catheter or stylet group before the pacemaker implantation procedure. The RV lead tip position was assessed using electrocardiogram-gated cardiac computed tomography in all patients after pacemaker implantation. Lead tip positions were classified into RV septum, anterior/posterior edge of the RV septal wall, and RV free wall. The primary endpoint was the success rate of the RV lead tip placement on the RV septum.

Results: RV lead implantation was performed as per allocation in all patients. The delivery catheter group had a higher RV lead deployment success rate on the RV septum (78% vs. 50%; p=0.024) and narrower paced QRS width (129±20 vs. 142±15ms p=0.003) than those in the stylet group. However, there was no significant difference in procedure time (91 [IQR 68–119] vs. 85 [59–118] min; p=0.488) or the incidence of RV lead dislodgment (0% vs. 3%; p=0.486).

Conclusions: The delivery catheter system can achieve a higher success rate of RV lead placement on the RV septum and narrower-paced QRS width than the stylet system.

His Bundle Pacing as Alternative Strategy to Cardiac Resynchronization Therapy in Chronic Heart Failure

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Objectives: To report safety, feasibility and acute hemodynamic effects of His Bundle Pacing (HBP) as alternative strategy for cardiac resynchronization therapy (CRT) in heart failure reduced ejection fraction (HrEF) patient.

Material and Methods: A 73-year-old man with chronic HFrEF, hypertension, and type 2 diabetes mellitus came with New York Heart Association (NYHA) class III despite optimal medical therapy. ECG showed 1st degree AV block with complete LBBB. Left ventricular ejection fraction (LVEF) was 26% with basal to apical anterior and septal akinesia. HBP was attempted as a primary strategy. Using right femoral approach, temporary pacing wire was placed at the right ventricular apex. Bipolar lead was inserted into His bundle via left axillary vein and pacing was done after His signal was obtained on electrogram.

Results: QRS complex duration decreased significantly from 162 msec at baseline to 128 msec with pseudo delta wave (non-selective). His bundle capture threshold was 2.5 V at 1 msec at implant and increased slightly to 3.5 V at 1 msec at six months follow-up. There was improvement in NYHA functional class by one class and no heart failure hospitalisation six months after implantation. LVEF improved significantly from 26% to 40% six months after HBP implantation. There was absolute reduction in LV end-systolic volume index from 62.275 ml/m² to 49.76 ml/m².

Conclusion: HBP was safe, feasible and reasonable primary alternative to biventricular pacing for CRT in patients with cardiomyopathy, AV block and LBBB. HBP could lead to significant improvement in QRS duration, clinical and echocardiographic response.

SUPPORTING DOCUMENTS

Figure 1. ECG Pre HBP Implantation

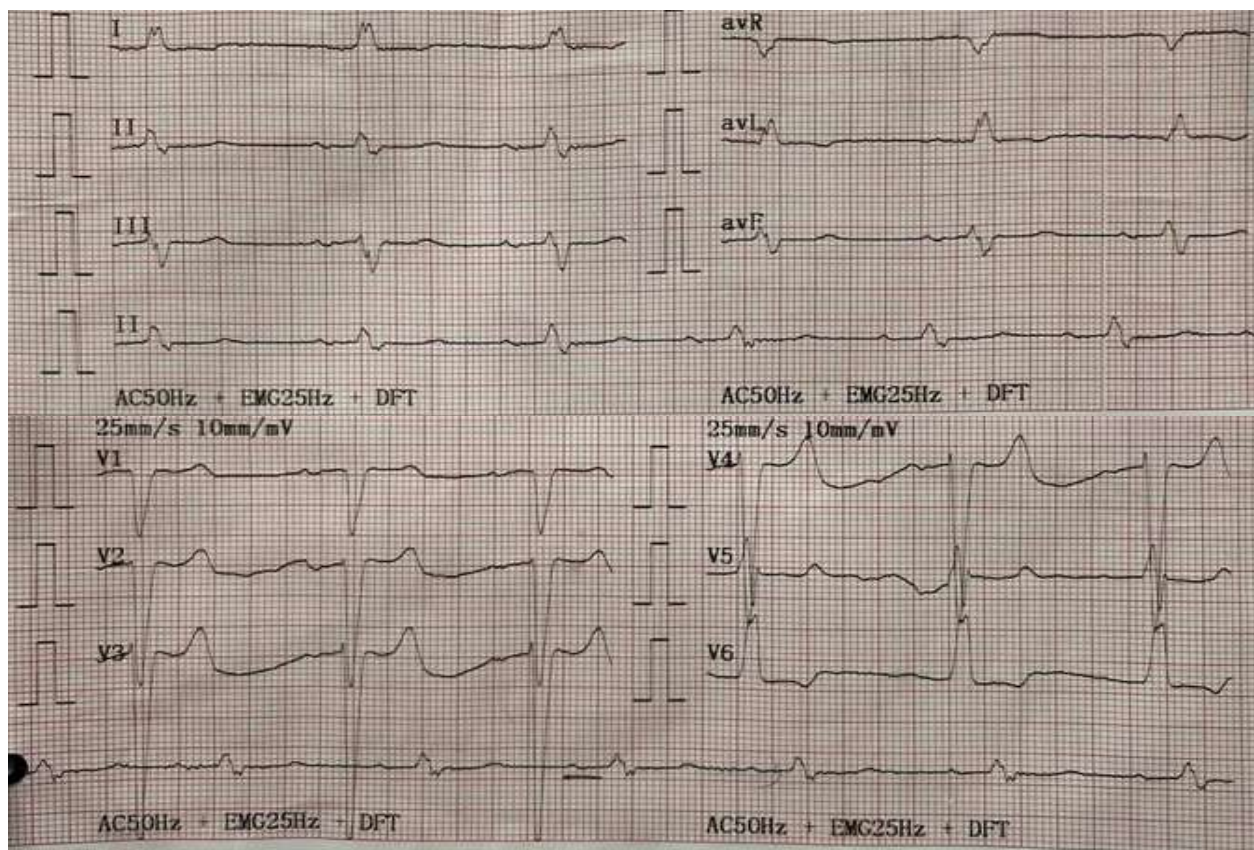
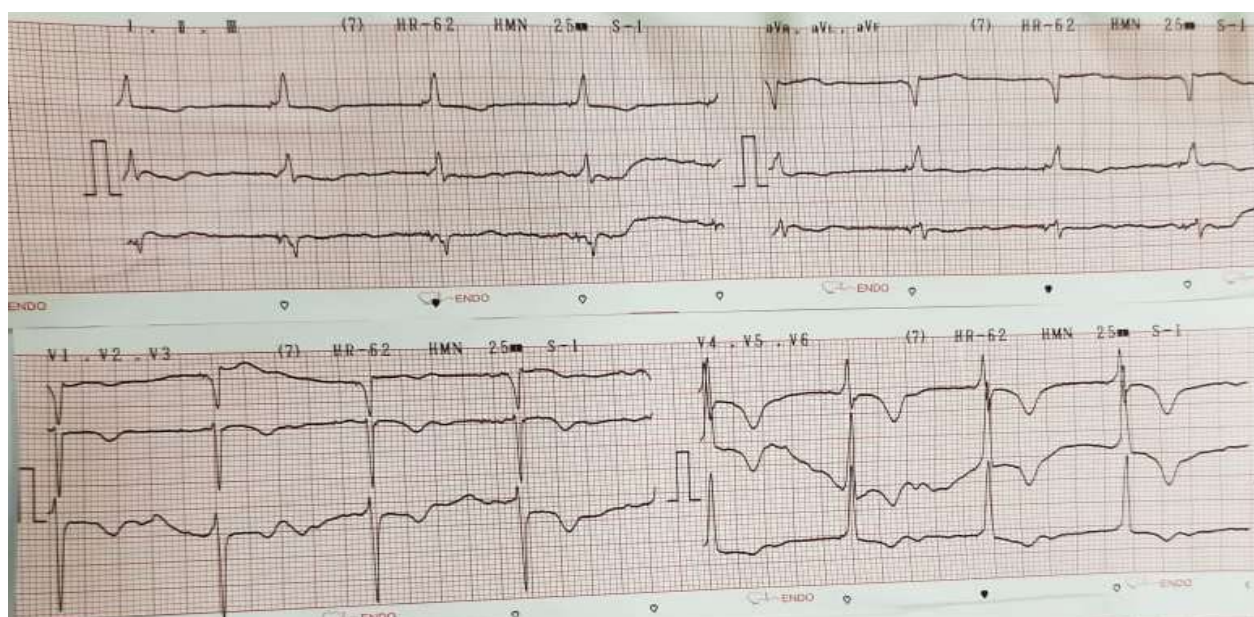


Figure 2. ECG Post HBP Implantation



Wire Mapping for LV Summit PVC

Dr Muhammad Yamin¹, Dr Simon Salim¹, Dr Angga Pramudita¹, Dr Rubiana Sukardi², Dr Friska Anggraini Helena Silitonga¹, Mrs Catur Wulanningsari², Mr Rohmad Widiyanto²

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Objectives: We present a case of LV summit PVC mapping using a single coronary wire

Results: A 32-year-old female came to our center due to symptomatic PVC. The 12-lead ECG showed RBBB morphology with inferior axis and aVL/aVR ratio of 1.5 which suggests LV summit origin. A 3D electroanatomical mapping was done using EnSite Precision and live wire duodeca catheter. The earliest activation timing in RVOT was -17 ms, while the earliest activation in LVOT was -38 ms. We decide to map LV summit area via GCV/AIV approach by using a single BMW coronary wire through a JR 3,5/6Fr. The distal outerpart of the wire was clipped using modified alligator (figure A2-A5). BMW wire was then positioned in the S1 branch (figure A6-8) (1) and showed earlier activation of -53 ms. The complete 3D geometry was shown in figure A9

Conclusion: PVC mapping is feasible to be done only using single coronary BMW wire without any help of microcatheter or balloon.

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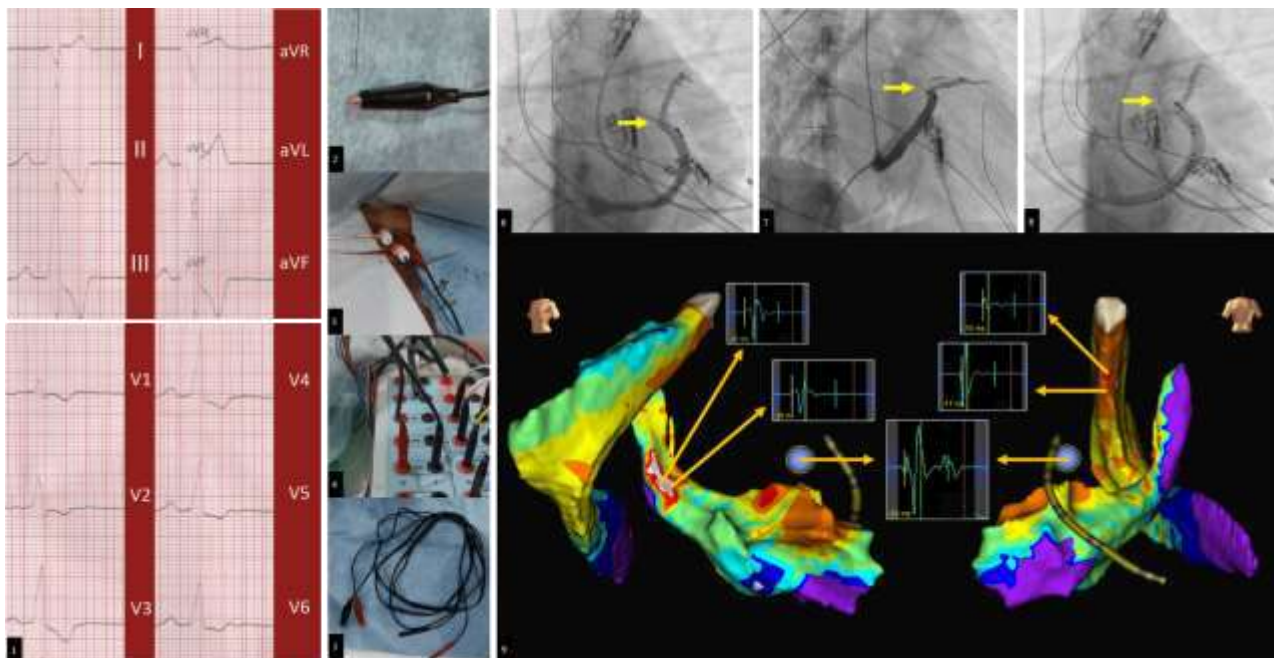


Figure A. (1) PVC morphology on ECG (2) Black alligator clip (3) Red alligator clip (4) Proximal end of wire (5) Complete wire with alligator clip (6) Left anterior oblique (LAO) caudal view of S1 branch (7) Right Anterior Oblique (RAO) view of S1 branch (8) LAO caudal view with wire on S1 branch (9) Complete 3D geometry

Intermittent High Grade AV Block Due to Phase 4 Block

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Objectives: Syncope in young individual is more often due to vasovagal syncope. However dangerous arrhythmia should be excluded as a possible etiology. We report a case of intermittent high degree AV block in a patient with recurrent syncope.

Results: A 34-year-old male with history of polycythemia vera was referred to our cardiology division due to recurrent syncope. Surface ECG showed sinus tachycardia with right bundle branch block and left anterior fascicular block (bifascicular block). Further evaluation using Holter ECG revealed episodes of high-grade AV block induced by ventricular premature beats.

One could argue that ablating PVC would help in preventing the phase 4 block. However, the mechanism phase 4 block is usually associated with a diseased His-Purkinje. The diseased His-Purkinje tissue spontaneously depolarize at the start of phase 4 (diastolic phase), property normally reserved only for pacemaker cells. If impulse arrive late (e.g., SA node reset by retrograde atrial conduction of a PVC) during late spontaneous diastolic depolarization, action potential cannot be stimulated to reach depolarization threshold due to sodium channel inactivity. (1) Only after an early escape beat of a timely manner can the phase 4 be reset to its maximum resting value and normal conduction can resume as seen in the Holter. (1,2) This patient was best to have PPM implanted rather than PVC ablation.

Conclusion: Cardiac syncope should be highly suspected in patients found to have bifascicular block on surface ECG. Premature beat can act as a trigger for initiating high grade AV due to phase 4 block. Permanent pacemaker is warranted in this condition.

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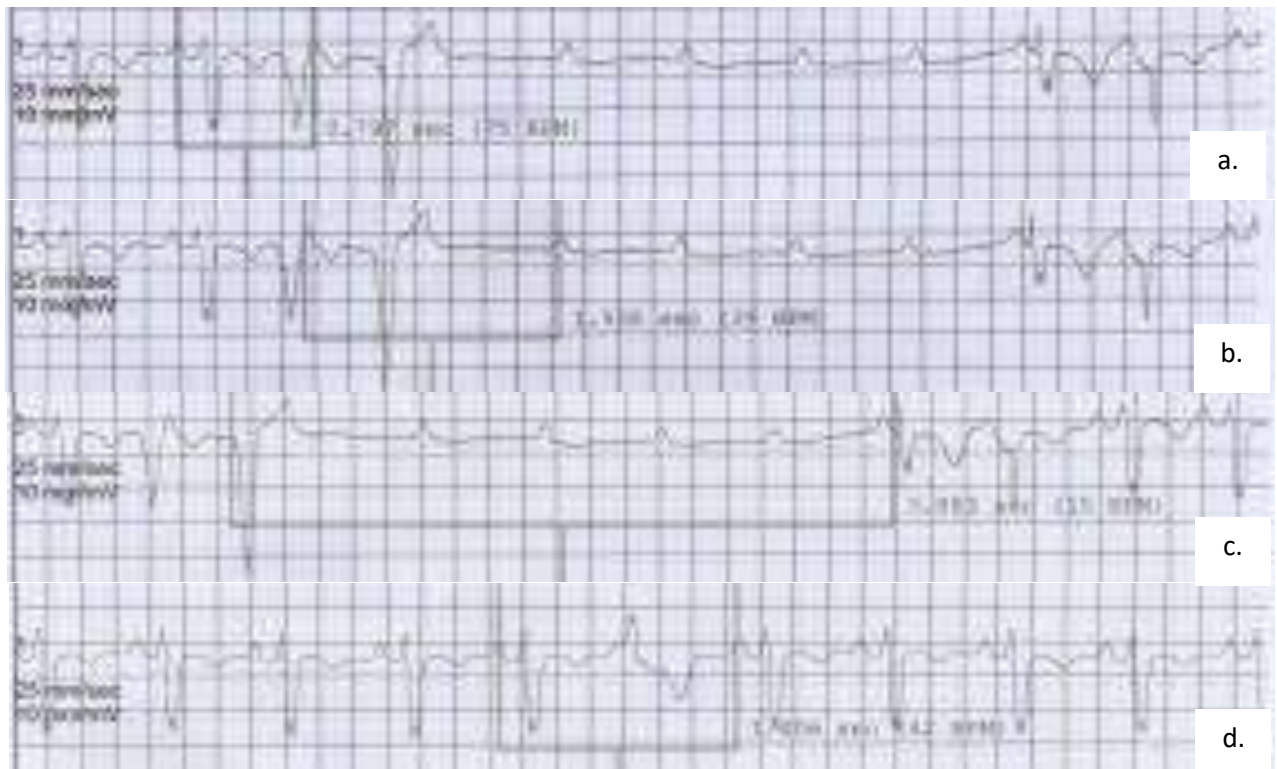


Figure 1. a. 1st PVC didn't reset SA node b. 2nd PVC resets SA node and induces phase 4 block c. Escape beat improves conduction d. Late PVC no resetting

Pitfall in Open Window Mapping (OWM) for Accessory Pathway

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Objectives: We report a case of septal Wolff-Parkinson-White (WPW) syndrome which showed lateral breakthrough using automated annotation.

Results: A 36 years old male with WPW type B history came to our center due to chest discomfort for 20-60 seconds, accompanied with nausea and perspiration. The pain was alleviated by resting and ISDN consumption. A 12 lead ECG showed a positive delta wave in V1 and negative in AVF which favors the right posteroseptal accessories pathway (1). A 3D electroanatomical mapping was done using EnSite Precision and live wire duodeca catheter. We performed automap with absolute dv/dt setting in the right atrium and ventricle using the Open Window Mapping (OWM) concept (2). We found a breakthrough in the lateral wall, however, the local signal showed late activation in this area. At the septal side, we also found a breakthrough ventricular activation with earlier Local Activation Timing (LAT) compared to the lateral side. Ablation performed on this septal area for 10 seconds diminished the delta waves. No recurrence was observed after 30 minutes of observation.

Conclusion: OWM simplifies the work of Electrophysiologists by demonstrating automated signal annotation using a certain algorithm to help elucidate the location of antegrade accessory pathway conduction. However, our case highlighted the need for basic EP understanding in interpreting the map provided by automatic annotation.

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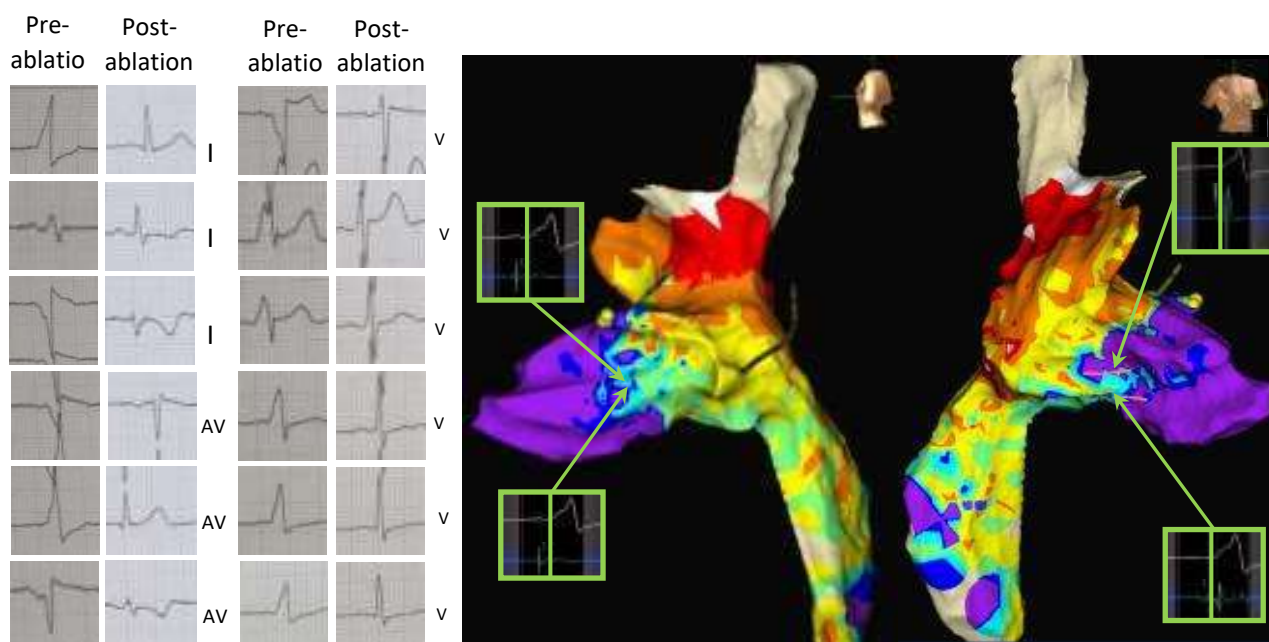


Figure 1. ECG Before and After Ablation and Complete 3D Geometry

Alternating Wenckebach Periodicity in a Patient Implanted With Dual Chamber Pacemaker for Sick Sinus Syndrome

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Objectives: We present a case of an incidental Alternating Wenckebach Periodicity (AWP) during pacemaker follow up of a patient with Sinus Node Dysfunction (SND).

Results: A 68-year-old male with a history of SND and implanted dual chamber permanent pacemaker complained of palpitation. During routine PPM evaluation, pacing mode was changed to VVI (40 BPM) and surface ECG was recorded to identify P wave morphology. His 12 lead ECG revealed a complete RBBB with 2:1 atrioventricular (AV) block and progressive prolongation of PR interval in the conducted P waves which ends in 2 blocked P waves (Figure A), known as Alternating Wenckebach Periodicity (AWP). (1)

The existence of AWP in this patient could suggests infranodal disease which already mitigated with dual chamber PPM implant. Should the patient had single chamber atrial pacemaker for his SND, the existence of AV node disease would render him still vulnerable and would need upgrading into dual chamber PPM.

Conclusion: We showed an SND patient which later develop AWP pattern that argues for the existence of concomitant AV node disease. Our case highlight that some SND patients will develop AV node disease, therefore, a routine first line therapy of dual chamber pacemaker might be preferred.

SUPPORTING DOCUMENTS

REFERENCE

- 1) Halpern MS, Nau GJ, Levi RJ, Elizari MV, Rosenbaum MB. Wenckebach periods of alternate beats. Clinical and experimental observations. Circulation. 1973 Jul;48(1):41-9.



Figure A. Alternating Wenckebach Periodicity

Risk Stratification of Atrial Fibrillation and Stroke From Blood Tests and Novel ECG Analysis

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Background: Atrial fibrillation (AF) is the most common arrhythmia in Japan, and it causes a high rate of complications such as cerebral infarction (CI). It is known that AF begins as paroxysmal form and gradually progresses to persistent form, and sometimes it is difficult to identify paroxysmal AF (PAF) before having CI. The aim of this study is to evaluate the risk of PAF and CI from blood tests and ECG during sinus rhythm.

Materials and Methods: A total of 600 adult subjects were enrolled (300 from PAF and control groups). Blood test was performed to identify the genetic variation and novel biomarkers including microRNA and cell-free DNA (cfDNA). ECG was analyzed using fragmentation analysis.

Results: Genotyping identified 3 single nucleotide polymorphisms (SNPs) were significantly associated with AF (rs6817105, rs10824026, and rs2106261). Circulating miRNAs and cfDNA did not show significant differences between PAF and control groups, but the cfDNA concentration was significantly higher in patients with history of CI. ECG fragmentation analysis revealed that the number of fragmentation was larger in the PAF group. Combining a genetic risk score and an ECG analysis, we could predict PAF with AUC of 0.654.

Conclusion: The risk of AF could be assessed by combining genetic risk score and ECG fragment analysis. Furthermore, the risk of strokes might be evaluated by plasma cfDNA level, in addition to the AF risk score.

Signal quality and R-wave sensing using chest strap and dry electrode system for arrhythmia monitoring

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¹*AIG Hospital, Hyderabad, India*, ²*M S Ramaiah Medical College and Hospital, Bangalore, India*,
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Objective: To investigate the signal quality of electrocardiogram (ECG) as measured by the duration of time the ECG signal is of diagnostic quality during a 24-hour period in an inpatient setting.

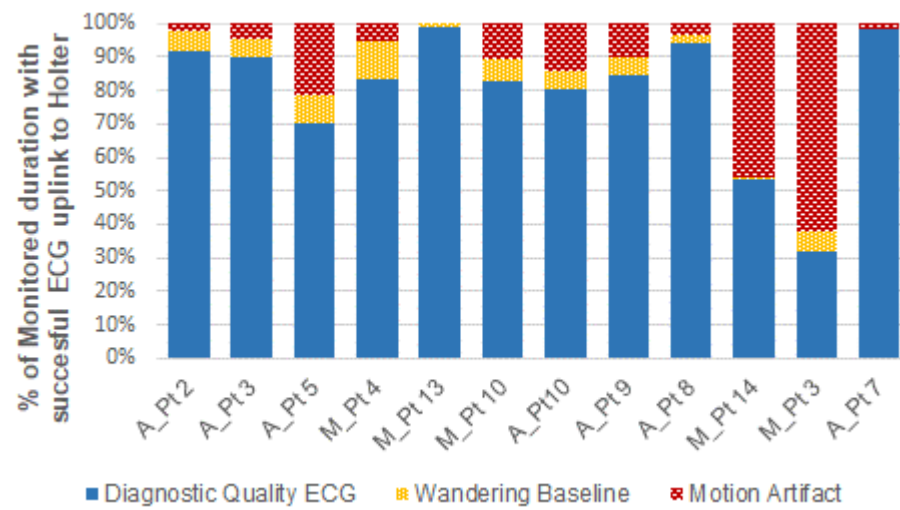
Methods: The prospective observational Cardling external cardiac monitor (ECM) feasibility study enrolled patients with history of cardiovascular disease or increased risk of cardiac arrhythmia. Patients were continuously monitored for 24 hours in an inpatient setting. Patients wore ECM prototype in parallel with the DR220 Holter monitor to acquire raw ECG signal from the ECM device and surface ECG from adhesive skin electrodes. The ECM prototype was designed using a chest strap with dry electrodes connected to a coin cell battery powered implantable cardiac monitor electronics capable of patient-initiated loop recording and automatic detection of pause, bradycardia, tachycardia, and atrial tachyarrhythmia (AT/AF).

Results: The study enrolled 20 patients for inpatient monitoring (53% females, average age 63.4 years, average BMI 24.8 kg/m²). Reviewable data was successfully collected for 12 patients. The diagnostic quality ECG was recorded on an average 76.5% of the monitoring duration with successful ECG recording uplink to the Holter device (Fig-A). Motion artifacts caused loss in ECG signal for 18.7% of the time leading to detection of false pause or tachycardia. The device also automatically detected true AT/AF in 2 patients (Fig-B), junctional rhythm in 1 patient.

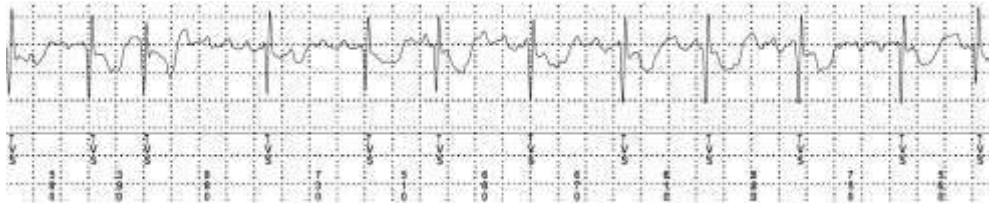
Conclusion: The ECM recorded diagnostic quality ECG in over three-fourth of time during a 24-hour monitoring period. Motion artifacts caused multiple false detections. Cardiac arrhythmia was detected in 25% of patients.

SUPPORTING DOCUMENTS

A



B



Cardiac Arrhythmia Diagnosis Using a Chest Strap and Dry Electrode System for Longer Term Monitoring

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Objective: To investigate cardiac arrhythmia diagnostic yield during a short term (Group-A: 24-hours) and longer term (Group-B:12-weeks) monitoring using a single lead longer term cardiac monitor.

Material and Methods: The Cardling external cardiac monitor (ECM) feasibility study is a prospective observational study that enrolled patients with history of cardiovascular disease or increased risk of cardiac arrhythmia. The ECM investigational prototype was designed using a chest strap with dry electrodes connected to a coin cell battery powered implantable cardiac monitor electronics capable of loop recording initiated by patient, and automatic detection of pause, bradycardia, tachycardia, and AT/AF.

Results: The study enrolled 34 patients (38% females, average age 57.5 years, average BMI 25.4 kg/m², 65% had palpitations, 12% had syncope), 31 patients had their device stored episodes available for review. Total episodes and number of patients with observed cardiac arrhythmia are shown in Table. Cardiac arrhythmia was observed in 4 of 17 patients (24%) in Group-A and 9 of 14 patients (64%) in Group-B respectively. Highest diagnostic yield was observed in AT/AF followed by patient activated and bradycardia episodes. All device detected pause and tachycardia were false detections due to motion artifacts and temporary device removal. Simple algorithm modifications can reduce 97% of false detections.

Conclusion: The ECM was able to observe cardiac arrhythmia in 24% and 64% of patients during 24-hour inpatient and 12-week ambulatory monitoring. Motion artifacts caused multiple false automatic detections. Algorithm modifications and tighter chest straps can make this device feasible for routine clinical use.

SUPPORTING DOCUMENTS

		Group-A	Group-B
	Patients	17	14
	Monitoring Duration	24 hours	12 weeks
Device recorded number of episodes with ECG (patients)	AT/AF	33 (7)	33 (7)
	Bradycardia	7 (3)	37 (7)
	Pause	198 (16)	537 (13)
	Tachycardia	24 (9)	103 (13)
	Patient Activated	0 (0)	52 (11)
Number of patients with true cardiac arrhythmia	AT/AF	3	2
	Bradycardia/pause	0	2
	PVC	0	3
	Sinus arrhythmia	0	1
	Sinus tachycardia (≥ 110 bpm)	0	4
	Junctional rhythm	1	0

Effect of Particulate Matter 2.5 on QT Dispersion in Patients With Chronic Respiratory Disease

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¹*Chiang Mai University, Thailand*

Background: PM2.5 air pollutants increased risk of ventricular arrhythmias. The prolonged corrected QT interval (QTc) and QT dispersion (QTd) is common in patients with chronic airway disease and is associated with heightened risk of ventricular tachyarrhythmia. We sought to examine the effect of PM2.5 exposure on QTc and QTd in patients with chronic airway disease.

Methods: We enrolled 73 patients with chronic airway disease into the study. The 12-lead ECGs were recorded during high-exposure and low-exposure periods of PM2.5. QTc and QTd were compared between 2 periods.

Results: Mean age was 70±10 years. Mean FEV1/FVC was 63±14%. There was no difference in QTc between PM2.5 high-exposure and low-exposure periods. However, QTd was significantly increased during PM2.5 high-exposure compared to low-exposure periods in male patients (43.5±15.0 vs. 38.2±12.1 msec, P=0.044) but no difference was found in females. We found that patients who worked mostly indoor had less QTd than those working outdoor during PM2.5 low-exposure period. In addition, those who wore face mask tended to have less QTd during low-exposure period than those who did not.

Conclusions: High PM2.5 exposure increased QTd in male patients with chronic airway disease. Working indoors and wearing face mask were associated with less QTd.

Asymptomatic Complete Heart Block: How Soon Should a Pacemaker Be Implanted?

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Objectives: To determine timing of adverse events happened during waiting for permanent pacemaker (PPM) implantation in patients diagnosed with asymptomatic complete heart block.

Materials and methods: A retrospective analysis of data from electronic medical record between 2002 and 2020 was conducted at a university hospital in southern Thailand. Complete heart block diagnosed by standard 12-lead ECGs which were confirmed by attending cardiologists. Patients eligible for the study must not have symptoms related to complete heart block at the time of diagnosis. Kaplan-Meier survival analysis of time from diagnosis to any adverse events was used.

Results: Among 95 patients (mean age 70.4±15.0 years old) presented with incidental detection of bradycardia (40.5±7.2 beats per minute; median QRS duration 110.0 ms (IQR 92.0, 145.8 ms)) during hospital visits for annual physical checkup or other non-related illnesses. The median waiting time for PPM implantation was 61 days (IQR 14, 223 days). Thirty-four patients (35.8%) developed adverse events during the waiting period. Major adverse events included congestive heart failure (4.2%), syncope (4.2%), ventricular arrhythmias (1.1%), and survival of cardiac arrest (2.1%). The first major adverse event - syncope, happened 27 days after diagnosis. In addition, the first cardiac arrest event happened 36 days after diagnosis. Survival analysis revealed 30-day and 90-day event-free survivals of 94.2% and 83.7% respectively.

Conclusion: The waiting period for PPM implantation even in patients with asymptomatic complete heart block carries some risks including cardiac arrest. To avoid major adverse events, PPM implantation should be performed sooner than 27 days after diagnosis.

To See It is to Believe It...

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¹*Department Of Cardiology, Serdang Hospital, Malaysia*, ²*Loh Guan Lye Specialists Centre, Malaysia*

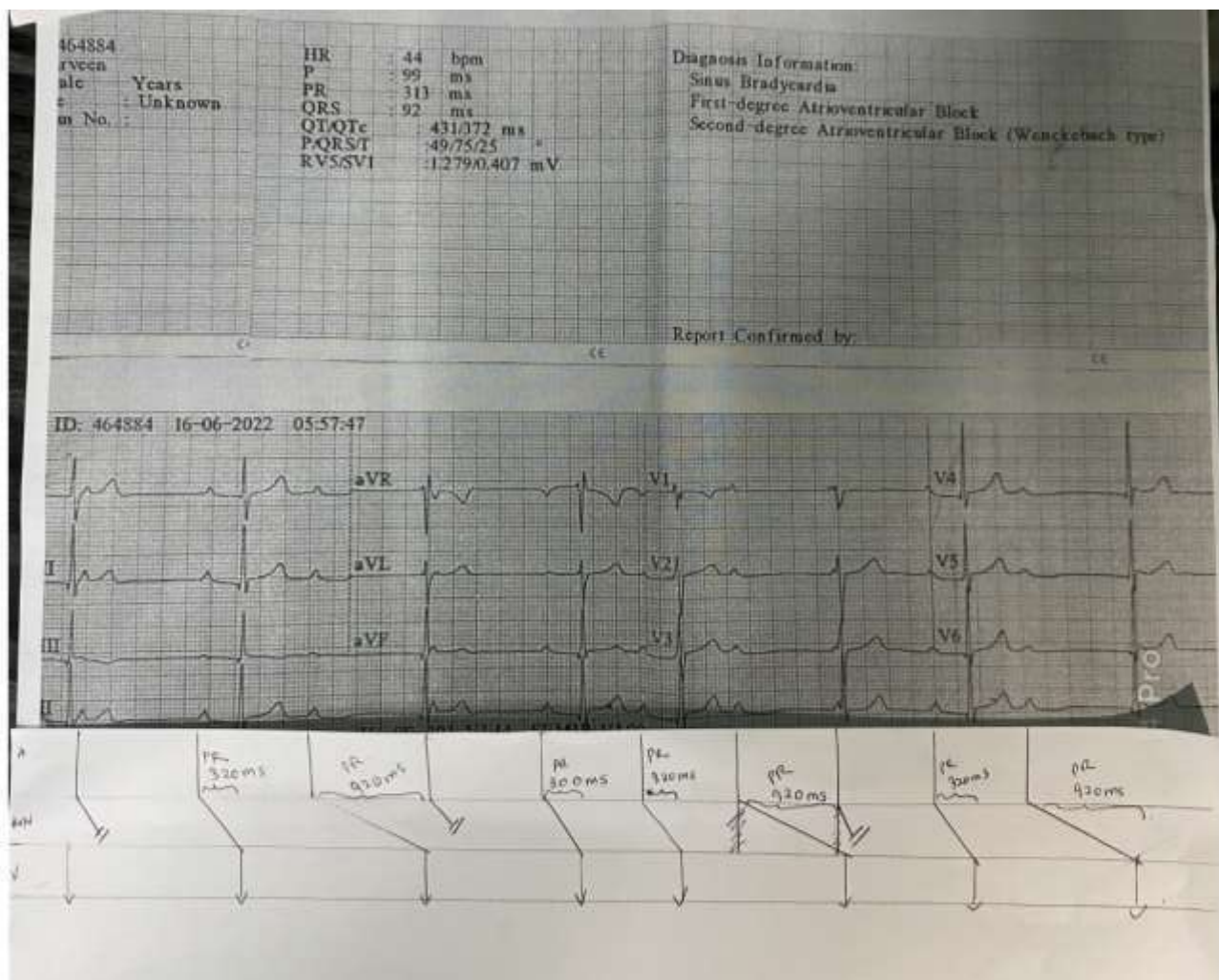
Objective: To demonstrate PR interval can go up to 932 ms in patient referred to us for complete heart block.

Materials and Methods: For young patients presented with syncope, most often they were referred to cardiology department to rule out cardiac syncope. This 15 years old boy with post dengue myocarditis was referred to our clinic for complete heart block. Workup done such as Echocardiogram showed Ejection Fraction preserved, Structurally normal heart and in Exercise Stress Test he managed to achieve METS 8 and reached HR 166 beats per minute with 1 to 1 conduction.

Result: With split opinion between 1st degree AV block and Wenkebach vs complete heart block and he got admitted for recurrent syncope, Electrophysiology Study was done showed the similar finding as our ladder diagram done with AH 230 ms and HV 34 ms with ECG PR 332 ms, QRS 102 ms

Conclusion: PR interval can go as long as 940 ms and for this gentleman with first degree and second degree type 1 (Wenkebach) he doesn't require Permanent Pacemaker implantation.

SUPPORTING DOCUMENTS



Looks like me, Sounds like me but it is not ME!

Dr Wei Shen Chee¹, Dr Soot Keng Ma², Dr Kok Wei Koh³, Dr Abd Ghani Abd Raqib¹, Dr Mohd Yusof Hartini¹, Dr Habizal Nor Halwani¹, Dr Selvaraj Kamaraj¹, Dr Abdullah Ramaiah Asri Ranga¹, Dr Abd Ghapar Abd Kahar¹

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Objectives: To illustrate the clinical significance of relative narrowing of QRS complexes during tachycardia in discriminating Ventricular tachycardia(VT) from Supraventricular Tachycardia (SVT) with aberrancy in patients with pre-existing bundle branch block using a case of middle aged gentleman with Ischemic Dilated Cardiomyopathy with Ejection Fraction of 35% who presented to district hospital with palpitation.

Methods: There are various algorithms in place to guide to discriminate SVT from VT and still clinical dilemma exists for those patients presenting with wide complex tachycardia with pre-existing Bundle Branch Block. Besides this, clinicians tend to see the changes in axis after reversion to sinus rhythm to conclude whether it is SVT with aberrancy vs VT.

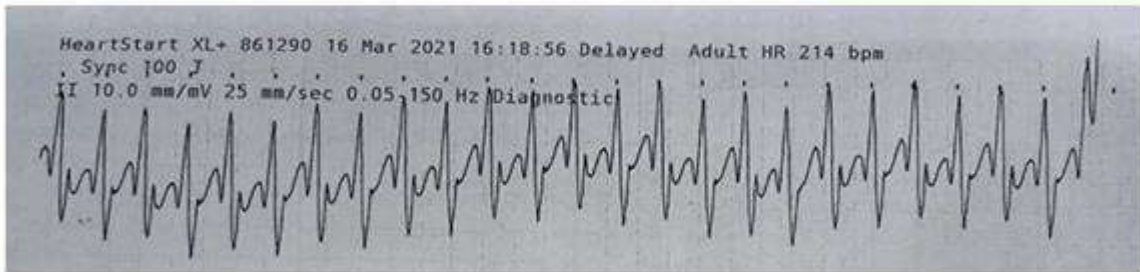
Results: With the relative narrowing of QRS duration in tachycardia and for this case from QRS duration in Sinus Rhythm of 240 ms to QRS duration of 160 ms in tachycardia clinched the diagnosis of VT in pre-existing RBBB as the sequential activation of Left ventricle followed by Right Ventricle in RBBB during sinus rhythm became simultaneous activation with the VT origin close to septum during tachycardia. Thus, Implantable Cardioverter Defibrillator was implanted for secondary prevention on top of goal directed medical therapy for heart failure.

Conclusion: Relative narrowing of QRS complexes during Tachycardia suggests VT.

Behold the QRS duration

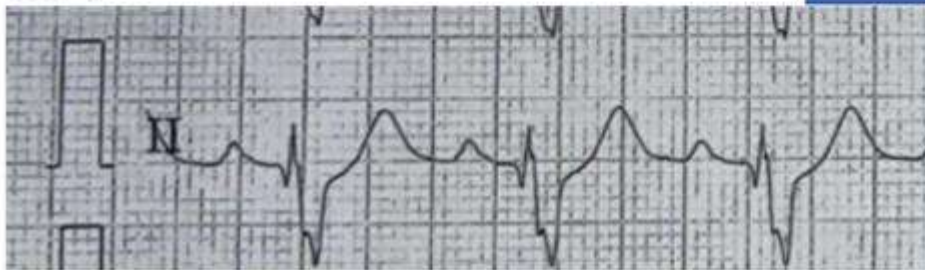
Tachycardia

QRS = 160ms



SR

QRS = 240ms



Association of Preterm Birth With Maternal Arrhythmia: Machine Learning Analysis Using National Health Insurance Data

Dr Jue Seong Lee¹, Dr Eun Saem Choi¹, Miss Yujin Hwang¹, PhD Kwang-Sig Lee¹, Professor Ki Hoon Ahn¹

¹*Korea University Anam Hospital, South Korea*

Objectives: The purpose of this study is to build the prediction model of preterm birth (PTB) using machine learning analysis and nation-wide population data and to investigate the association between arrhythmia and PTB.

Materials and Methods: Population-based retrospective cohort data came from Korea National Health Insurance claims for 174,926 primiparous women who aged 25 - 40 and delivered in 2017. The 36 independent variables were included (demographic/socioeconomic determinants, disease information, medication history, obstetric information). Machine learning analysis was used to establish the prediction model of PTB. Random forest variable importance was used for identifying major determinants of PTB. Furthermore, we calculated the SHAP (Shapley additive explanations) values to identify the direction of association between maternal arrhythmia and PTB in prediction model.

Results: Among the study population, 12,701 women had PTB and 7,312 women had arrhythmia. The areas under the operating-characteristic-curve of prediction model with oversampling data were within the range of 88.53 - 95.31. The prediction model registered the accuracy of 89.59-95.22%, the sensitivity of 85.34-95.58% and the specificity of 91.71-95.04% as well. Based on the variable importance of prediction model, arrhythmia was the most significant determinants of PTB among maternal heart diseases (ranked 15th). Within the arrhythmia group, atrial fibrillation/flutter was the most significant risk factor of PTB in terms of the SHAP value.

Conclusions: Maternal arrhythmia has significant associations with PTB. Careful evaluation and management of maternal arrhythmia during pregnancy may help reduce PTB and improve neonatal outcome.

Efficiency Assessment of Continuous Ambulatory ECG Monitoring Using Patient and Workflow Analysis

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¹*Philippine General Hospital, Metro Manila, Philippines*

Objective: This is an observational time and motion cross-sectional study with a primary aim of analyzing the Operational delivery of continuous ambulatory ECG monitoring (holter) service in a tertiary hospital.

Method: The data included holter studies of adult patients (19 years old) who were requested for holter monitoring from private or charity services. The observation began with the request for holter study and ended with the official release of the holter result.

Results: A total of 99 Holter studies were included and analyzed. The median total wait time for the clinical service delivery took 5 days. The median total elapsed period for operational service delivery were 28.5 days. The study observed that the process of fellow interpretation to electrophysiology consultant overreading took the most time in the procedure, which the said procedure has an IQR = 4-32 days, wherein its median = 7 days, followed by the duration of Holter which has an IQR = 6-24 days, with a median of 14.5 days.

Conclusion: The median clinical and operational delivery times of the holter service were significantly delayed. The major administrative conveyance delay was in the term from the point of Fellow translation or interpretation to Electrophysiology consultant overreading. The following are important factors to focus on for improvement of timely service of holter monitoring: Simplification of the multi-step process, Digitalization, Strict adherence to protocol, Dedication of machines, Personnel and training.

Delayed Effect of Catheter Ablation for Intramural Outflow Tract Ventricular Arrhythmias

Dr Guan-Yi Li¹, Dr Fa-Po Chung^{1,2}, Professor Li-Wei Lo^{1,2}, Professor Yenn-Jiang Lin^{1,2}, Professor Shih-Lin Chang^{1,2}, Dr Yu-Feng Hu^{1,2}, Dr Tze-Fan Chao^{1,2}, Dr Jo-Nan Liao^{1,2}, Dr Ta-Chuan Tuan^{1,2}, Dr Ting-Yung Chang^{1,2}, Professor Shih-Ann Chen^{1,2,3}

¹Heart Rhythm Center, Taipei Veterans General Hospital, Taipei, Taiwan, ²Faculty of Medicine and Institute of Clinical Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan,

³Cardiovascular Center, Taichung Veterans General Hospital, Taichung, Taiwan

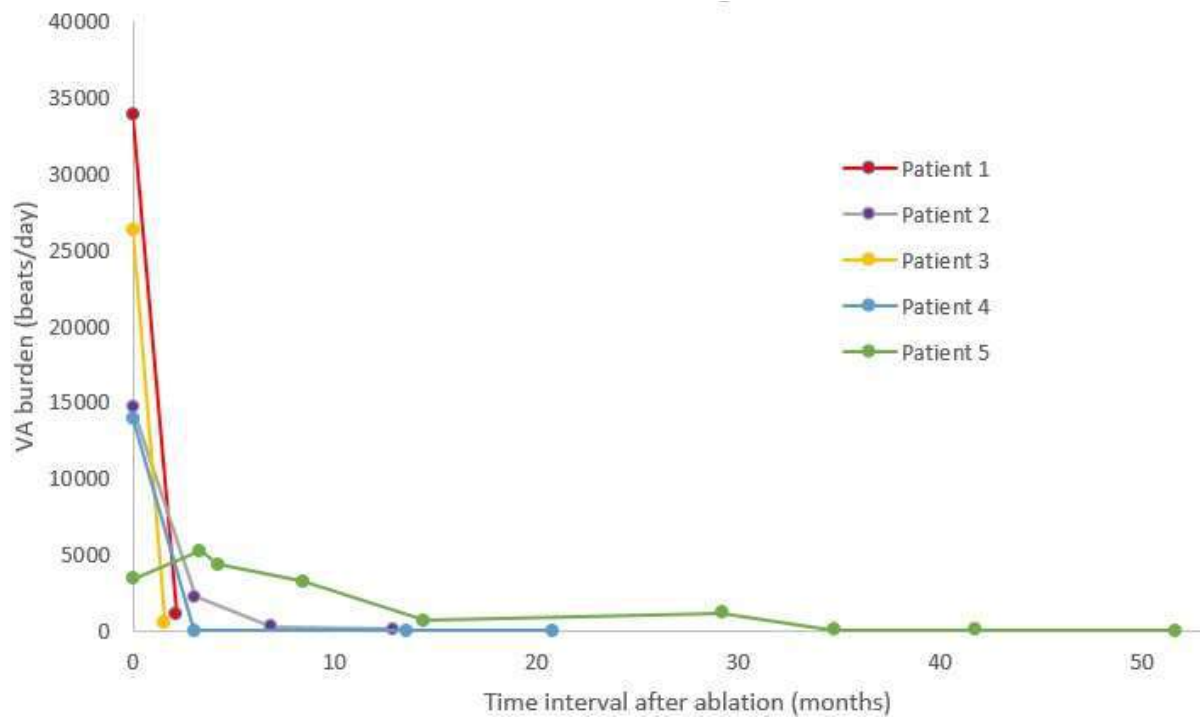
Objectives: Intramural outflow tract ventricular arrhythmia (OT-VA) can be clinically challenging. We aimed to investigate the outcome of intramural OT-VA without complete elimination after sequentially bilateral catheter ablation (CA).

Materials and Methods: During 2008 to 2020, patients with intramural OT-VA undergoing sequentially bilateral CA were recruited. ECG and electrophysiological parameters were analyzed. The intramural OT-VA was defined by one of the following: 1. Difference of activation time between RVOT and LVOT <20 ms; 2. Pacemapping at the earliest activation site could not yield 12/12 matched morphology; 3. CA at the earliest activation site could not completely eliminate the VA. Partial success was defined by a >80% reduction in VA burden immediately after CA. Delayed resolution was defined by a VA burden persistently <2% of total daily beats during follow-up.

Results: 124 patients (76 men, age: 53.5 ± 14) were studied. Acute success, partial success, and failure were found in 85(68.5%), 26 (21.0%), and 13(10.5%) patients respectively. For those with partial success, delayed resolution were observed in 5 (19.2 %) patients, within 3.0 (IQR: 1.9-10.6) months after CA (Figure). The VAs of these 5 patients were characterized by LBBB morphology and dominantly precordial R/S transition at V3, and the activation time at RVOT was earlier than LVOT.

Conclusion: Despite partial success could be achieved immediately after bilateral CA of intramural OT-VA, the recurrence rate was high. Delayed resolution of intramural OT-VA could only be observed in 19.2% of patients and the majority was observed within 3 months after CA.

SUPPORTING DOCUMENTS



Physical activity on mortality and MACCE in patients with concomitant AF and coronary artery disease

Asst Prof Moo-Nyun Jin¹, Dr Hye Young Lee², Dr Jong Kwon Seo², Dr Byung Gyu Kim², Dr Gwang Sil Kim², Dr Young Sup Byun², Dr Byung Ok Kim²

¹*Ewha Womans University College Of Medicine, Seoul, South Korea*, ²*Inje University College of Medicine, Seoul, South Korea*

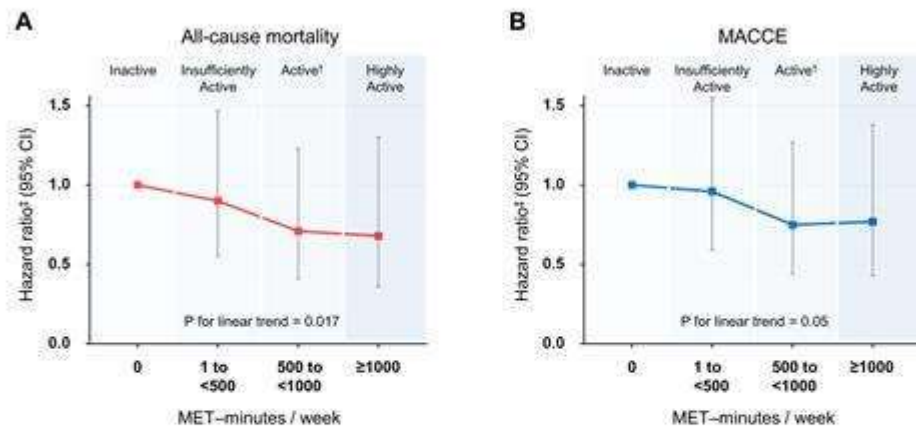
Objectives: Although physical activity benefits cardiovascular health, there is concern that intense exercise is linked promoting atrial fibrillation(AF) and coronary plaque rupture. However, impact of physical activity on outcomes in patients with concomitant AF and coronary artery disease(CAD) is unclear. This study aimed to evaluate the impact of physical activity on outcomes in patients with AF and CAD.

Materials and Methods: We assessed 551 patients with AF and CAD (age, 67.1±9.8 years) who completed self-reported questionnaire for physical activity in single tertiary-care hospital. We examined the associations of physical activity with all-cause mortality and major adverse cardiac and cerebrovascular event (MACCE).

Results: The risk of all-cause mortality(P for linear trend=0.017) and MACCE(P for linear trend=0.05) were inversely linear associated with greater level of physical activity. Meeting and exceeding guidelines recommended physical activity were associated with reduced risk of all-cause mortality in unadjusted model, however, this association was not remained significance after adjusting model. There was no evidence of increased risk of mortality and MACCE at levels of physical activity above guidelines recommended key target range, even with vigorous intensity physical activity exceeding the key target range.

Conclusion: Physical activity is inversely associated with all-cause mortality and MACCE in patients with concomitant existing AF and CAD. No excess risk of mortality and MACCE was present at levels of exercise above guidelines recommended key target range. Our findings motivate inactive patients with to begin participation in exercise and refrain from discouraging patients with AF and CAD who exceed guidelines recommended physical activity.

SUPPORTING DOCUMENTS



Prevalence of Left Ventricular Dysfunction after Acute Myocardial Infarction in the Primary PCI Era

Asst Prof Jongmin Hwang¹, Associate Professor Hyoung-Seob Park¹, Professor Seongwook Han¹

¹*Keimyung University Dongsan Hospital, Daegu, South Korea*

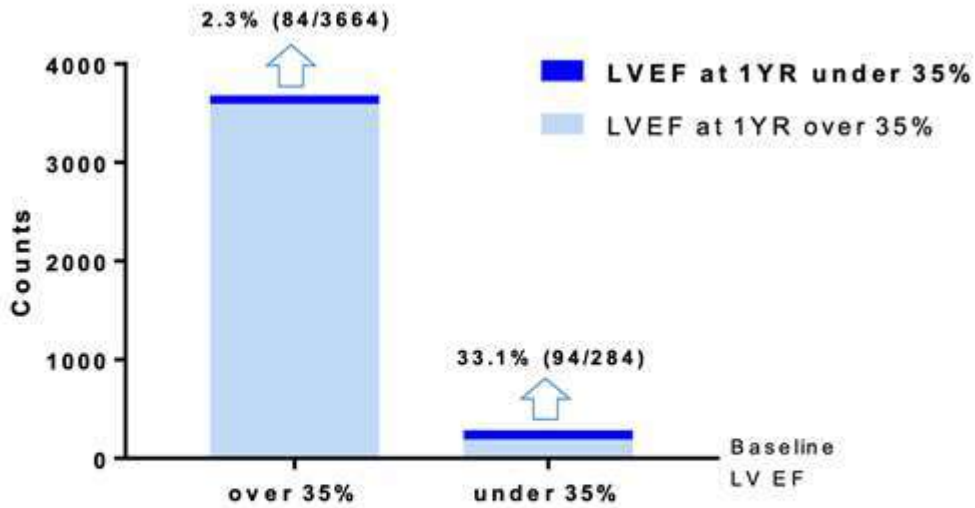
Background: Several randomized controlled trials had proven the mortality benefit of implantable cardioverter-defibrillator (ICD) in the primary prevention of sudden cardiac death (SCD) for ischemic cardiomyopathy (ICM). However, it is expected that the prevalence of ICM has changed significantly compared to the thrombolytic era because there is a remarkable progression in the treatment of ischemic heart disease. The ICD utilization for primary prevention in Korea is considered still low. The purpose of this study is to evaluate the real incidence of ICM in Korea.

Methods: We analyzed the data from the Korea Acute Myocardial Infarction Registry enrolled from 2016 to 2019. A total of 3,948 patients with acute myocardial infarction (AMI) were received initial (within three months) and follow-up (1-year) echocardiography after index event.

Results: The proportion of left ventricular ejection fraction (LV EF) $\leq 35\%$ at the index event was 7.2% (284/3,948). Among these patients, 33.1% (94/284) of patients showed persistent LV EF $\leq 35\%$ at the follow-up echocardiography. Meanwhile, 3,664 patients showed LV EF $> 35\%$ at the initial echocardiography, and 2.3% of these patients (84/3664) showed deterioration of LV EF $\leq 35\%$ during the 1-year follow-up period. Overall, 4.5% (178/3948) of (AMI) patients showed decreased LV EF after 1-year, who is the candidate for ICD implantation for the primary prevention of SCD.

Conclusion: In this large AMI registry, the incidence of ICM after 1-year of index event was only 4.5%. This result can explain the low absolute number of ICD implantation for primary prevention of post-AMI ICM patients in Korea.

Results



	Baseline	LV EF after 1YR
Over 35%	3680 (92.8%)	3786 (95.5%)
Under 35%	284 (7.2%)	178 (4.5%)
Total counts	3964	3964

Risk of Long-term Cardiovascular Death in Patients With Mid-range Ejection Fraction After Acute Myocardial Infarction

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¹Seoul St. Mary's Hospital, Seoul, South Korea, ²Eunpyeong St. Mary's Hospital, Seoul, South Korea,

³St. Vincent's Hospital, Suwon, South Korea

Objectives: Prognostic significance of mid-range ejection fraction (mrEF) in acute myocardial infarction (AMI) has not been well demonstrated. We investigated the risk of cardiovascular death in patients with mrEF following AMI.

Materials and Methods: Subjects were enrolled from two multicenter, prospective AMI registries. A total of 19,100 patients with documented left ventricular ejection fraction (EF) at admission were included. Risk of long-term cardiovascular death was evaluated according to EF strata.

Results: There were 2,457 patients with reduced EF (EF<40%), 5,276 patients with mrEF (40%≤EF<50%), and 11,367 patients with preserved EF (EF≥50%). Rate of cardiovascular death during a mean 48 (±31) months was 26.3% in the reduced EF group, 11.5% in the mrEF group, and 7.7% in the preserved EF group (p<0.001). Among patients with mrEF, age >65 years, hypertension, chronic kidney disease, Killip class ≥3, and cardiac arrest during index hospitalization were independent predictors for cardiovascular death. A presence of ≥2 predictor best discriminated the patients at higher risk of cardiovascular death (sensitivity 0.718, specificity 0.666).

Conclusion: Patients with mrEF after AMI had modest risk of cardiovascular death. Intensive treatment to improve long-term survival is warranted in high risk patients with mrEF.

Heart Rate Variability Could Predict Obstructive Sleep Apnea That is Risk Factor of Atrial Fibrillation

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Objective: Obstructive sleep apnea is a well-known risk factor of atrial fibrillation. It remains unclear which variable of heart rate variability (HRV) is associated with apnea-hypopnea index (AHI).

Materials and Methods: We prospectively enrolled 66 patients who visited our sleep clinic complaining of habitual snoring or sleep apnea. All underwent 24-hour Holter monitoring combined with full-night polysomnography. We evaluated the associations between HRV parameters and polysomnography indices.

Results: The night-time very-low-frequency (VLF), low-frequency (LF), and high-frequency (HF) were significantly higher than the day-time values. On correlation analysis, the day/night VLF ($r=0.550$, $P<0.001$), LF ($r=0.556$, $P<0.001$), and HF ($r=0.303$, $P<0.001$) values were significantly associated with the AHI. Of the day/night HRV ratios, the VLF (P for trend = 0.003) and LF (P for trend = 0.013) ratios decreased significantly by obstructive sleep apnea severity. Multivariable analysis showed that the day/night VLF ($\beta = 16.387$, $P<0.001$) and day/night LF ($\beta = 25.248$, $P<0.001$) were independently associated with the AHI.

Conclusion: The day/night VLF and day/night LF ratios were associated with the AHI. These parameters tended to decrease by obstructive sleep apnea severity.

Utility of in Vivo Zebrafish Cardiac Assay to Predict the Functional Impact of KCNQ1 Variants

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¹*Kanazawa University, KANAZAWA, 日本*

Objectives: Genetic testing for inherited arrhythmias and discriminating pathogenic or benign variants from variants of unknown significance (VUS) are essential for the gene based medicine. KCNQ1 is known as a causative gene of type 1 long QT syndrome (LQTS) and familial atrial fibrillation (AF), and about 30% of the variants found in LQTS are classified as VUS. We studied the role of zebrafish cardiac arrhythmia model in determining the clinical significance of KCNQ1 variants.

Materials and methods: We generated homozygous *kcnq1* deletion zebrafish (*kcnq1del/del*) by CRISPR/Cas9 technique, and expressed human Kv7.1/MinK channels on *kcnq1del/del* embryo. We dissected the hearts from the thorax at 72 hour-post-fertilization and measured transmembrane potential of the ventricle in zebrafish heart. Action potential duration was calculated as the time interval between the peak maximum upstroke velocity and 90% of repolarization (APD90).

Results: The APD90 of *kcnq1del/del* embryo was 279±48 ms, which was significantly shortened by injecting KCNQ1 WT cRNA and KCNE1 cRNA (159±29 ms, $P<0.05$ vs. *kcnq1del/del*). The study of 2 pathogenic variants (S277L and T587M) and one VUS (R451Q) associated with LQTS showed the APD90 of *kcnq1del/del* embryos with mutant Kv7.1/MinK channels was significantly longer than that with Kv7.1 WT/MinK channel. Regarding the pathogenic variant (S140G) associated with familial AF, however, the APD90 of *kcnq1del/del* embryos with mutant Kv7.1/MinK channel was comparable to that with Kv7.1 WT/MinK channel.

Conclusion: In conclusion, functional analysis of in vivo zebrafish cardiac arrhythmia model might be useful for determining the pathogenicity of loss-of-function variants in patients with LQTS.

Overcoming challenging atrial flutter ablation with point density exclusion electroanatomic mapping

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Background: Typical atrial flutter (AFL) ablation could usually be performed without utilizing 3D mapping system. However, in rare instances, anatomical challenges including prominent Eustachian ridge could hinder effective ablation delivery.

Objectives: The purpose of this study is to evaluate the use of point density exclusion (PDX) electroanatomic mapping in typical AFL ablation.

Materials and Methods: Procedures were performed under sedation. 3D electroanatomical map of the RA with PDX was created with a multipolar mapping catheter. During ablation, areas with absent 3D points but increased contact force were identified as endocavitary structure. CTI line was ablated and bidirectional block determined for all the cases. Comparison was made with cases that did not utilize this technique.

Results: 5 patients (all males, mean age 64.4 +/- 16.1 years) underwent the procedure with PDX mapping whilst 23 patients (15 males and 8 females, mean age 60.7 +/- 10.9 years) underwent typical AFL ablation without PDX mapping. Procedure time was shorter in the PDX group although this was not statistically significant (102.0 +/- 45.5 mins vs 124.8 +/- 88.2 min, p= 0.42). Lesions delivery was also lower in the PDX group (16 +/- 7.1 vs 18.7 +/- 21.7, p= 0.64) with shorter ablation duration (10.6 +/- 2.1 mins vs 11.7 +/- 12.1 mins, p = 0.68). Bidirectional block were demonstrated in all patients in both groups. No procedural complication was observed.

Conclusion: PDX mapping could facilitate the success of otherwise challenging AFL ablation procedures without the need of specific software nor intracardiac imaging.

Prevalence of Atrial Fibrillation at Referral Hospital in Indonesia: A Smartphone Based Diagnosis

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Objective: Atrial fibrillation (AF) is one of the most common arrhythmic disorders worldwide. This study aims to describe the prevalence of AF from various cities in Indonesia using single lead electrocardiography (AliveCor Kardia Mobile system) linked to a smartphone-based application.

Methods: This is a cross-sectional epidemiological study conducted at several referral hospitals in Indonesia between January 2018 and July 2019. This study utilized AliveCor device as a screening tool for AF and confirmed its finding with clinical diagnoses by cardiologists. Variables assessed were gender, age, history of heart failure, hypertension, diabetes, stroke, coronary artery disease, peripheral artery disease and prior history of AF.

Results: A total of 9773 subjects were enrolled in this study. The prevalence of atrial fibrillation reported by AliveCor and cardiologist was 3.3% and 3.5%, respectively. Sensitivity and specificity of AliveCor in our study were 93.3% and 100%, respectively. AF is more common in men than women. Based on risk factors, majority of patients with AF did not report a history of heart failure, stroke, diabetes mellitus, hypertension, peripheral artery disease, coronary artery disease and history of AF.

Conclusion: The prevalence of AF at referral hospital in Indonesia based on smartphone diagnosis in Indonesia was 3.3%. Sensitivity and specificity of AliveCor in our study were 93.3% and 100%, respectively.

A Non-invasive Method to Detect Sinoatrial Node Function in Human

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Objective: The sinoatrial node (SAN) is the main pacemaker of the heart, and it governs the heart rate. Two main mechanisms control the SAN function: the autonomic nervous system (ANS) that stimulates receptors on the pacemaker cell membrane, and the intrinsic mechanisms of the SAN cells. Because the systems work in synergy, it is challenging to separate their individual contribution and identify SAN dysfunction in early state. We hypothesized that a signal processing algorithm could be developed to identify the unique SAN signature on the Heart Rate Variability (HRV) by exploring short-term and long-term HRV indices.

Materials and Methods: As a part of electrophysiological evaluation, 39 patients having paroxysmal supraventricular tachycardia underwent autonomic blockade with intravenous propranolol and atropine. The patients were divided into two age groups: minors (bellow 21) and elderly, and their ECG recordings were analyzed.

Result: Reducing the ANS activity by autonomic blockade reduced HRV parameters in time domain (e.g. mean RR Interval duration and standard deviation), frequency domain (e.g. normalized low frequency content), and non-linear domain (e.g. multiscale entropy of mid and high scales).

For both age groups, we designed an algorithm containing low-pass filter acting on RR interval time series that allows us to evaluate SAN signature. Our method includes filtration targeting low and high frequency bands of RR interval spectrum.

Conclusion: Our novel method can serve as a unique non-invasive diagnostic tool for cardiac conditions in health and disease, affecting the SAN and heart.

Heart rate variability according to Ambulatory glucose profile in patients with Diabetes Mellitus

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Objectives: Autonomic neuropathy commonly arises as a long-term complication in diabetes mellitus (DM) and can be diagnosed from heart rate variability (HRV), calculated from electrocardiogram (ECG) recordings. There is limited data about HRV using real-time ECG and ambulatory glucose monitor in patients with diabetes mellitus.

Materials and Methods: Total of 43 patients (66.3 ± 7.5 years) with DM underwent continuous real-time ECG monitor (225.7 ± 107.3 hours) for HRV and ambulatory glucose monitor using remote monitoring system. And we compared HRV according to ambulatory glucose profile.

Results: During the monitor, we checked total 15090 times of ECG and ambulatory glucose level simultaneously of all patients. Both time and frequency domain HRV were lower when the patients had poor controlled glucose level ($>200\text{mg/dL}$) as compared with normally controlled glucose levels ($<200\text{mg/dL}$) in Table. In addition, Heart rate and respiration rate increased according to real-time glucose level ($P < 0.001$).

Conclusions: Poor controlled glucose level was independently associated with lower HRV in patients with DM. This is further substantiated by independent continuous associations between real-time measures of hyperglycemia and lower HRV. These data strongly suggest that cardiac autonomic dysfunction can be caused by elevated blood sugar alone.

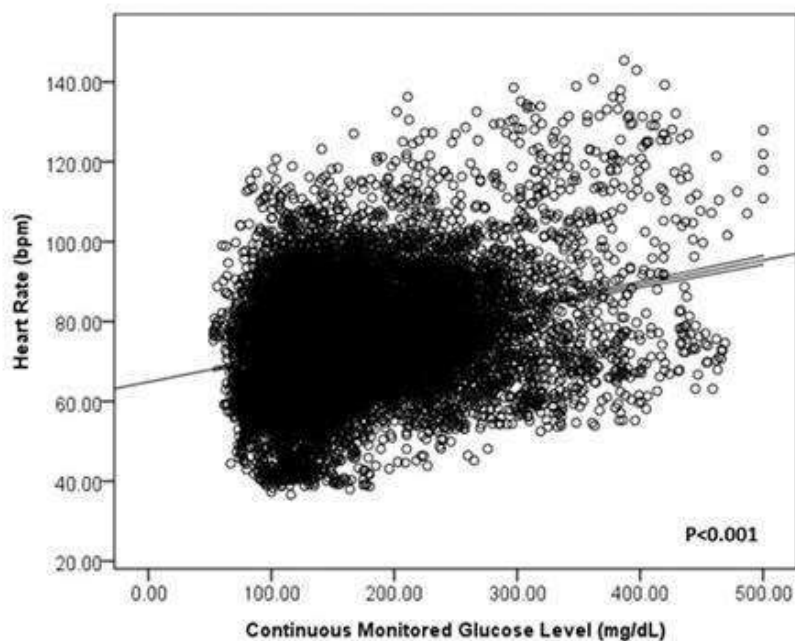
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Table. HRV measures in DM patients according to glucose control

HRV			
Time domain	Poor controlled Glucose level	Normally controlled Glucose level	P value
SDNN, ms	38.7 ± 31.2	47.8 ± 44.6	<0.001
RMSSD, ms	7.6 ± 6.4	9.9 ± 9.1	<0.001
SDSD, ms	7.6 ± 6.4	9.9 ± 9.1	<0.001
NN50, count	12.4 ± 36.1	24.7 ± 55.0	<0.001
pNN50, %	0.8 ± 2.6	1.7 ± 3.9	<0.001
Frequency domain			
Total Power, N.U.	474.1 ± 227.0	792.1 ± 280.4	<0.001
VLF, N.U.	320.3 ± 211.7	452.8 ± 237.6	<0.001
LF, N.U.	104.1 ± 251.2	215.1 ± 522.5	<0.001
HP, N.U.	49.7 ± 128.7	124.2 ± 276.4	<0.001

HRV indicates heart rate variability; DM, diabetes mellitus; SDNN, Standard deviation of NN intervals; Root mean square of successive RR interval differences; SDS, standard deviation of differences between adjacent NN intervals; NN50, number of NN intervals differing by more than 50ms; pNN50, ratio of NN50; Total power, 5 min total power in frequency range ≤ 0.4 Hz; VLF, power in very low frequency range ≤ 0.04 Hz; LF, power in low frequency range 0.04 - 0.15 Hz; power in low frequency range 0.15 - 0.4 Hz; N.U., Normalized unit.

Figure. Heart rate according to Continuous Monitored Glucose level in patients with DM.



Contemporary Review of Temporary Transvenous Pacing: Indications, Complications, and Prognosis

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Objectives: This study aims to review TTP procedural indications, rates, types of complications, and patient prognosis in a tertiary teaching hospital's cardiac intensive care unit.

Material and Methods: A retrospective analysis was performed on the medical records of consecutive patients who required TTP insertion between August 2014 to June 2017.

Results: 106 patients underwent TTP insertion. Symptomatic bradyarrhythmia was the most common indication (101 patients [95%]), ventricular overdrive pacing for tachyarrhythmias (3 [3%]), and perioperative prophylactic insertion (2 [2%]). Ultrasound guidance for central venous access and fluoroscopy for positioning of the pacing wire in the right ventricle were used routinely. A total of 135 TTP procedures performed. The femoral vein was the most common access site (65%); followed by right internal jugular vein (IJV) (30%) and least frequently left IJV (4%). Mean duration of temporary pacing was 5 days (range 1-19 days).

There were no significant vascular complications. Revision was needed in 21 cases due to pacing wire dislodgement or loss-of-capture. 2 right ventricle (RV) perforations required emergency pericardiocentesis. Permanent pacemaker or defibrillator were implanted in 61 patients (58%). 20 patients (19%) recovered and did not require permanent implantable system, while others declined further therapy or died prior to definitive therapy. 21 patients (20%) died within the same hospital admission, with 2 deaths related to TTP complications (RV perforation).

Conclusion: TTP remains an important urgent cardiac procedure. Serious complications like RV perforation may occur and should be considered in patients who become haemodynamically unstable post insertion.

Relationship Between Abnormal Signal-averaged Electrocardiograms and Left Ventricular Ejection Fraction in Patients With Non-ischemic Cardiomyopathy

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Objective: This study is to evaluate the correlation between left ventricular ejection fraction (LVEF) with Signal Average Electrocardiogram (SAECG) in patients with Non-Ischaemic Cardiomyopathy (NICM) and analyse if there is a relationship between LVEF, SAECG & Ventricular arrhythmias (VAs).

Method: Patients with NICM, who had all three parameters of SAECG (Total QRS duration, Low Amplitude Signal (LAS) under 40µvolt, Root-mean-square (RMS) voltage of last 40 msec) were included. Based on echocardiogram patients were grouped into preserved LVEF (> 50%) and reduced LVEF <50%. They were connected to a Holter monitor to record VAs.

Results: A total of 19 patients were included in the study. The mean age of the patients was 63 (SD 10.5), 43% were female and 68.4% were in the reduced LVEF group. RMS value was positive in 84.6% of patients in the reduced LVEF group while it was 16.6% in another group (P<0.005). Positive QRS value was noted in 53.8% of patients in the reduced LVEF group and in 16.6% in another group (P<0.005). 53.8% of patients had positive LAS values in the reduced LVEF group and zero in another group (P<0.005). In patients with reduced LVEF and positive SAECG, 60% had significant VAs. In contrast, patients in preserved LVEF group experienced no VAs.

Conclusion: In our study, we noticed SAECG along with LVEF is a good predictor of cardiac arrhythmia events.

Severe Hypothyroidism With Variable Atrioventricular Block in an Elderly Patient With Right Coronary Artery Disease

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Case Presentation: A 65-year-old female presented to our institution with a chief complaint of chest discomfort. She is a known hypertensive who has been complaining of fatigue, exertional dyspnea, and orthopnea for three months now. The patient experienced 7 days of intermittent angina and shortness of breath that worsened two days before admission. She was noted to have increased sleeping time. At the emergency department, the patient was received bradycardic with otherwise stable vital signs. Electrocardiograms (ECG) performed showed high grade AV block and 2:1 AV block. Although initially comfortable, symptoms recurred 6 hours into admission and were accompanied by dizziness and weakness. Emergency temporary pacemaker insertion was performed and a coronary angiogram done, revealing significant 1-vessel disease involving the mid-segment of the right coronary artery. Workup revealed the patient to have severe hypothyroidism. Levothyroxine was started. The patient's symptoms improved and she was discharged with her temporary pacemaker removed and no revascularization necessary.

Discussion: The thyroid hormone exerts major influence on the cardiovascular system – with both hyper and hypothyroidism alike causing prominent cardiovascular effects. Hypothyroidism has important effects on the cardiac electrical conduction system. Electrical activity changes manifest on ECG as sinus bradycardia, QT interval prolongation, T-wave inversions, and AV block. Hypothyroidism, however, is said to be related but not necessarily causal for up to 3% of patients with 2nd, high grade, or 3rd degree AV block. Although data is still wanting, majority of these patients do not improve with hormonal replacement and require permanent pacing.

WPW and PVC Ablation: Kill Two Birds with One Stone

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Introduction: Wolff Parkinson White (WPW) and premature ventricular complex (PVC) are a common cardiac arrhythmia. However, the occurrence same arrhythmia in one patient is rare. We are reporting a case of successful ablation of left sided WPW and outflow tract PVC in same procedure.

Case Report: A 19-year-old girl previously well presented with sudden onset palpitation associated with giddiness. On examination, her blood pressure was normal with a heart rate of 170 bpm. Initial ECG showed broad complex atrial tachycardia and terminated with Valsalva maneuver. ECG post Valsalva showed sinus rhythm, presence of delta wave, and unifocal posteroseptal RVOT PVC. She underwent an electrophysiology study with single catheter 3D mapping. The procedure was done by via right femoral vein and transeptal puncture using the HeartSpan transeptal needle. The accessory pathway was identified at the left posterior atrioventricular groove and ablated with 35W. Subsequently, proceed with mapping at RVOT and earliest prepotential signal 28msec found at posteroseptal subpulmonic. The lesion was ablated with 35W and further consolidated. Patient was observed and no inducible tachycardia after 30 minutes. 2 weeks post procedure, she was asymptomatic.

Discussion: WPW with tachycardia manifestation is an indication of catheter ablation as this condition potentially leads to sudden cardiac death, especially in the presence of PVC. This case illustrate the successful ablation of two cardiac arrhythmia at same procedure.

Conclusion: WPW and PVC in the same patient is a rare condition. Catheter ablation is useful to treat this condition in the same setting with minimal cardiac risk.

A Successful PVC Ablation With 'zero fluroscopy' in Pregnancy: A Case Report

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Introduction: Premature ventricular complex (PVC) known to be a benign condition and in pregnancy it may cause unwanted consequences to both mother and fetus. Here we are reporting a successful abolishment of PVC of outflow tract origin using 3D electroanatomical mapping system and zero radiation.

Case Report: A 30-year-old primigravida lady at her 31 weeks period of gestation complained of gradual worsening shortness of breath and lethargy for since early pregnancy. On admission, incidental finding of ventricular bigeminy. Clinical examination was unremarkable. Holter revealed PVC burden of 25.6% with structurally normal heart. She subsequently underwent for PVC ablation with a single catheter 3D mapping system with abdominal shield due to unable to tolerate beta blocker. During mapping the right ventricular outflow tract (RVOT), we found the earliest activation on the posteroseptal aspect of RVOT with sharp presystolic potential and match with baseline clinical PVC. PVC signal was terminated with single attempt ablation. The patient was observed for 30 minutes post ablation with no recurrence of PVC. After 2 weeks post-procedure, she was asymptomatic, and ECG showed normal sinus rhythm.

Discussion: In pregnancy, the PVC frequency can increase due to structural and hormonal changes. Our patient unable to tolerate beta blocker hence 3D electrophysiology mapping was done. In the advancement of 3D mapping, PVC ablation can successfully be done in pregnancy without radiation.

Conclusion: This case highlights the successful ablation of high burden PVC in a pregnant mother without radiation to prevent adverse event in both mother and fetus.

Utilization of Artificial Intelligence for Detection of Critical Arrhythmias in Portable ECG Monitoring Device

Asst Prof Chih-Min Liu¹, Professor Shih-Lin Chang¹, Master Chih-Wei Yu², Master Yi-An Chen², Master Po-Hung Lin², Master Wei-En Hsu², Master Shih-Hung Pai², Professor Yenn-Jiang Lin¹, Professor Li-Wei Lo¹, Professor Yu-Feng Hu¹, Associate Professor Fa-Po Chung¹, Associate Professor Tze-Fan Chao¹, Assistant Professor Ta-Chuan Tuan¹, Assistant Professor Jo-Nan Liao¹, Assistant Professor Chin-Yu Lin¹, Assistant Professor Ting-Yung Chang¹, Dr. Ling Kuo¹, Dr. Cheng-I Wu¹, Dr. Shin-Huei Liu¹, B.S.Eng. Yang-Che Shiu¹, Professor Shih-Ann Chen¹

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Objectives: We aim to create a new artificial intelligence (AI) algorithm to detect critical cardiac arrhythmias in patients with continuous single-lead ECG monitoring.

Materials and Methods: This prospective clinical study enrolled patients suspected of arrhythmias from Taipei Veterans General Hospital, a single tertiary center. Each patient underwent a continuously portable ECG monitoring device (Figure 1A) for minutes to several days in the outpatient or inpatient departments. Three types of critical arrhythmias were classified: pause ≥ 3 seconds, atrial fibrillation (AF)/atrial flutter (AFL) (irregular R-R interval without P wave ≥ 30 seconds), and ventricular tachycardia (VT)/ventricular fibrillation (VF). A total of 188 patients were recruited (12 [6.4%] with pauses, 63 [33.5%] with AF/AFL, and 8 [4.3%] with VT/VF). One hundred seven patients and open resources were utilized for AI training, and 81 patients were divided into the test set. The proposed AI algorithm is illustrated in Figure 1B.

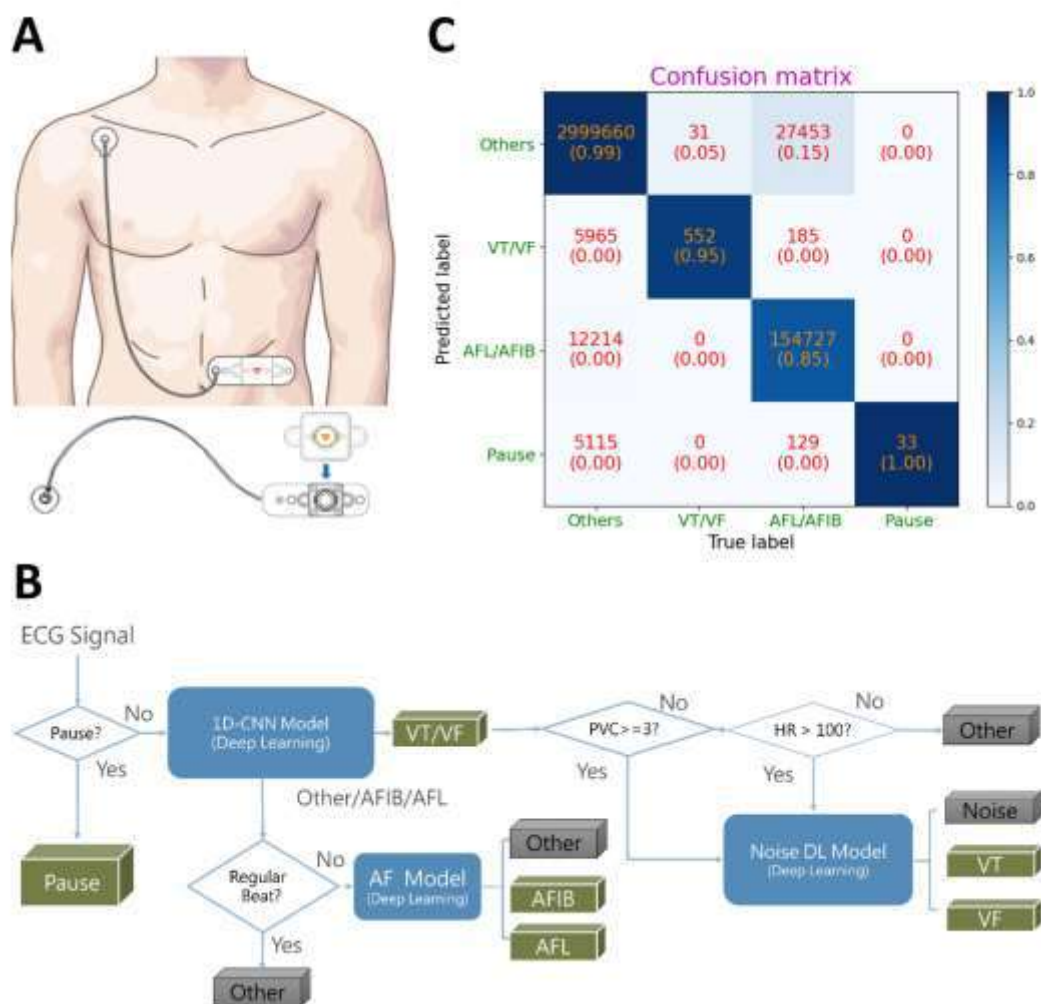
Results: In the test set, the pause achieved a sensitivity of 100%, specificity of 99.8%, and accuracy of 99.8%. The AF/AFL and VT/VF could achieve a sensitivity of 84.8%, specificity of 99.6%, accuracy of 98.8%, and a sensitivity of 94.7%, specificity of 99.8%, accuracy of 99.8%, respectively (Figure 1C). The portable ECG device detected critical arrhythmias (pauses, AF/AFL, or VT/VF) in 44.1% of patients suspected of arrhythmias. No serious adverse events in patients wearing the portable ECG device were reported.

Conclusions: The incorporated AI algorithms in portable ECG devices are capable of real-time identifying individuals with hidden critical arrhythmias in the outpatient or inpatient settings.

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Figure 1. The portable ECG monitoring device for detection of critical arrhythmias.

A. The portable ECG monitoring device. **B.** The AI algorithm for critical arrhythmias. **C.** The confusion matrix of test results of AI module.



Impact of Holter Monitoring on Cardiac Resynchronization Therapy in Heart Failure Patients with Atrial Fibrillation

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Objectives: Cardiac resynchronization therapy (CRT) in heart failure (HF) patients with atrial fibrillation (AF) have poor outcome due to AF can lead to ineffective biventricular pacing (BiVP) and cause fusion, pseudo-fusion beats and even loss of capture.

Material and Methods: This prospective cohort study evaluated the impact of 24-hr Holter monitoring on CRT treatment in HF patients with AF on the incidence of effective and ineffective pacing. AF patients who had CRT, LVEF $\leq 35\%$, NYHA FC II-IV, BiVP $\geq 93\%$ were enrolled. The results from 24hr-Holter monitoring were used to evaluate the percentage of truly effective BiVP and identify fusion and pseudo-fusion beats and loss of capture.

Results: Twenty-five HF patients with AF were analyzed (14 and 11 patients in PAF and non-PAF groups, respectively) with 6 months follow-up period. The overall incidence of ineffective BiVP was 28%. A total of seven patients had inadequate BiVP, six patients in non-PAF group. PAF patients were less likely to have subsequent adjusted treatment (p-value 0.032). CRT interrogation was likely to overestimate the degree of effective BiVP in non-PAF group more than PAF group significantly (p-value 0.009). In PAF group, there was higher average of percentage of true BiVP (p-value 0.046) and a significantly lower incidence of pseudo-fusion beats (p-value 0.044). A higher percentage of adequate BiVP was achieved in six patients after subsequent adjusted treatment.

Conclusion: Current CRT interrogation alone in HF patients with AF could overestimate the effective BiVP. The 24-hr Holter monitoring is a useful and convenient tool to uncover the incidence of truly effective and ineffective BiVP.

SUPPORTING DOCUMENTS

Table 1 : Comparison of an adequate and inadequate biventricular pacing between PAF and non-PAF group

BiVP	PAF group (n=14)	Non-PAF group (n=11)	p- value
Adequate BiVP (n=18)	13 (92.9%)	5 (45.5%)	0.009*
Inadequate BiVP (n=7)	1 (7.1%)	6 (54.5%)	

Figure 1 : Each bar represents an individual subject in the study who had percentage of true biventricular pacing < 93. Colors represent the timing that patient had 24hr-Holter monitoring, the first time (blue), the second time (orange)

*NPAF3 patient died before 2nd follow up

Table 2 : The change in percentage of biventricular pacing after treatment in subjects with first 24hr-Holter monitoring demonstrated < 93% true biventricular pacing

Patients No.	BiVP (%) from CRT interrogation (at enrollment)	BiVP (%) from 1 st Holter	Treatment			BiVP (%) from 2 nd Holter	p-value
			Increase dose of medication	Add new medication	AVJ ablation		
NPAF1	100	87.3	☑B			99.97	
NPAF2	99.9	67.8		☑B		77.41	
NPAF3	99.2	89.4	☑B			Deceased	
NPAF4	96.4	62.6		☑A	☑	100	
NPAF5	99.9	48.9	☑B			56.29	
NPAF6	99.9	55.3		☑A		78.07	
PAF7	97.4	43.5		☑A		92.91	
Total	98.96±1.46	64.97±17.9				84.11±16.95	0.02*

A = Amiodarone, B = Beta Blocker

BiVP = Biventricular Pacing

☑ = was done

AVJ = atrioventricular junctional ablation

The Relationship of Conduction Disorder and Prognosis in Patients With Acute Coronary Syndrome

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Objective: Conduction disorders with a widened QRS are associated with poor prognosis in patients with acute coronary syndrome (ACS). Previous studies did not have conflicting results regarding the type of bundle branch block (BBB) with the worst prognosis, and few studies have focused on the prognosis of patients with NICD.

Methods: Patients with ACS were enrolled between January 2005 and December 2019. Following clinical outcomes were compared between patients with and without conduction disorders.

Results: This study enrolled a total of 33970 participants and involved 3392 and 30578 patients with and without conduction disorders, respectively. Lower mean LVEF was exhibited in patients with conduction disorders (with vs. without; $44.64 \pm 20.73\%$ vs. $49.85 \pm 20.63\%$; $p < 0.001$). Higher incidences of HF hospitalization (21.55% vs. 17.51%; $p < 0.001$), CV mortality (17.98% vs. 12.14%; $p < 0.001$), and all-cause mortality (38.86% vs. 31.15%; $p < 0.001$) were noted in patients with conduction disorder. The lowest mean of LVEF was presented in the patients with RBBB (LBBB vs. RBBB vs. NICD; $41.00 \pm 19.47\%$ vs. $47.73 \pm 20.82\%$ vs. $34.57 \pm 20.02\%$; $p < 0.001$). The highest incidence of HF hospitalization was noted in patients with LBBB and the lowest incidence of CV and all-cause mortality was observed in patients with RBBB.

Conclusions: In ACS population, patients with conduction delay had a poor prognosis due to higher prevalence of comorbidities and lower mean LVEF. Those with LBBB and NICD had a higher incidence of clinical outcomes. Patients with NICD had the lowest mean LVEF compared to those with LBBB and RBBB.

Impaired Regional Strain by CMR-FT Predicts Low Sensing Value After ICD Implantation in ACM Patients

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Objectives: Inadequate ventricular sensing at implantable cardiac defibrillator (ICD) implantation in patients with arrhythmogenic cardiomyopathy (ACM) is troubling and might cause inappropriate ICD interventions and complications. We aimed to evaluate the value of ventricular mechanics features in predicting low sensing value by emerging cardiovascular magnetic resonance-feature tracking (CMR-FT) in ACM patients.

Hypothesis: CMR-FT characteristics prior to ICD implantation might assist in predicting low R wave amplitude.

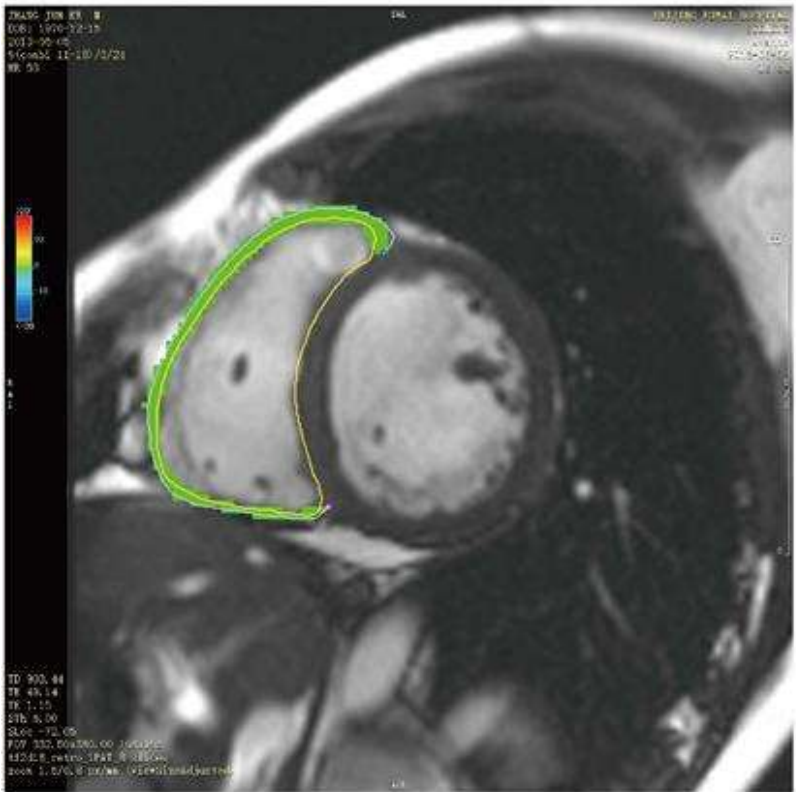
Materials and Methods: We retrospectively enrolled ACM patients undergoing CMR examinations prior to ICD implantation at our center from January 2011 to July 2021. The strain parameters of LV and RV were analyzed by CMR-FT. The R wave amplitude (RWA) was obtained within 24 hours of completion of the ICD implantation and its association with CMR strain parameters was analyzed.

Results: We enrolled 83 ACM patients with a median RWA of 8.0 mV (Interquartile range:5.4-12.1 mV) and impedance within the normal range. 18 (21.7%) patients were found with low RWA (<5mV) despite attempts in over 5 positions. RV strain parameters including RV global longitudinal, circumferential and radial strain rather than LV strain parameters correlated significantly with RWA (Spearman's correlation coefficients: GLS: -0.35, GCS: -0.58, GRS: 0.59, all P<0.01). RVGRS and RVGCS were found independently associated with RWA, and valuable in predicting low RWA (areas under the curve: 0.76 and 0.73 respectively; sensitivity: both 0.72, specificity: both 0.71).

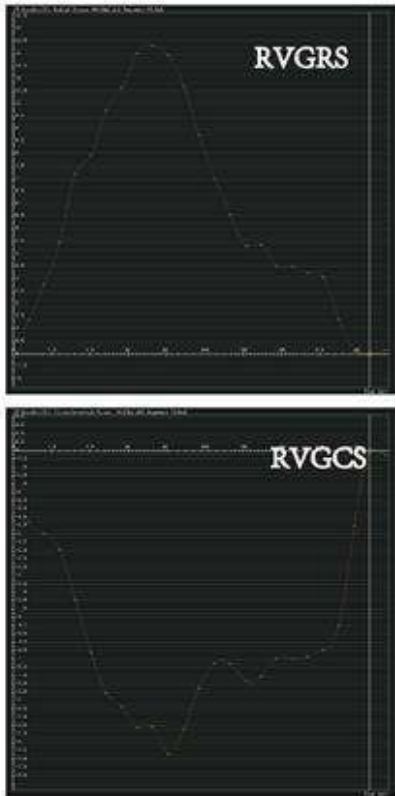
Conclusion: Low sensing of ICD lead in ACM patients was associated with impaired RV mechanics. RVGCS and RVGRS by CMR-FT were valuable parameters for predicting low RWA.

SUPPORTING DOCUMENTS

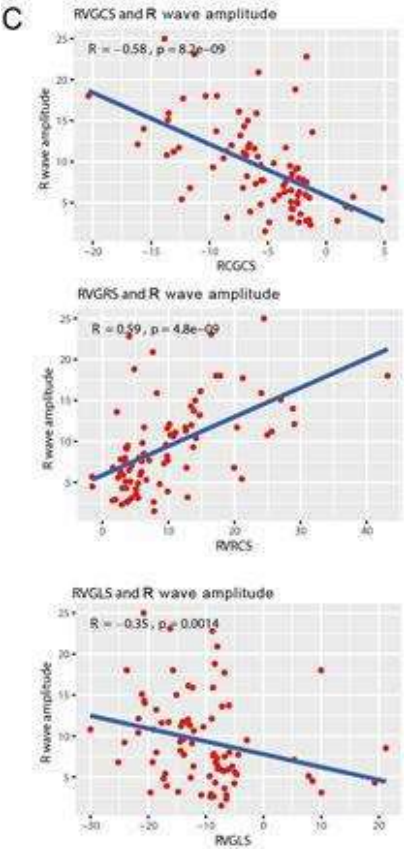
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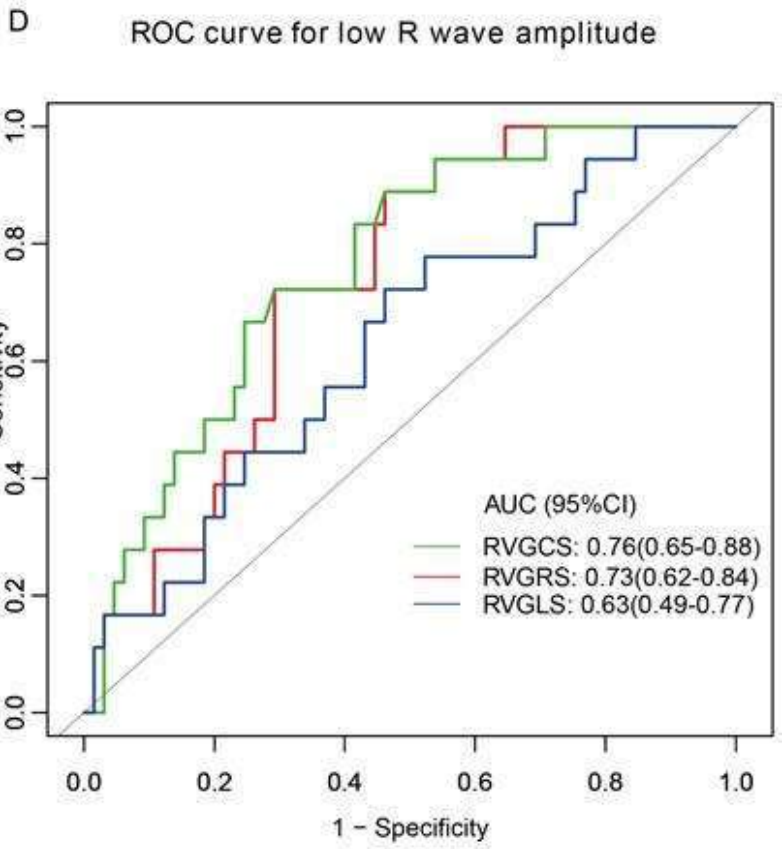
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Single Centre Experience of Radiofrequency Catheter Ablation at a Tertiary Care Centre in Northern India

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Objectives: The purpose of this study was to analyse the epidemiological characteristics, findings, acute success and complications of radiofrequency catheter ablation for cardiac tachyarrhythmias at a tertiary care centre in Northern India

Materials and Methods: This retrospective observational study was conducted at the Department of Cardiology, Mahatma Gandhi Medical College & Hospital, Jaipur. Prior approval was taken from the institutional ethics committee. All patients who underwent RF catheter ablation for cardiac tachyarrhythmias from October 2018 to August 2021 were included in this study.

Data recorded for this study included age, gender, indication for RF ablation, type of arrhythmia, location of accessory pathway(s), concomitant structural heart disease, fluoroscopy time, ablation results and complications.

Results: The study analysed 273 patients of which AVNRT was the commonest (52.0%), followed by AVRT at 33.3% and focal atrial tachycardia at 3.6%. The initial success rate was significantly higher in the patients with atrioventricular nodal reentry tachycardia 99.29% and lower in those with VPC/ NSVT/VT 88.2%. The mean fluoroscopy time was 12.9±7.9 minutes and was more prolonged in atrial flutter at 20.2±8.9 minutes.

Conclusion: RF catheter ablation proved to be a safe and effective method for treating arrhythmias in our study. It can act as a more economical treatment modality for a select group of patients. Our results support the use of RF catheter ablation therapy in the management of cardiac tachyarrhythmias with a high rate of success and low complication rates.

VT or SVT : A Common Intrigue Dilemma

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Objectives: We present a case of palpitation with wide complex tachycardia and extreme axis deviation

Materials and Methods: A 40-years-old gentleman come to our center with palpitation, dyspnea and chest tightness. He was an active smoker with history of diabetes and hypertension. His ECG showed an RBBB with LPFB pattern and extreme axis deviation (EAD) and no apparent V-A dissociation (Figure A). The emergency team used Amiodarone 150 mg iv drip first but failed to terminate the tachycardia, and subsequent verapamil bolus of 5 mg over 1 minute succeed in terminating the tachycardia. His ECG during sinus rhythm show similar morphology (Figure B). The golden rule is to treat any wide complex tachycardia as VT until proven otherwise. Amiodarone had a delayed onset of action hence need a higher loading dose whereas verapamil had rapid onset. Faced with RBBB + LPFB and EAD morphology, a differential of fascicular VT surfaced and verapamil was given, as this kind of VT reportedly to respond well with verapamil (verapamil sensitive). However, the similar axis and morphology during sinus rhythm favor SVT as the underlying mechanism. Should the patient did not respond with medication or deteriorating even further an electrical cardioversion might be mandated.

Results: There are several differential diagnosis in regards to wide complex tachycardia with right bundle branch block (RBBB). It could be supraventricular tachycardia (SVT) with underlying aberrancy or ventricular tachycardia (VT) mainly idiopathic fascicular left ventricular tachycardia (ILVT). VT from intramyocardial reentry or from mitral annulus which is close to the conduction system has narrow QRS due to an early invasion of the His-Purkinje system. Both can present morphology of RBBB, right axis and a relatively narrow QRS. VT from interfascicles has QRS morphology that is similar in sinus rhythm and tachycardia and anterior or posterior hemiblock as the tachycardia circuit is established between the two fascicles. Upper septal fascicular VT will presents as RBBB, narrow QRS and normal frontal axis. In this case, RBBB, QRS morphology and cardiac axis which is left axis deviation remain similar during tachycardia and sinus rhythm. No ventriculoatrial dissociation in the ECG It responded very well to verapamil. Based on clinical presentation and ECG, the most probable diagnosis are SVT with aberrancy or posterior fascicular VT. Established criteria that are traditionally used for VT versus SVT discrimination do not apply to posterior fascicular VT and SVT with RBBB and LAHB. Criteria that support the diagnosis of VT may not be relevant to posterior fascicular VT. These criteria include atypical RBBB pattern in V1, QRS duration >140 ms, RS time >100 ms, initial R wave in aVr or Q >40 ms, and initial-to-terminal ventricular activation ratio (Vi/Vt) >1. Criteria that exclude SVT, such as QRS duration >140 ms, R/S ratio <1 in V6, and positive QRS in aVr have bigger overlap in cases of RBBB and LAHB compared with RBBB alone. In the absence of ventriculoatrial dissociation or fusion/capture beats, it is

difficult to achieve correct diagnosis. Furthermore, it is also difficult to differentiate posterior fascicular VT with posterior papillary muscle VT just based on ECG alone.

Conclusion: Our case highlight that not all wide complex tachycardia (WCT) were caused by VT. The algorithms we had differentiating SVT with VT were never had 100 % accuracy. Even in this case, EP study is warranted to elucidate the real cause of WCT.

SUPPORTING DOCUMENTS

Figure A

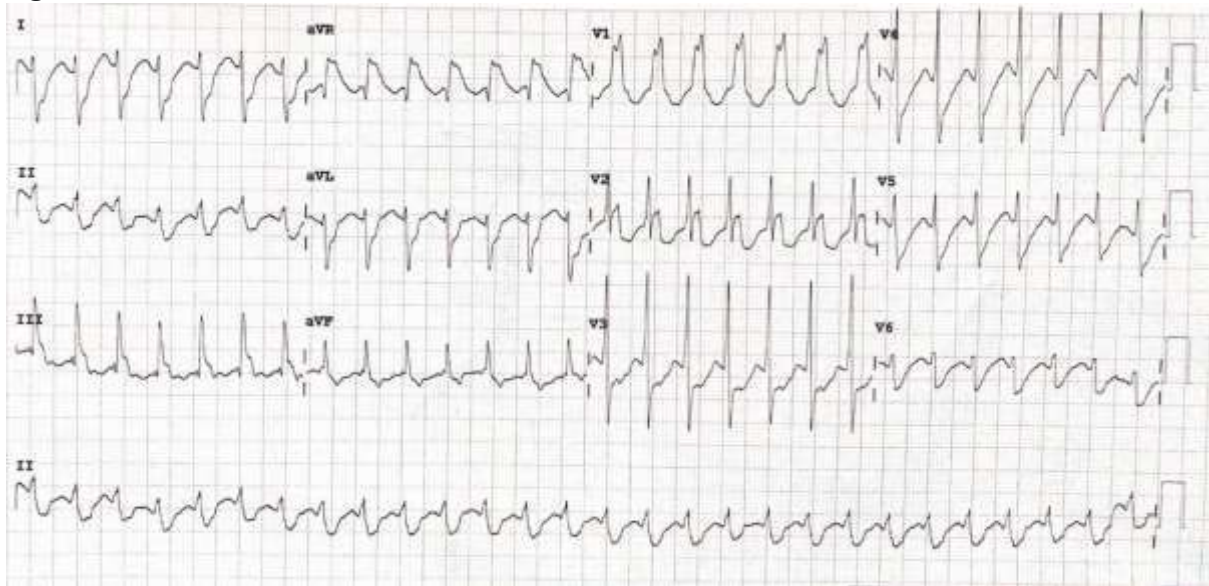
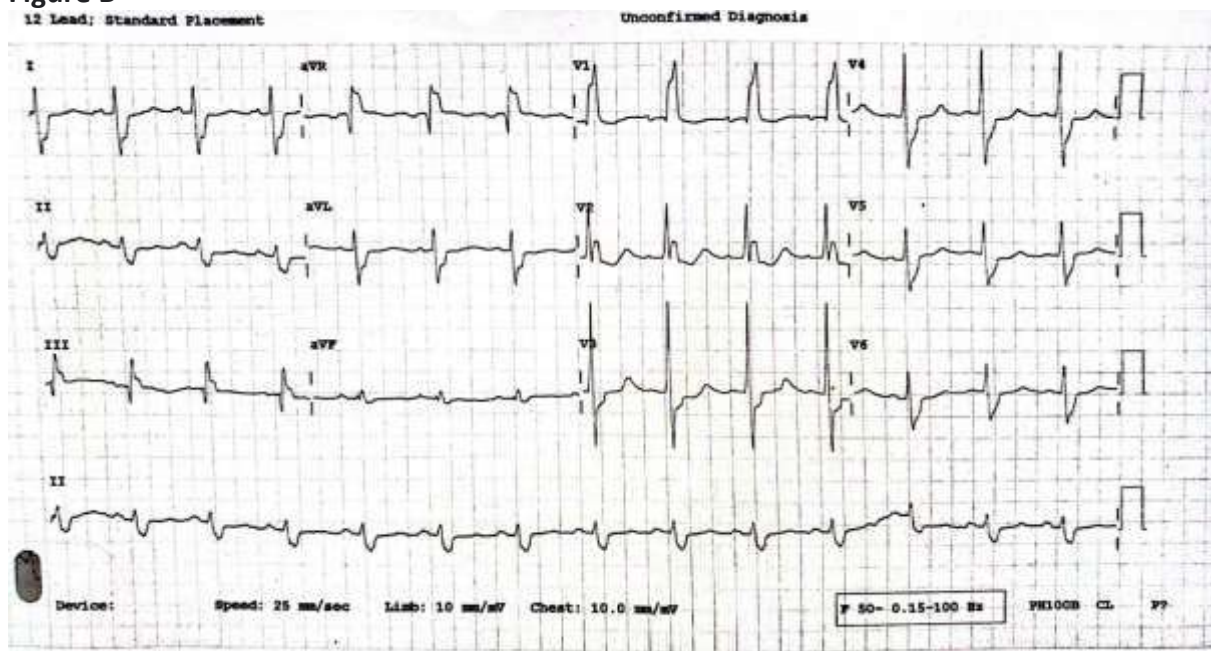


Figure B



Arrhythmic Storm with Acquired LQTS after Esophagectomy: Is Sepsis or ICIs Responsible for These?

Dr Weizhuo Liu¹, Dr Saiqi Li¹, Dr Yi Shen¹, Dr Qianyun Zhang¹, Pro. Bin He¹

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Objectives: Sepsis-induced cardiomyopathy (SIC) is one major cause of death for sepsis which is a known risk factor for arrhythmias. Immune checkpoint inhibitors (ICIs) also have potential cardiotoxicity manifesting as ECG abnormalities. However, data on repolarization changes and ventricular arrhythmias in these situations are limited. Here we report a case of arrhythmic storm with acquired LQTS with history therapy of ICIs after esophagectomy.

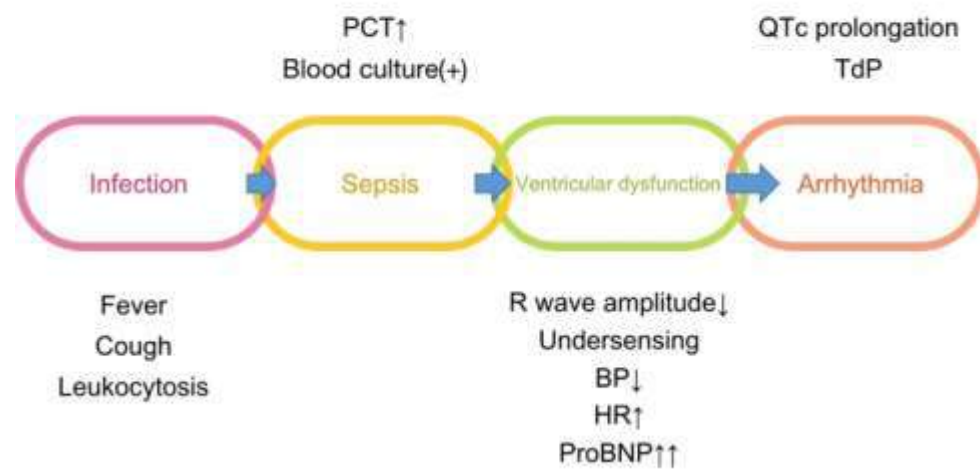
Methods: An 67-year-old male patient underwent esophagectomy who had received three cycles of immunity therapy before. Basic vital signs were monitored and recorded. Blood tests including BR, CRP, PCT, blood culture ect. were performed if needed. ECG, echocardiography and X-ray were closely followed up.

Results: ECG displayed sinus rhythm with normal QT interval at baseline and the operation went well. However, he got high fever 6 days after the surgery. Leukocytosis and elevated CRP, PCT and pro-BNP were observed while echocardiography showed no valve vegetation, after which esophagobronchial fistula was proven by bronchoscopy and *Escherichia coli* was recognized by blood cultures. Soon he suffered from arrhythmic storm caused by prolonged QT-Interval, including monomorphic VT and TdP, which could not be terminated by antiarrhythmic agents till his death. After tracing medical history, we found the patient had had once QT prolongation after the use of ICIs.

Conclusion: We assumed it could be a rare case of SIC associated acquired LQTS, causing severe cardiac function decline and lethal ventricular arrhythmia. ICIs may have occult cardiotoxicity manifesting ECG abnormalities which should be monitored carefully. However, the mechanism needs further discussion.

SUPPORTING DOCUMENTS

Graphical Abstract:



Different B-blocker Effects According to Heart Rate in Hfpef and Atrial Fibrillation

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Objectives: Beta-blockers (BBs) improve the prognosis of patients with heart failure (HF) by lowering the heart rate (HR). However, HR has no prognostic implication in cases of atrial fibrillation (AF). Furthermore, BBs do not improve the prognosis in cases of heart failure with preserved ejection fraction (HFpEF) and AF. Thus, the prognostic implications of BBs in patients with HFpEF and AF based on HR at discharge were assessed.

Material and Methods: A total of 5625 patients hospitalized for acute HF were enrolled from the Korean Acute Heart Failure Registry, of whom 687 with HFpEF and AF were selected. The participants were divided into high HR (355) and low HR (332) groups.

Results: BBs were used to treat 128 (36.1%) and 121 (36.4%) patients in the low and high HR groups. In the low HR group, BBs did not improve 60-day rehospitalization or mortality rates. In the high HR group, BBs were associated with 82% reduced 60-day rehospitalization due to HF but not with mortality.

Conclusions: When the high HR at discharge was maintained using a BB, there was a reduction in the 60-day rehospitalization rate than when a BB was not administered

Patient Centric Outcomes of Cardiac Resynchronization Therapy with SyncAV Dynamic Optimization

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Objectives: Cardiac Resynchronisation Therapy(CRT) is a well-established treatment for patients with heart failure, LV dysfunction, a low ejection fraction, and prolonged QRS duration. However, one-third of patients do not benefit from CRT, owing to anatomical and procedural issues in achieving efficient LV-pacing or changes in LV threshold over time, which may result in sub-threshold stimulation or inadequate CRT delivery due to suboptimal AV and VV delays. SyncAV CRT technology, which uses a unique device-based algorithm to dynamically adjust AV delay timing based on the intrinsic AV interval, may benefit patients with heart failure both clinically and economically.

Materials and Methods:

This review summarizes the latest evidence for SyncAV CRT use in patients with Heart Failure (HF) with LV-systolic dysfunction and prolonged QRS interval.

Results: Clinical benefits: SyncAV™ CRT adjusts the timing of AV delays based on intrinsic AV interval to create a triple fusion between LV and right-ventricular pacing with patient-tailored intrinsic conduction and delivers improved electrical-synchrony and narrower QRS-duration.^{1,2} Patient outcomes: Improved quality of life and significant reduction in all-cause readmissions (34%), cumulative HF-Hospitalisations (HFH) (30%), and HF-readmissions (41%).³ Decreased mortality rates with 82% survival in super-responders and 70% survival in responders at 5-years.⁴

Conclusion: Improving patient response to CRT is associated with decreased mortality rates, reduced HF-events and is expected to decrease healthcare expenditures due to reductions in rehospitalizations. Further, first and second HF events have been linked to 7 and almost 19-fold increased mortality risk, hence, SyncAV CRT reduction of HF-events is important for improving patient survival.⁵

SUPPORTING DOCUMENTS

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Elixir in Northern Peninsular – Local Audit of Entresto Efficacy and Safety for Heart Failure

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Objective: To initiate an audit of heart failure patients in our locality receiving Entresto, taking into account rate of re-hospitalization, NYHA class improvement and safety outcomes.

Materials and Methods: Retrospective cohort study of heart failure patients, assigned to receive Entresto twice a day as recommended by guidelines, within six months period. Patients with cardiac device and those who underwent electrophysiological study were excluded from this audit.

Results: Patients were of mean age of 56 years. Majority were NYHA class II and III (81.4%) with 35.6% of them having history of heart failure admission. NYHA class improved during the 1st and 6th months follow up (62.7% and 74.1% respectively). Large improvement were also seen in rate of readmission, (8.5% and 18.6%). Diuretics usage were reduced considerably for 30.5% of patients at 1 month follow up while 52.4% did not require escalation of diuretics. At 6 months, similar improvements were seen at 40.7% and 47.5% respectively. Entresto, was well tolerated with only six cases of adverse drug reactions. Two hypotensive cases noted after 1 month follow up and one at 6 months. Two renal impairment and one hyperkalemia at 6 months follow up.

Conclusion: Entresto was effective and safe in heart failure patients of Asian origin within our locality. For a more significant outcome, study with larger sample size and longer follow up is required.

Relationship Between Heart Sounds Detected with 3D-Accelerometer and Heart Failure Status in Acute Decompensated Patients

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Objective: The S1 Heart sound (HS) is a surrogate for the beginning of systole. When combined with electrocardiogram, it can be used to measure electromechanical activation time (EMAT). In this clinical investigation, EMAT obtained from HS using a 3D accelerometer was compared against NT-proBNP on patients hospitalized due to acute heart failure (HF) decompensation (ADHF).

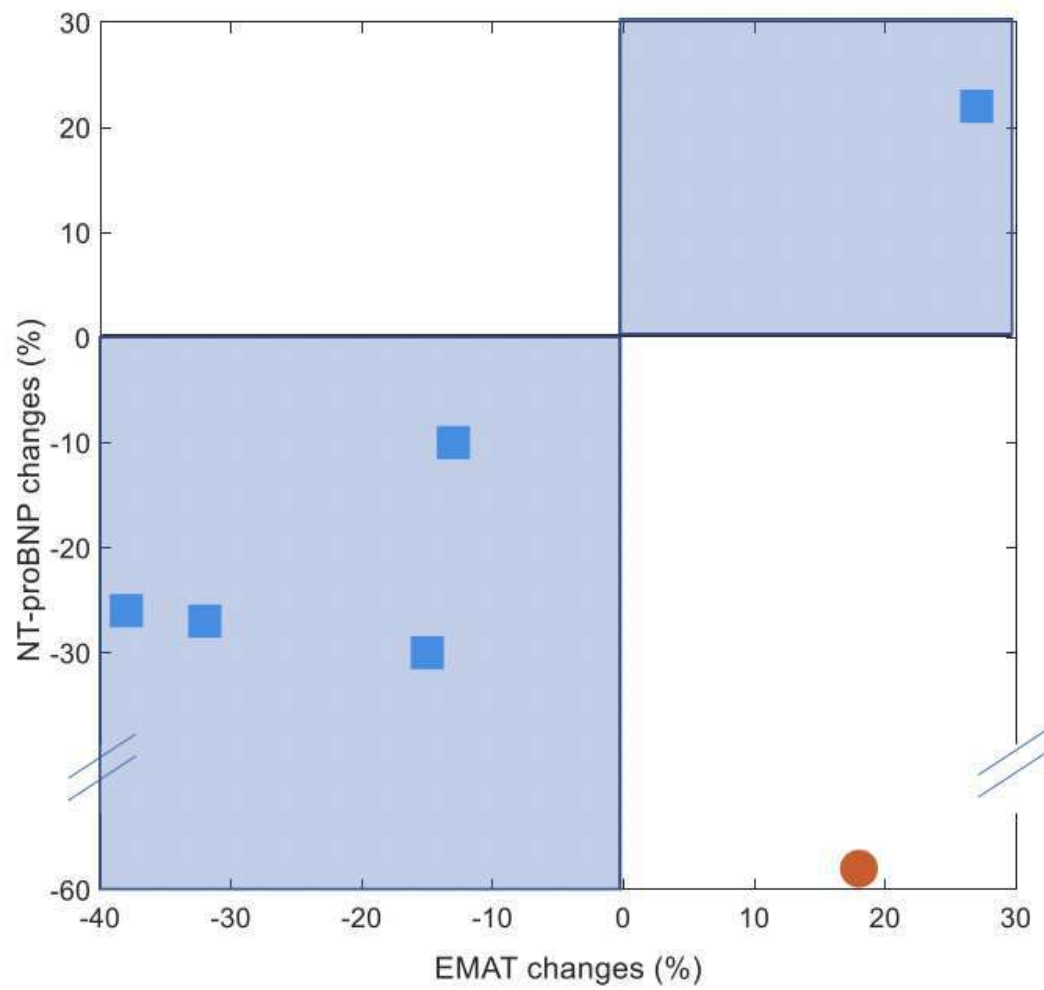
Methods: Data was collected using a custom wearable data collection unit (DCU) which included a 3D accelerometer capable of x/y/z axis recording of HS and electrodes for simultaneous electrocardiogram collection. The DCU was placed on the chest of pts hospitalized for ADHF. EMAT measurement, defined as the interval between QRS peak and S1, was compared against NT-proBNP measured at baseline and again 48 hours later.

Results: Seven HF pts in NYHA class III-IV (7 male, median age 52 years) were included in the analysis. During the first 48 hours of hospitalization, average NT-proBNP decreased by -369.4 pg/ml (9.6% reduction from an average of 3843 pg/ml baseline) while the average EMAT decreased by -10.1 msec (12.5% reduction from an average of 81 msec baseline). EMAT and NT-proBNP changed in the same direction for 5 out of 6 pts who had significant changes in NT-proBNP. In one pt with low NT-proBNP at baseline (134 pg/ml), EMAT decreased by 22% while the NT-proBNP increased slightly to 138 pg/ml.

Conclusions: EMAT changes directionally correlated with NT-proBNP changes in 5 out 6 patients. Change in electromechanical interval did not correlate well in one pt whose NT-proBNP was very relatively normal.

SUPPORTING DOCUMENTS

Figure 1. Changes in EMAT and NT-proBNP during 48 hour HF hospitalization. Blue shaded indicated regions of concurrent changes between EMAT and NT-proBNP.



Conduction System Pacing in Heart Failure with Reduced Ejection Fraction: A Systematic Review and Meta-analysis

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Objectives:

Conduction system pacing (CSP) – including His bundle pacing (HBP) and Left bundle branch area pacing (LBBAP) – are emerging alternatives to biventricular pacing (BVP) for cardiac resynchronisation therapy (CRT) in heart failure. However, evidence is limited to small and observational studies. This meta-analysis aims to assess CSP pacing and clinical outcomes compared to BVP.

Materials and Methods: We conducted a literature search of PUBMED, MEDLINE and EMBASE of randomised control trials (RCTs) and non-RCTs which compare CSP (HBP & LBBAP) with BVP in patients with CRT indications. Out of 12 studies with 2138 patients, we assessed the mean difference in QRS duration (QRSd), pacing threshold, left ventricular ejection fraction (LVEF) and New York Heart Association (NYHA) class score.

Results: With CSP, the pooled mean QRSd improved by 21.8ms (95% CI -27.96 – -15.63, $p < 0.05$, $I^2 = 86.77\%$) versus BVP. For LVEF, a weighted mean increase of 6.46% (95% CI 4.58–8.35, $p < 0.05$, $I^2 = 44.74\%$) was seen following CSP versus BVP. The mean NYHA score was lowered by 0.43 (95% CI -0.62– -0.24, $p < 0.05$, $I^2 = 60.03\%$) post CSP compared to BVP. These QRSd, LVEF and NYHA benefits were uniformly seen across HBP and LBBAP groups. When compared with BVP, the mean pacing threshold significantly improved by 0.52V (95% CI -0.65– -0.4, $p < 0.05$, $I^2 = 82.27\%$) for LBBAP, while this was non-significantly reduced (-0.46V, 95% CI -0.34 -1.27, $p = 0.26$, $I^2 = 95.59\%$) for HBP.

Conclusion: Overall, both CSP techniques are feasible and effective CRT alternatives for heart failure. Further RCTs are needed to establish long term efficacy and safety.

Bradycardiomyopathy Post Atrial Septal Defect (ASD) Closure – Late Complication: A Case Report

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Introduction: Conduction disorder complication post atrial septal defect (ASD) closure with heart failure is rare. We are reporting a case of delayed complication of percutaneous ASD closure leading to sinus node dysfunction with heart failure.

Case presentation: A 19- year- old girl with a history of percutaneous closure of patent ductus arteriosus (PDA) and ASD in 2005 and 2014, respectively. She had complained of reduced effort tolerance for 3 months. It was associated with orthopnea and paroxysmal nocturnal dyspnea with NYHA II-III. On examination, her vital sign was stable. Presence of elevated jugular venous pressure, pedal edema and fine crepitation both lower zone. Her ECG showed intermittent accelerated junctional rhythm with a QRS duration of 136 msec. Her echocardiogram showed a dilated left ventricle chamber, and LV function was 43%. Cardiac MRI showed fibrous tissue below ASD occlude with the pattern of non-ischemic cardiomyopathy. She was started with heart failure therapy and underwent a dual chamber permanent pacemaker with left bundle branch pacing and symptom was improved.

Discussion: Sick sinus dysfunction is common in surgical ASD closure up to 10-15% and rare in percutaneous ASD closure. In our patient, she was asymptomatic initially then progressed to heart failure as result from chronic sick sinus node. Hence, the left bundle branch pacing strategy was chosen to improve the LV synchronisation and function.

Conclusion: This is an interesting case report of delayed complication of percutaneous ASD closure leading to non-ischemic heart failure and treated with left bundle branch pacing.

Study on the Efficacy of CRT-D in Heart Failure Patients With Right Bundle Branch Block

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Objective: to explore the efficacy and safety of CRT-D in patients with chronic heart failure complicated with right bundle branch block.

Methods: patients who underwent CRT-D in the first affiliated Hospital of Xinjiang Medical University since April 2019 were selected. The clinical baseline parameters were collected before operation. During hospitalization and after operation, the complications of patients and device-related adverse events were collected to evaluate their safety. After operation, the echocardiographic indexes and QRS duration were measured to evaluate the response of patients to CRT-D.

Results: CRTD could improve the cardiac function and narrow the width of QRS wave in heart failure patients with right bundle branch block. During the follow-up period, there were no complications such as bag infection, hematoma, wire dislocation and phrenic nerve stimulation.

Conclusion: CRTD implantation can improve cardiac function and shorten QRSd in chronic heart failure patients with right bundle branch block.

Refractory Ventricular Arrhythmias in a Neonate With CPT II Deficiency

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¹*Singhealth / KKH, Singapore*

Objectives: A term infant female born to first-degree consanguineous couple developed recurrent apneas, generalized seizures, complicated by severe hyperkalaemia (potassium 8.1 mmol/L) with ventricular tachycardia (VT) and circulatory collapse at 55 hours of life. She required cardiopulmonary resuscitation, defibrillation, and her hyperkalaemia was corrected. She converted to sinus rhythm. Echocardiography showed normal heart function, biventricular hypertrophy. On day 5 of life, she was hypotensive again. ECG showed ischaemic changes, with elevated troponin I. She developed runs of VT requiring synchronized cardioversion. However, she developed refractory VT/VF. She was placed on ECMO and amiodarone infusion.

Tandem mass spectrometry (TMS) screen results on day 7 was suggestive of carnitine palmitoyltransferase II (CPT II) deficiency, confirmed by genetic test. She was started on intravenous carnitine and medium chain triglyceride formula milk. She remained in refractory VF. This was complicated by intracranial bleed. ECMO support was withdrawn and she passed away shortly after.

Results: Cardiac arrest from ventricular arrhythmias is rare in neonates with structurally normal heart. Underlying metabolic disorder or primary electrical disease should be considered. CPT II deficiency is a rare autosomal recessive mitochondrial fatty acid oxidation disorder. The enzymatic defect prevents long-chain fatty acids from being transported to the mitochondria for utilization. It is frequently lethal in neonates. Intermediate fatty acid metabolites accumulate e.g. long-chain acylcarnitine, and have proarrhythmic effects. Treatment is to avoid prolonged fasting, and high-carbohydrate low-fat diet.

Conclusion: CPT II deficiency is a rare cause of refractory ventricular arrhythmias in newborns. Despite medical therapy, this condition is usually lethal.

Adenosine-sensitive Bypass Tract-mediated Tachycardia in Repaired TOF With Post-operative Heart Block – PJRT Variant?

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Objectives: 6 years old boy underwent TOF repair at the age of 1 year old. He had post-operative heart block requiring insertion of dual chamber epicardial pacemaker. During early post-op follow-up, pacemaker interrogation revealed frequent runs of SVT, consistent with symptom of palpitation. Intrinsic rhythm was in first degree alternates with Mobitz I. SVT occurred following intrinsic rhythm with prolonged AV interval (255ms). He was started on atenolol and digoxin to suppress these episodes at the expense of increasing pacing requirements. He was thus scheduled for EP study. Antiarrhythmic drugs were discontinued. He had baseline prolonged PR (285ms), AH(234), HV (44). Baseline ECG showed RBBB with superior axis suggesting bifascicular block. Atrial extrastimulus induced SVT with eccentric atrial activation in CS poles. Ventricular entrainment findings favoured ORT as mechanism(PPI - TCL 89ms; SA - VA 63ms). Adenosine administration during SVT with background ventricular pacing showed VA block. The bypass tract was mapped to the lateral mitral annulus and ablation there was successful.

Conclusion: This case illustrates a concealed retrograde-conducting left lateral bypass tract that only manifests following prolonged AV delay. Being adenosine sensitive, we postulate that this could be a rare site of decremental by-pass tract but with short RP interval seen during SVT due to significant intraventricular conduction delay.

SUPPORTING DOCUMENTS

Figure 1 – SVT during intrinsic rhythm

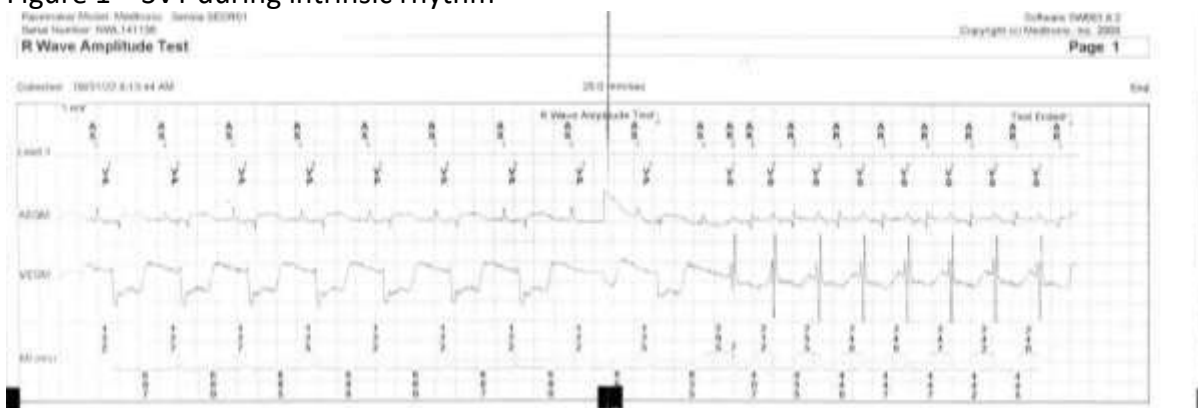


Figure 2 – Pathway block during adenosine

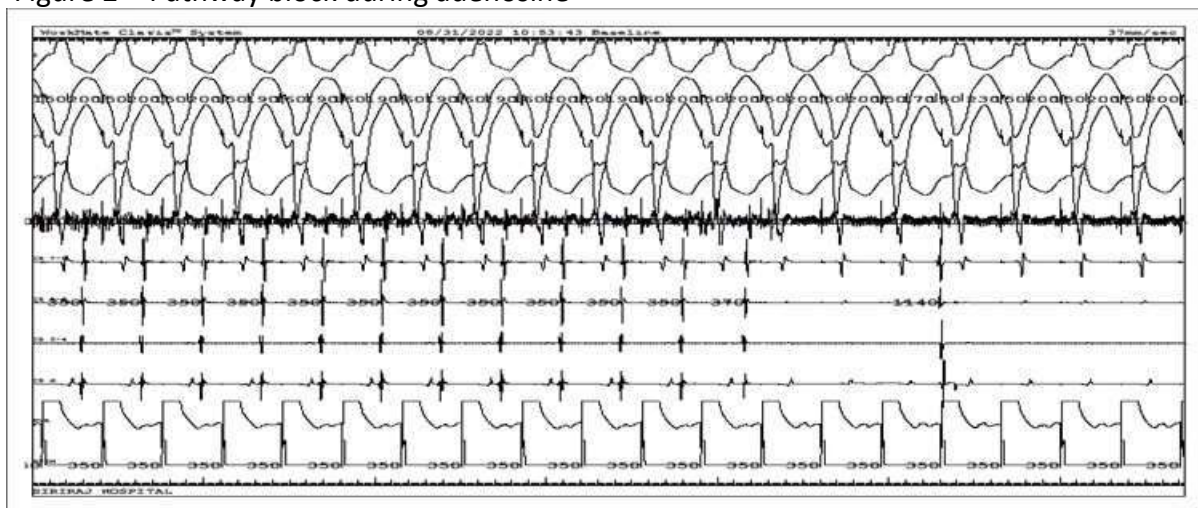
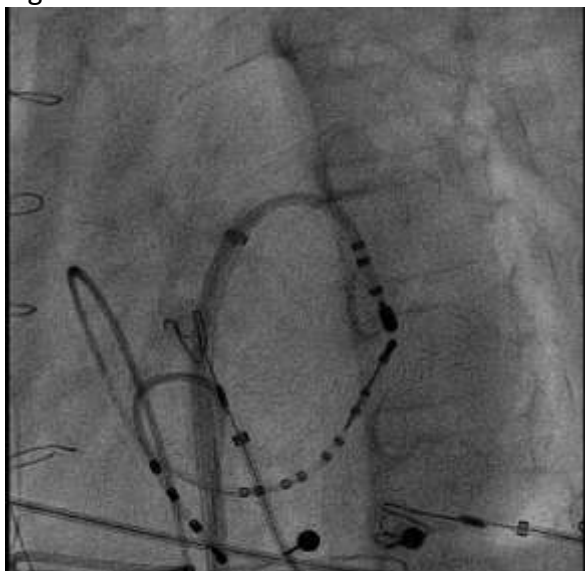


Figure 3 – ablation at left lateral mitral annulus



Young Boy With Recurrent Wide QRS Tachycardia- Narrowing Down to the Diagnosis

Dr Suchit Majumdar¹

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Material and Methods: A young boy of 16 yrs presented with recurrent palpitations with a structurally normal heart by echo. Episode ECG showed regular wide QRS tachycardia , was taken up for Electrophysiology study. Baseline HV was normal. VA conduction was central and decremental. Wide QRS Tachy induced after VA jump, which showed VA dissociation sometimes. Morphology of tachy was LBBB with late transition and leftward axis. Tachy was also induced by ventricular and atrial pacing, where it was sustained with 1:1 VA conduction and fixed VA. The ventricular beats during tachycardia had RV egm significantly early than His V. Atrial pacing also reproduced the tachy morphology with negative HV, suggestive of a preexcitation. During the wide QRS tachycardia, septal synchronous atrial extra beats didn't pull the next V.

Results: The analysis of all these maneuvers pointed towards possibility of a nodofascicular or nodoventricular pathway which was causing antidromic AVRT. VT was unlikely as the CS pacing resulted in gradual change from sinus morphology to full preexcited morphology. As these pathways are commonly related to slow pathway area , ablation was given during atrial pacing to that area which resulted in disappearance of preexcitation and further noninducibility of the tachycardia.

Conclusion: When dealing with wide QRS negative HV tachycardia with VA dissociation , NF/NV pathway should always come into mind as atrium is not a part of the circuit. Here VT was ruled out by atrial pacing.

Electrogram Changes as Predictor of Fast Pathway Heating During AVNRT Ablation

Dr Suchit Majumdar¹

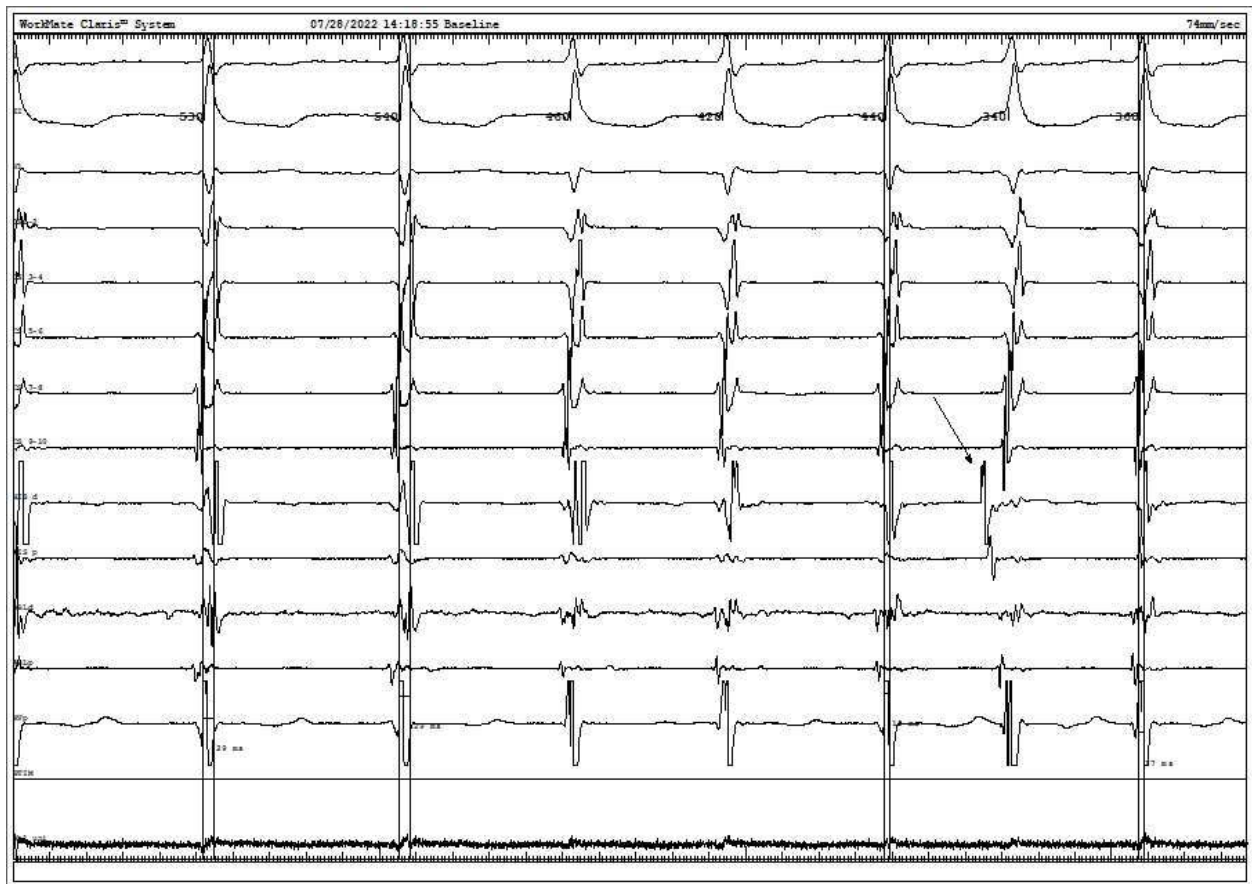
¹*Apollo Multispeciality Hospital, kolkata, India*

Material and methods: It is known that cause of complete heart block during slow pathway radiofrequency ablation in AVNRT is the collateral heating of the fast pathway and injury to it. It is manifested by fast junctional rhythm, VA prolongation (in slow fast AVNRT), AH prolongation (if atrial paced during ablation) or VA block. Our patient is a 47 yr lady with recurrent palpitations, EP study showed induced AVNRT. While ablating the slow pathway area, we noticed there was shortening of the interval between the local v at RV apex and local V at his distal significantly with the junction speeding up to around 350ms from 430-500ms (Figure 1)

Conclusions: The finding of the shortening of the interval between the local v at RV distal and His distal during radiofrequency ablation of slow pathway in AVNRT can predict fast pathway heating and increased chance of complete heart block. This and presence of frequent his ectopics can be a warning sign.

SUPPORTING DOCUMENTS

Figure 1



Also there was ectopics from near the his associated with this acceleration(arrow). This was reproducibly noticed and the radiofrequency delivery was discontinued whenever the junctional sped to less than 350ms cycle length. Hence this shortening of the interval or his ectopics can serve as warning sign for fast pathway heating and can indicate us to stop the RF , to reduce the chance of complete heart block.

The First Case Series on Fluoroless Ganglionated Plexus Ablation for Symptomatic Bradycardia

Dr Sri Sundaram¹, Benjamin Jones², Thomas Rogers², Tolga Aksu³, William Choe, Daniel Alyesh¹
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Objective and Background: Ganglionated plexus ablation (GP) and Fluoroless ablation (FA) are two emerging trends that have gained prominence in EP. GP has been proposed as a treatment for symptomatic bradyarrhythmias. With the young age of most of these patients, avoidance of ionizing radiation is important to limit potential long term deleterious effects. We report a case series of 9 subjects who presented for GP ablation without fluoroscopy. Our objective is to describe a case series of GP ablation performed without the use of fluoroscopy.

Methods: A retrospective analysis was performed of 9 subjects that had GP ablation performed.

Results: 9 subjects(4F) were evaluated in a retrospective analysis. The mean age was 45+/-15 years. Using a 3D impedance based system and intracardiac echo (ICE) catheters , mapping of the right and left atrium (RA, LA) was performed without fluoroscopy. Both the RA, SVC and LA were mapped for High Amplitude Fractionated Electrograms (HAFE), Low Amplitude Fractionated Electrograms (LAFE) and parasympathetic response evoked during high-frequency stimulation (HFS). With ablation in these GP locations, HAFE was eliminated and there was no increase in HR with atropine post. After a follow up of 6+/-3.2 months, all 9 subjects had no further symptoms. There were no complications noted.

Conclusion: GP and FA ablation has emerged as new treatment modalities. As most patients that need GP ablation are young, the need to avoid ionizing radiation is important. This case series illustrates that GP ablation can be performed safely and effectively without the use of radiation.

Successful Ablation of an Epicardial Left Anterior-lateral Accessory Pathway Inside the Distal Coronary Sinus

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Objectives: Catheter ablation of accessory pathway (AP) is the standard treatment for AVRT. The presence of epicardial AP is challenging for AP ablation. We presented a case with concealed left anterolateral AP, which was successfully ablated at the distal coronary sinus (CS) area.

Materials and Methods: A 45-year-old woman received electrophysiology study due to palpitation, and the event ECG showed a short RP supraventricular tachycardia. The induced supraventricular tachycardia (SVT) demonstrated retrograde eccentric atrial activation, and the SVT terminated with AV block, supporting the diagnosis of AVRT. With trans-aortic approach, we found a VA fusion signal over the left atrial appendage region (Figure IA). However, ablation at this site failed to eliminate the AP. Considering an epicardial AP, we mapped inside the CS and found a good VA fusion signal at the distal CS area (Figure IB). Radiofrequency energy (slowly titrated from 20 to 30 watts) was applied at this point, and successfully eliminated the AP in 2 seconds. An occlusive CS venogram disclosed the successful site was at the junction of great cardiac and anterior interventricular veins (Figure II). The patient was uneventful at 6-month follow-up.

Conclusion: Although most left-sided APs cross the AV groove between the CS and the annulus fibrosus, epicardial APs might be located over the left anterolateral region. These APs could be treated from the LA appendage, left sinus of Valsalva, CS, or surgical approach. This case indicated that ablation inside the CS also provided good catheter stability for a successful epicardial AP ablation.

SUPPORTING DOCUMENTS

Figure I:

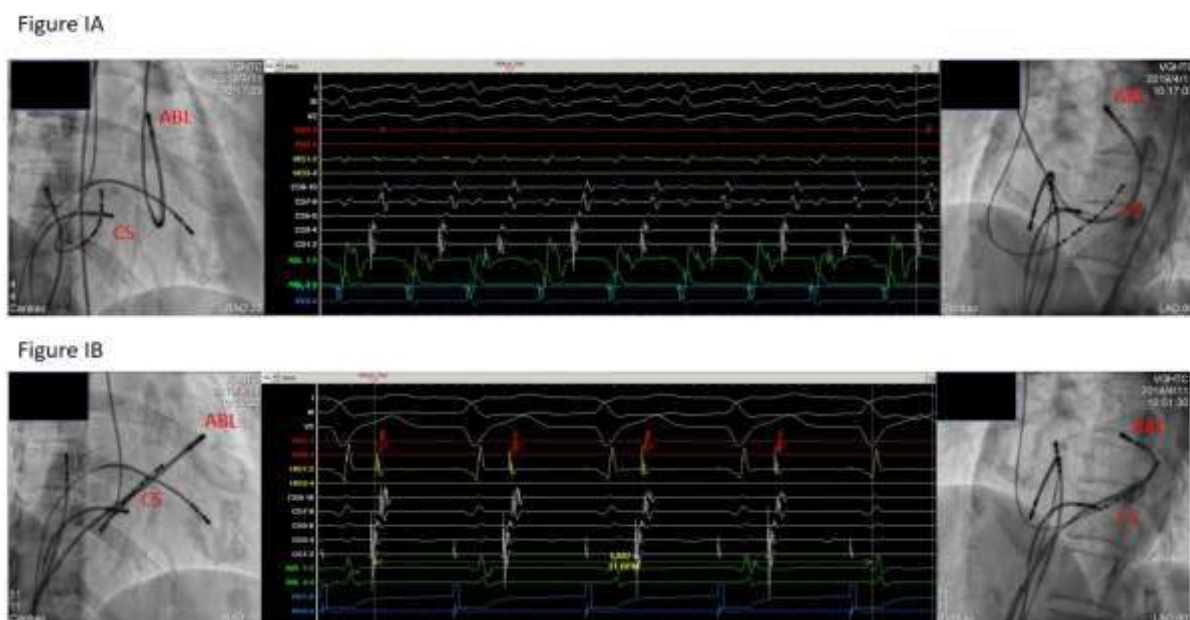


Figure IA: VA fusion signal at LAA region, mapped by trans-aortic approach and during PSVT

Figure IB: VA fusion signal at distal CS, mapped inside the CS and during RV pacing.

Figure II

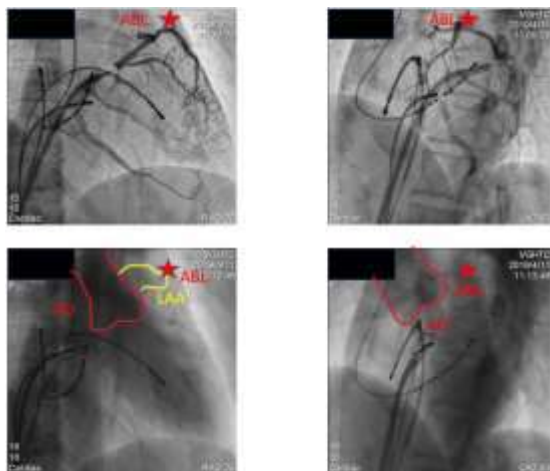


Figure II: Occlusive CS venogram and right atrial angiography to delineate the structure in the vicinity of the successful ablation site.

THE FAT AND THIN COMPLEXES: COUMEL'S LAW.

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¹*Ministry of health Malaysia, Cheras, Malaysia*

We present to you a case of a 17 years old teenager whom presented with recurrent palpitations and unable to play sports due to feels palpitations upon strenuous exertion.

ECG noted narrow complex regular tachycardia, with suspicious of long RP tachycardia together with QRS alternans.

Differential of orthodromic AVRT, AT and atypical AVNRT was made. Echocardiography showed structurally normal heart.

EP study performed, AH and HV were within normal ranges. Noted similar morphology tachycardia was induced with earliest fused signal was at C5,6, eccentric activation. RVOP was not able to perform as it terminates the tachycardia. AH jump was noted during single extrastimulus.

Antegrade pacing re-induced the tachycardia and subsequently noted the change of QRS from narrow to broad to narrow. Patient claims this tachycardia is similar to his complains of palpitations.

Here, we measured the AH during the broad complex tachycardia and narrow complex tachycardia. During broad, it was 105ms and during narrow it was 72ms. We measured the tachycardia cycle length (TCL) during broad complex tachycardia to be longer compared to narrow complex tachycardia.

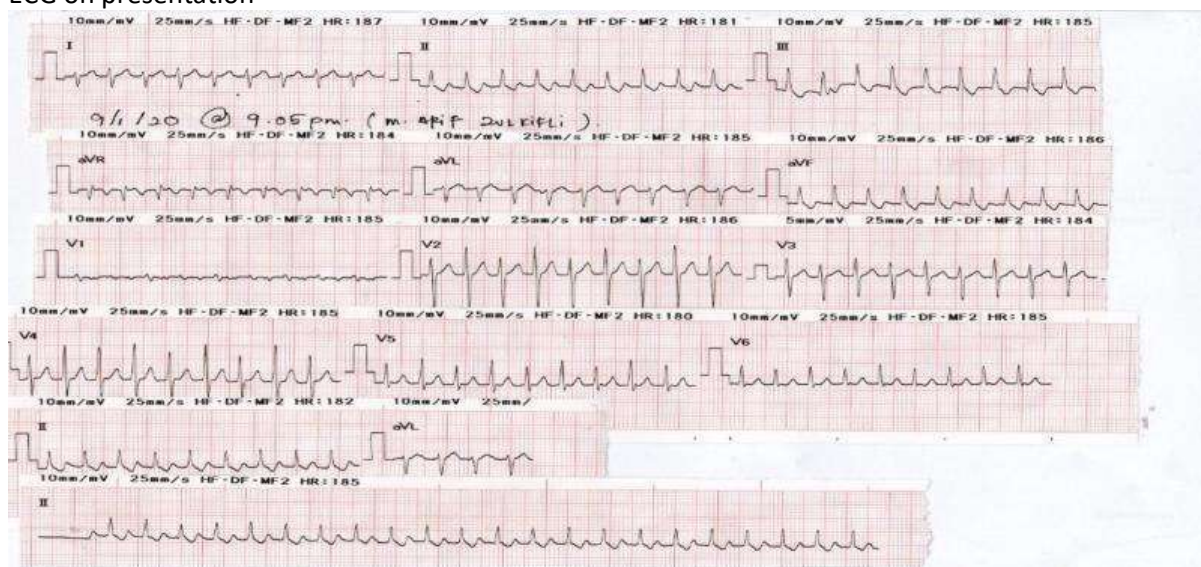
The LA was mapped at the CS 5.6 area. Earliest and fused signals seen with Kent potentials. The area was ablated. Tachycardia still persisted, and seemed like a slanting pathway. Ablated throughout the area up till CS 7,8.

After few consolidations, the tachycardia were not inducible anymore. No more eccentric activation seen either. AH Jump still present.

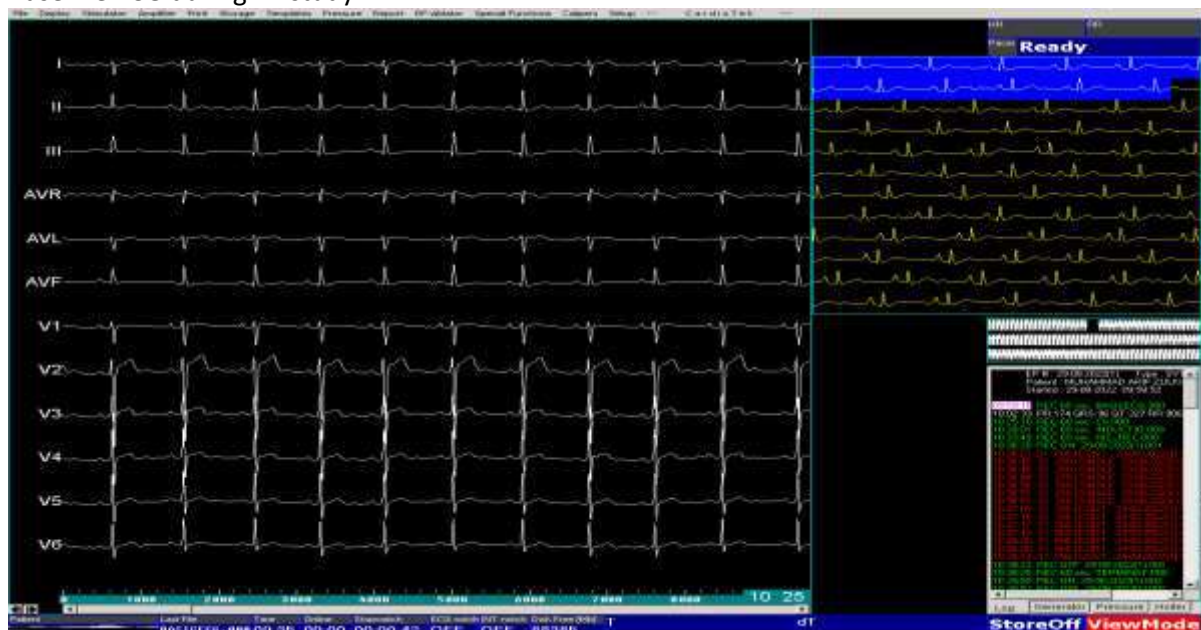
Post ablation, patient is well now and able to play sports like before and asymptomatic.

SUPPORTING DOCUMENTS

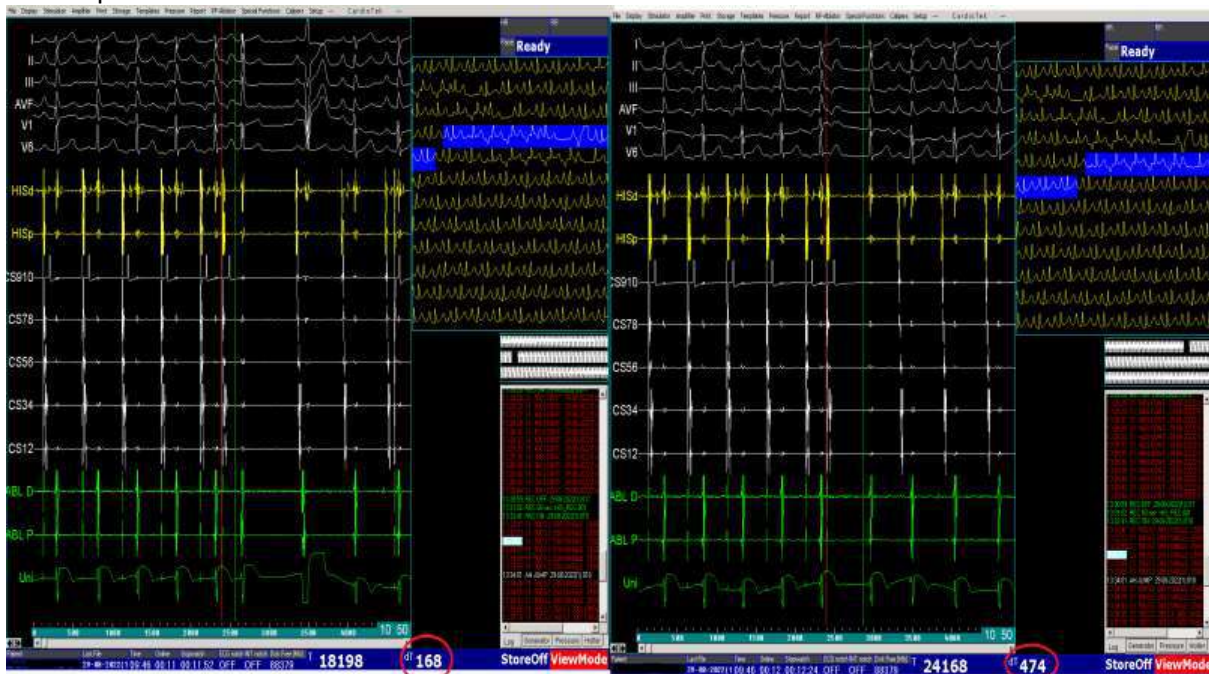
ECG on presentation



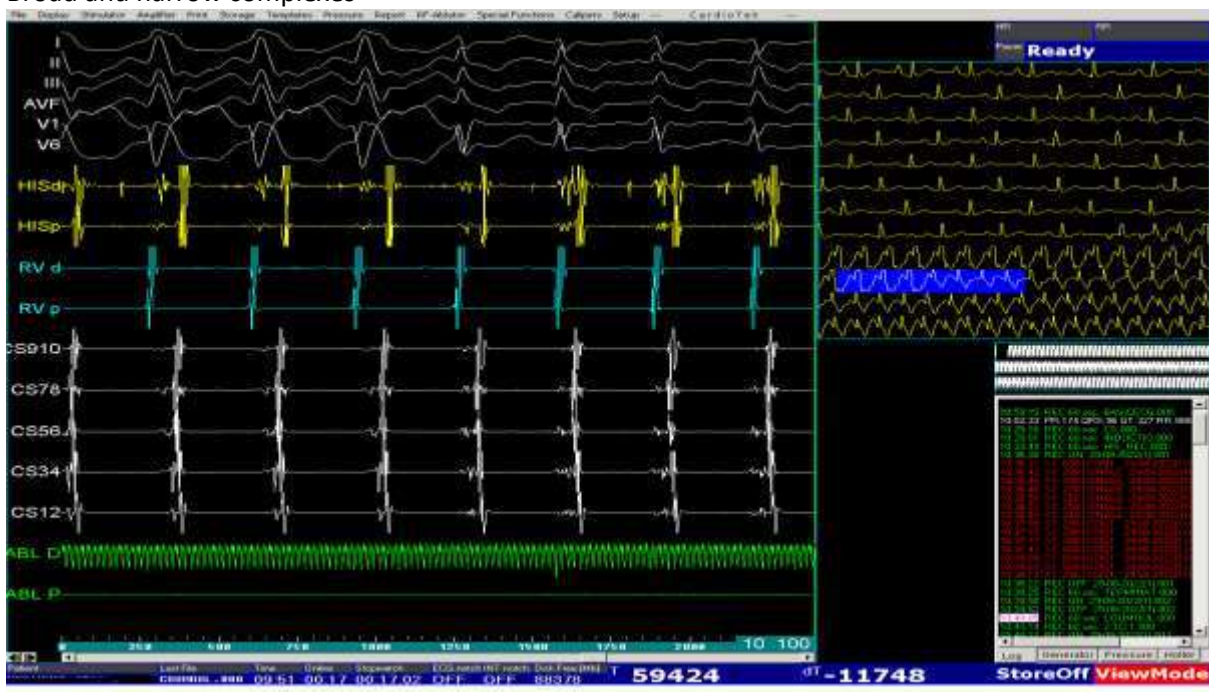
Baseline ECG during EP study



AH Jump

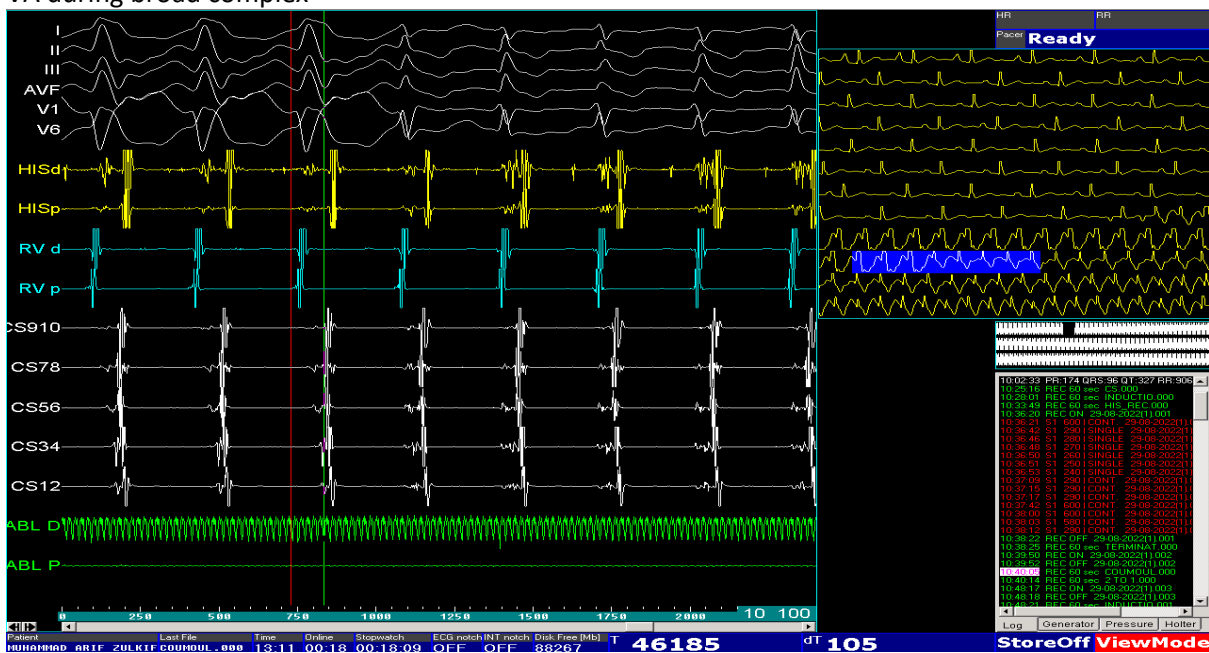


Broad and narrow complexes

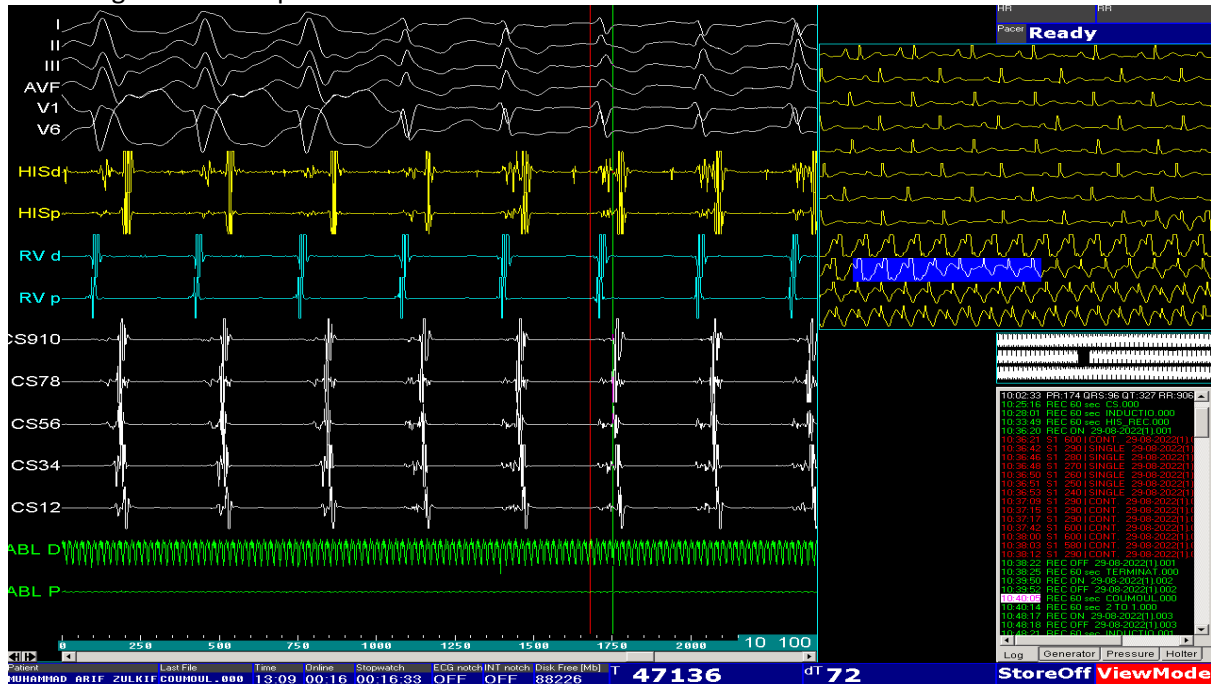




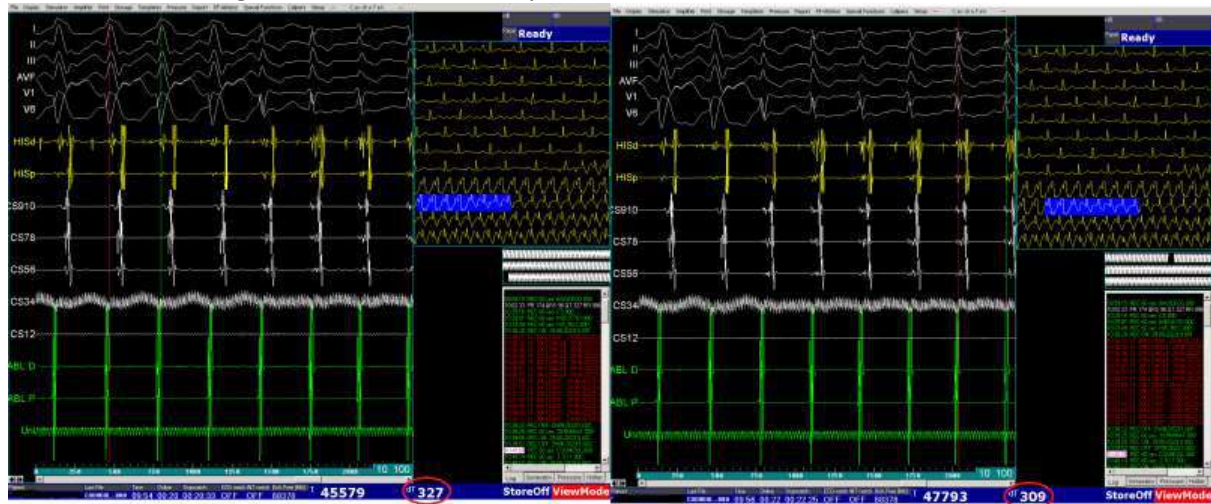
VA during broad complex

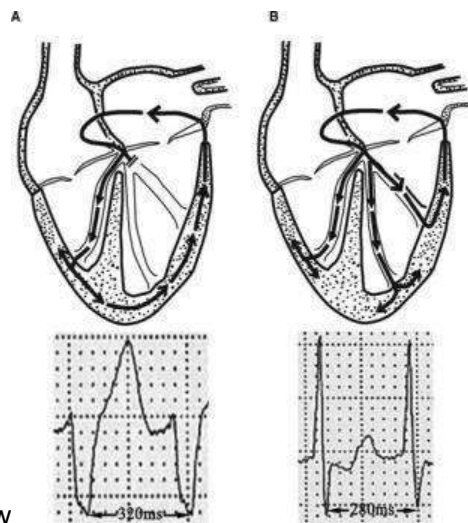


VA during narrow complex



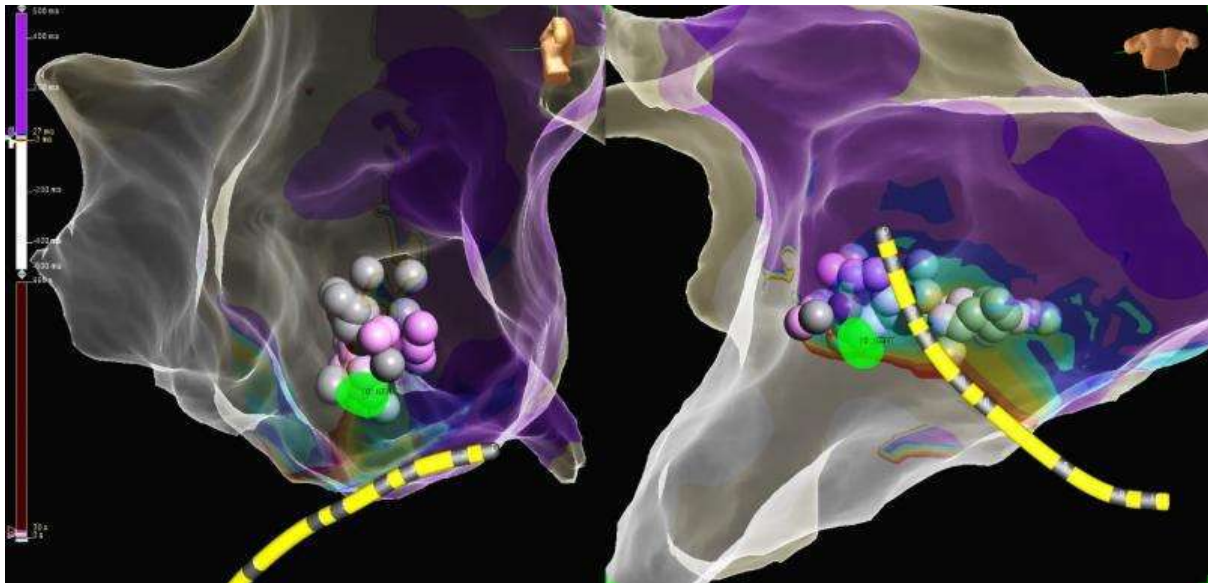
Different TCL during broad and narrow complexes.





Coumel's Law

Ablated lesions over LA



A Case of Atypical Atrioventricular Nodal Reentrant Tachycardia with Alternating Retrograde Slow Pathway Conduction

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¹*Korea University College Medicine and Korea University Medical Center, Seoul, South Korea*,
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⁴*The First Central Hospital of Mongolia, Mongolia*

Background: We report a case of atypical fast-slow AVNRT with alternating retrograde slow pathway conduction that successfully ablated at a typical slow pathway location.

Case Illustration: A 49-year-old male was referred to our clinic for recurrent palpitation for seven years. The ECG during tachycardia showed regular narrow QRS tachycardia with short RP intervals with RP more than 90 ms. The patient underwent an electrophysiology study and ablation. We could induce tachycardia during RVP 600 ms. It had a narrow QRS duration, AH < HA, and AH interval of 80 ms, with the earliest A at CS ostium. The tachycardia cycle length was alternating due to alternating HA intervals (320 ms and 290 ms). His refractory PVC couldn't reset the subsequent A. V entrainment showed VAV response with cPPI-TCL 180 ms. No AH jump was observed. Our conclusion was atypical fast-slow AVNRT with alternating HA intervals. We ablated the slow pathway at typical RIE with induction of junctional rhythm during ablation. Tachycardia couldn't be induced despite isoproterenol. VA jump with the change of earliest A activation to proximal CS was observed after ablation.

Conclusion: The precise mechanism of atypical AVNRT remains elusive. It has been reported that atypical AVNRT uses a different fast pathway from typical AVNRT. Its reentry circuit involves both right inferior extension (RIE) and left inferior extension. In our case, we speculated that the tachycardia utilized two retrograde slow pathways alternatively due to concealed conduction. A conventional ablation at RIE was safe and effective because part of the critical tachycardia circuit.

SUPPORTING DOCUMENTS

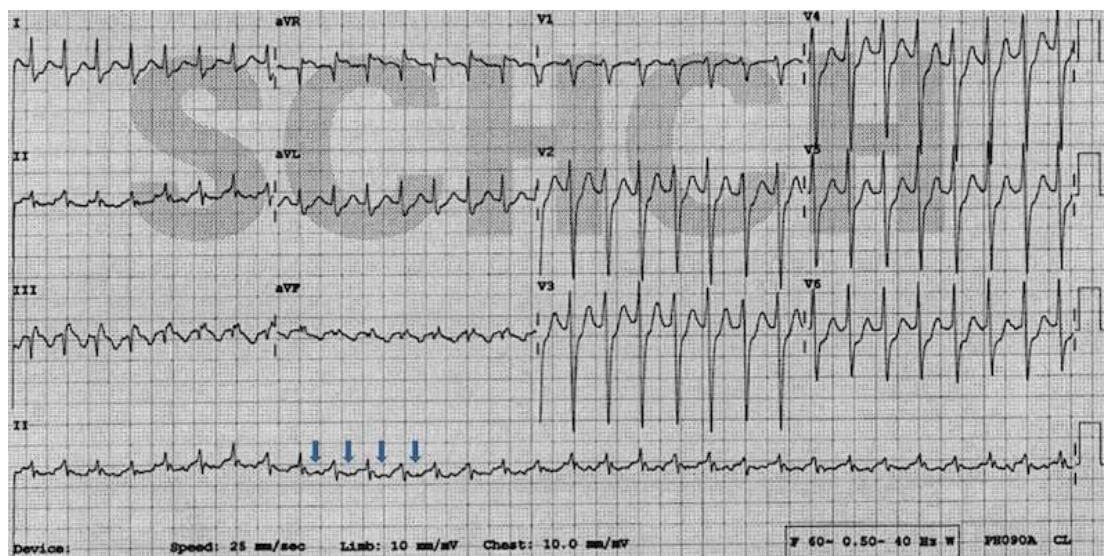


Figure 1. ECG tracing during tachycardia

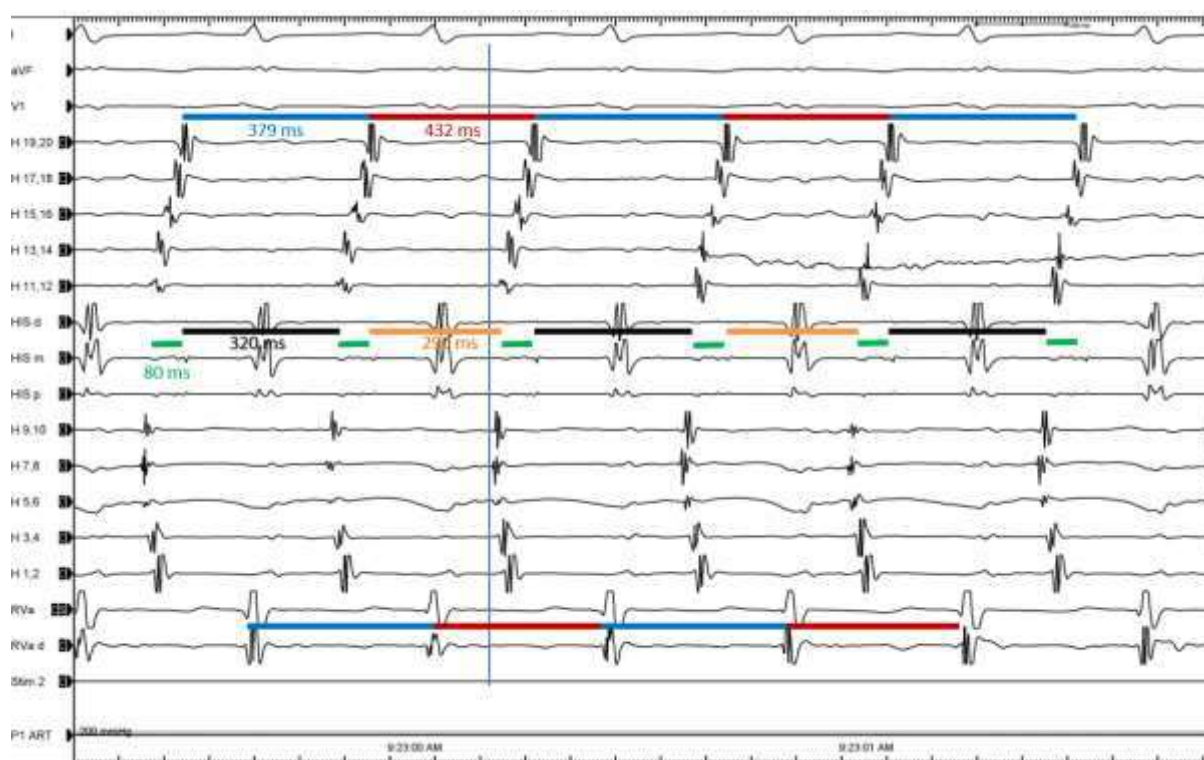


Figure 2. Electrogram tracing during tachycardia.

Forbidden Touch

Dr Ahmad Faiz Mohd Ezanee¹, Dr Leong Chew Wei¹, Dr Mohanraj Jayakumar¹, Dr Phang Yuen Hoong¹, Dr Vijayendran Rajalingam¹, Dr Kantha Rao Narasamuloo¹, Dr Saravanan Krishinan¹
¹*Hospital Sultanah Bahiyah, Alor Setar, Malaysia*

Objective: This study explores the feasibility and safety of radio frequency ablation of AT under EnSite NavX mapping guidance.

Materials & Methods: Electrophysiology study and radio frequency ablation done using Ensite NavX 3D system from St Jude medical (Abbott).

Baseline AH 60ms (54-130 ms), HV 40ms (31-55 ms) were normal.

PR 140ms

RR 600ms

QRS 68ms

QT 330ms

Noted narrow complex tachycardia. Long VA >50% of R-R interval.

p wave morphology during tachycardia and sinus beats was similar with paroxysmal & runs of tachycardia. Thus, suspicious focal origin from RA.

RA was mapped using 3D EnSite NavX.

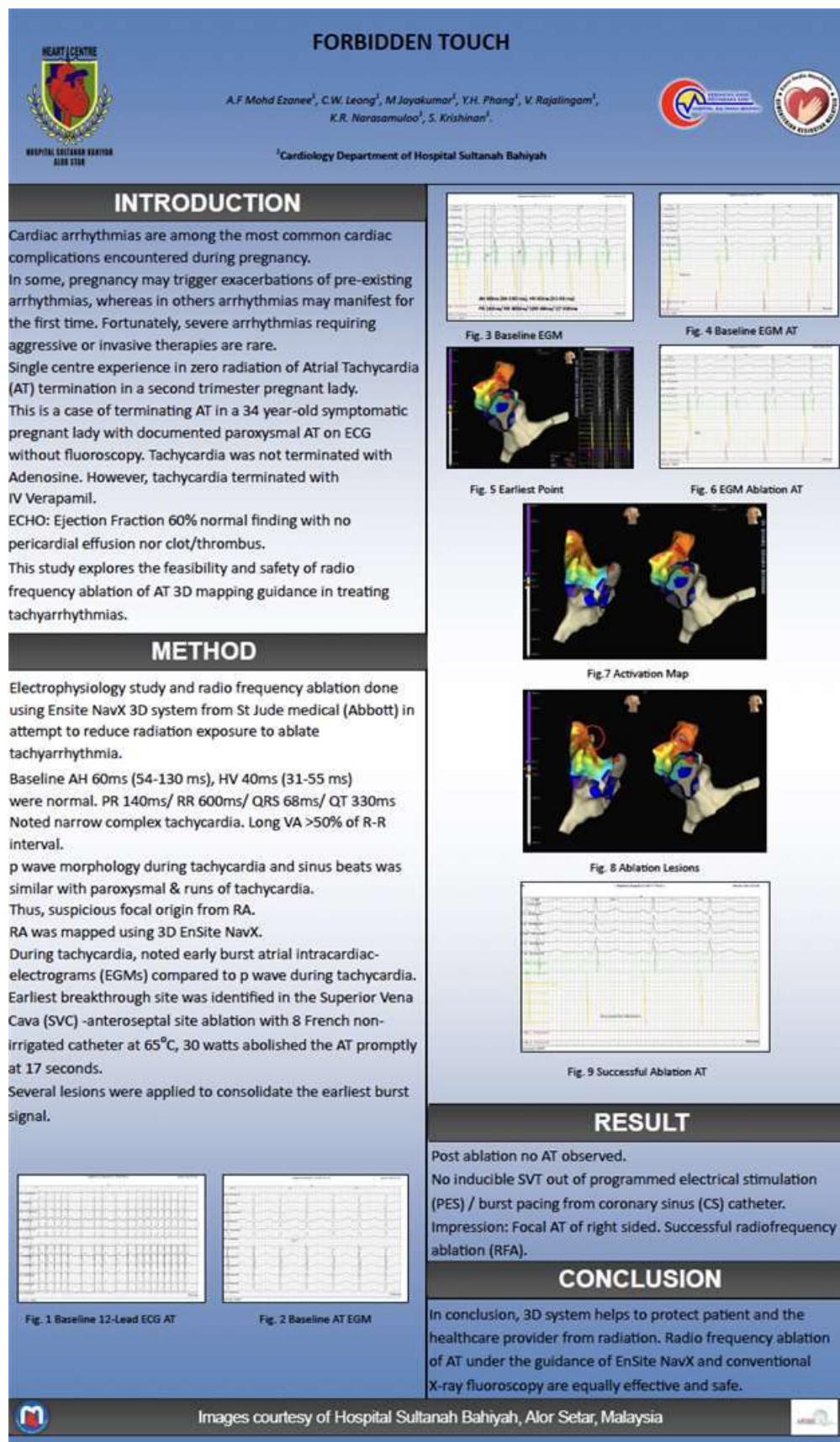
During tachycardia, noted early burst atrial electropotential waves (EPW) arranged to p wave during tachycardia.

Earliest breakthrough site was identified in the Superior Vena Cava (SVC) - anteroseptal site ablation with 8 French non-irrigated catheter at 65°C, 30 watts abolished the AT promptly at 17 seconds. Several lesions were applied to consolidate the earliest burst signal.

Result: Post ablation no AT observed. No inducible SVT out of programmed electrical stimulation (PES) / burst pacing from coronary sinus (CS) catheter.

Impression: Focal AT of SVC done. Successful radiofrequency ablation (RFA).

Conclusions: In conclusion, 3D system helps to protect patient and the health provider from radiation. Radio frequency ablation of AT under the guidance of EnSite NavX and conventional X-ray fluoroscopy are equally effective and safe.



Outcome of Supraventricular Tachycardia Ablation in a Single Centre Northern Malaysia From 2016 to 2022

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Objectives: To compare patient demographic, safety and clinical outcome of catheter ablation of supraventricular tachycardia (SVT) in a single centre experience in Northern Region of Malaysia

Materials and Methods:

A retrospectively collected data on cardiac ablation procedures performed from 2016 - 2022. A total of 225 patients who underwent catheter ablation for AtrioVentricular Nodal Re-entrant Tachycardia (AVNRT, 167), focal Atrial Tachycardia (AT, 35) and AtrioVentricular Re-entrant Tachycardia (AVRT, 23), were retrospectively collected.

The aim was to compare patient baseline characteristics, demographic, safety, outcome and efficacy of conventional catheter ablation of supraventricular tachycardia (SVT).

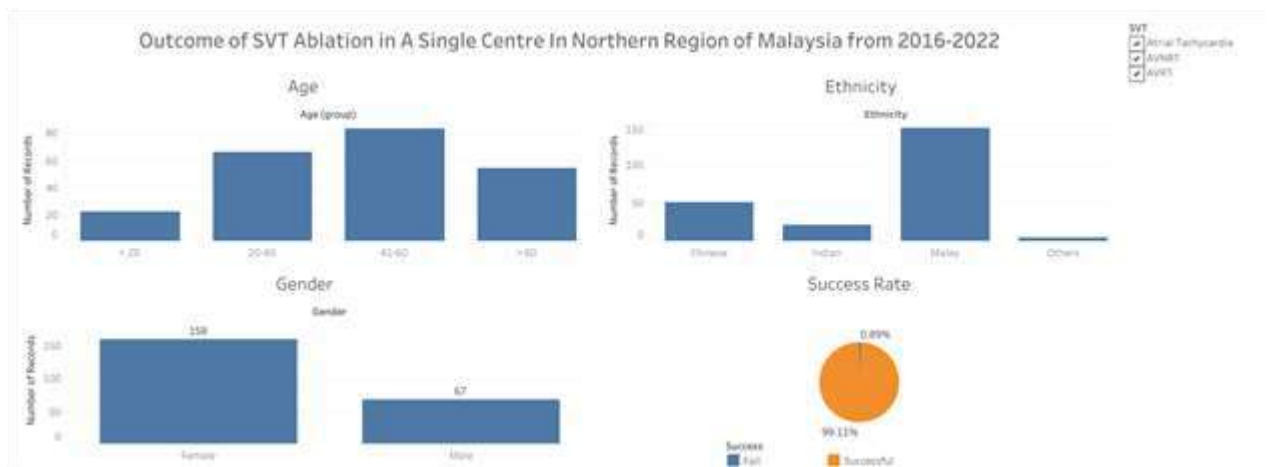
Results: From this data, the most common gender is female. Ethnicity Malay with 150 out of total Malaysia population 32.7 million. Most common age group 20 – 60 years old.

Overall, procedural success rate was high in the three groups. The periprocedural success rate was 99.10%, ranging from 99.39% (AVNRT) to 100% (AT).

A total of 221 out of 223 patients (99.10%) had successful SVT ablation. Recurrence rate with repeat ablation was performed in 2 (0.90%). of patients.

Conclusions: Patients undergoing SVT ablation exhibit high overall success rates and low major complication rates, despite higher age, disadvantageous baseline characteristics. These data highlight the safety and efficacy of SVT ablation in patients regardless age, gender and ethnic. Although periprocedural success rate has approached 99.10%, late arrhythmia recurrence requiring repeat ablation in 0.90% of patients.

SUPPORTING DOCUMENTS



Left Atrial Flutter Ablation in a Patient of DVR with CS OS AT

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¹*Batra Hospital, Faridabad, India*

Clinical Presentation: Fifty eight year old male with RHD having severe MR and AR underwent DVR. 15 days after DVR he developed Regular Wide QRS Tachycardia with RBBB and RAD. Baseline ECG showed Atrial flutter with positive P wave in V1 and leads II,III, and aVF suggestive of LA flutter after they treated with Diltiazem injection. LVEF was 40% with global hypokinesia may be due to tachycardiomyopathy. Taken up for 3D mapping of LA flutter.

Summary and Conclusion: LA flutter is relatively rare arrhythmia after valve surgery . But this flutter was roof dependent and having slow conducting channel from roof to anterior wall of LA.

As the channel was narrow so with single RF at 45 degree and 30 watt cool tip ablation lead to termination of LA Flutter but we connected and made roof line.

This patient also had AT from CS OS which was easily induced in lab which was ablated in the posterior part of CS OS with termination of AT.

Over six months of follow up there was no recurrence of tachycardia. LVEF became 50% .

Focal atrial tachycardias related to non-incisional low-voltage-areas resulting from an undiscovered atrial septal defect

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Most atrial tachycardias after surgical ASD repair were macroreentries. Focal atrial tachycardias, however, have been seldomly reported. The highlight of this case was that both focal ectopies pertained to non-incisional LVAs.

A 50-year-old woman was admitted for frequent palpitation with a history of surgical secundum atrial septal defect (ASD) repair 45 years ago. The Holter showed ectopic atrial burden (two origins, Figure 1) as high as 70.3%. Echocardiography displayed biatrial enlargement (LA 42mm, RA 51×60mm), RV enlargement (RVOT 37mm), severe tricuspid regurgitation and mild pulmonary hypertension (sPAP 48mmHg), with LV 38mm, LVEF 60%. Cardiac tomography discovered an inferior sinus venosus ASD.

In the electrophysiological study, a low voltage area (LVA, bipolar voltages <0.10mV) was mapped lateral to the mid-inferior crista terminalis where the inferior vena cava joined the RA (Figure 2). The earliest atrial activation (EAA) of the first atrial tachycardia (AT) was within the LVA. The EAA of the second AT was pinpointed at the high CT adjacent to an LVA (Figure 2), with double potentials nearby. Focal ablation to the EAAs successfully eliminated both ATs. Another ASD repair was recommended.

The LVAs were considered from the remodeling of right atrial volume overload (RAVO). Recent research exposed the RA was predisposed to electrical remodeling from RAVO, especially within the intercaval region. The LVA housing the first AT was close to the inferior sinus venosus ASD. The left to right shunt of flow might constantly hit that area, and gradually prompted electric remodeling (Figure 3).

SUPPORTING DOCUMENTS

Figure 1 Two focal atrial ectopies from the patient's Holter. (A) The P' wave shape of the first premature atrial beat: blue arrow indicated sinus beat, and red arrows pointed at the first atrial ectopies. (B) The P' wave shape of the second premature atrial beat as indicated by red arrows.



Figure 2 Ablation targets of the two atrial tachycardias (ATs). Targets shown in right anterior oblique (RAO) views (left in RAO 45°, right in RAO 122°).

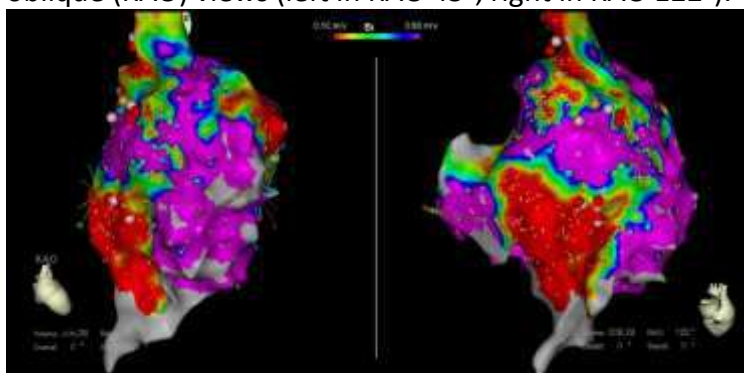
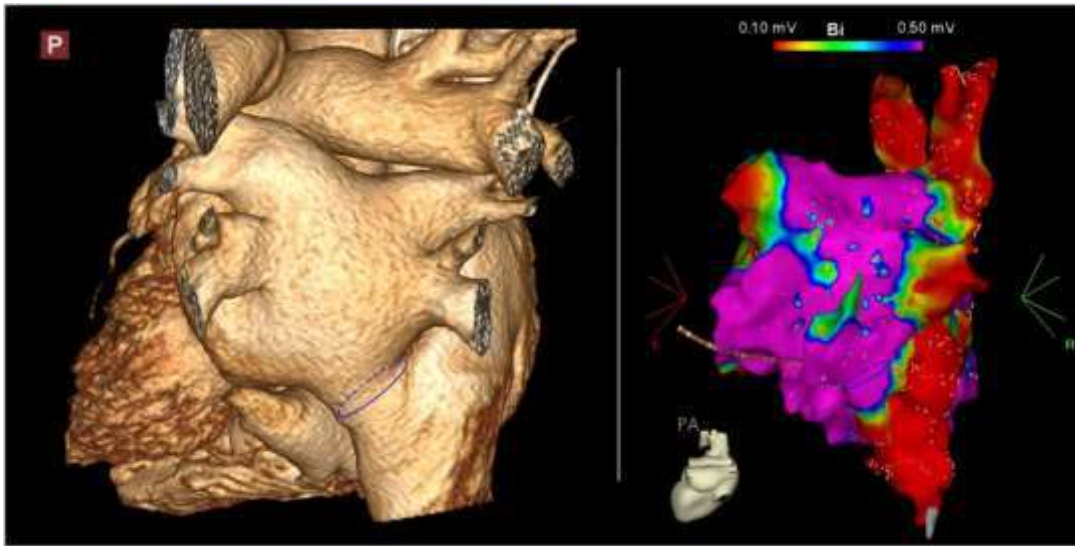


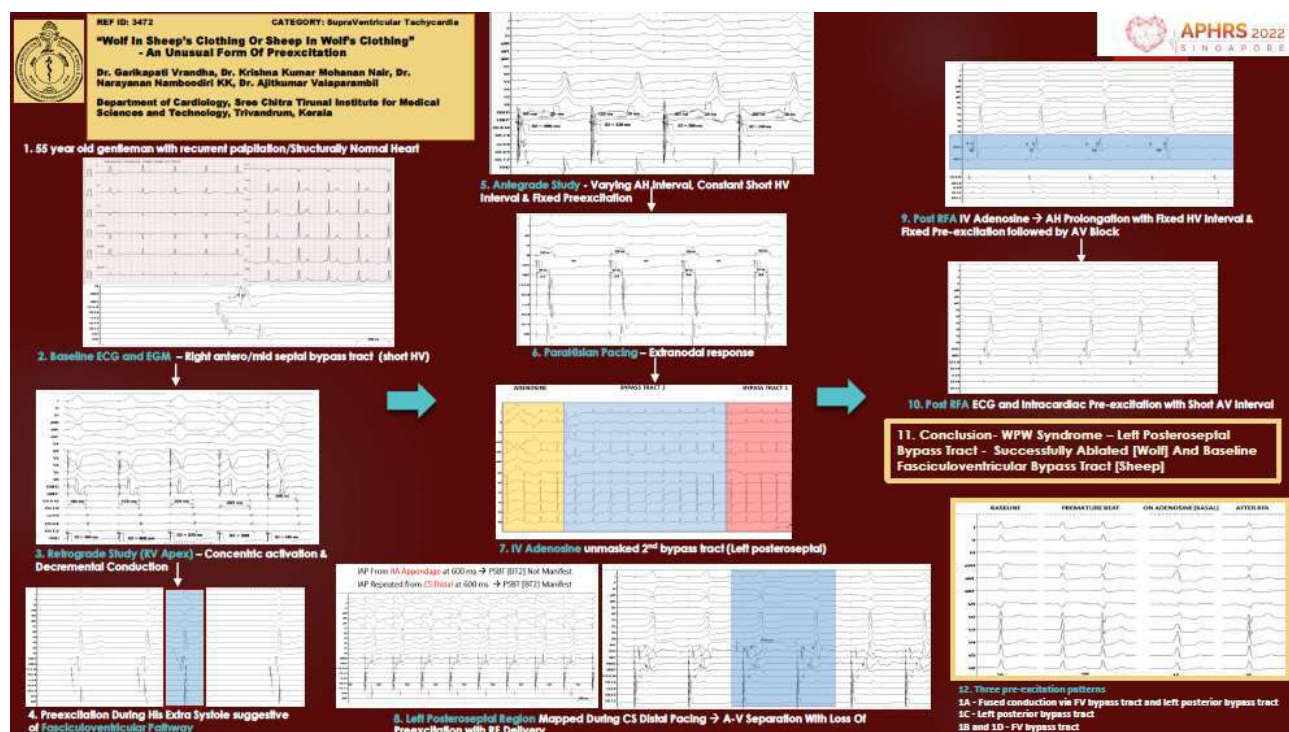
Figure 3 Locational adjacency between the inferior sinus venosus atrial septal defect and the low posterolateral low voltage area. The blue circles illustrated the inferior sinus venosus atrial septal defect.



“Wolf in Sheep’s Clothing or Sheep in Wolf’s Clothing” - an Unusual Form of Preexcitation

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¹Sree Chitra Tirunal Institute Of Medical Sciences And Technology, Thiruvananthapuram, India



Temporary Cardiac Pacing in Electrical Storm Due to Long QT Syndrome - a Case Report

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¹*Hanoi Heart Hospital, Ha Noi, Viet Nam*

Objectives: Management of the electrical storm caused by long QT syndrome remains challenging. Current recommendations for the management of arrhythmias in the acute phase still focus primarily on cardioversion and drug administration. Temporary cardiac pacing can be a safe and effective method to terminate electrical storm.

Materials and Methods: We report a clinical case of a patient with onset of episodes of ventricular tachycardia due to the use of an anxiolytic drug (sulpiride). After 1 week of taking sulpiride, the patient developed multiple episodes of ventricular tachycardia within 24 hours and required electric shocks. We decided to insert a temporary pacemaker for the purpose of pacing faster than the baseline to shorten the QT interval, in combination with beta-blockers.

Results: In the following 48 hours, the patient did not have any episodes of ventricular tachycardia, we stopped the pacemaker to re-evaluate the QT interval, excluding the possibility of long QT secondary to drugs. The patient was followed up for the next 5 days and was implanted an ICD to prevent cardiac sudden death.

Conclusion: Temporary pacemaker placement may be useful to control the electrical storm caused by long QT syndrome.

Predicting Arrhythmic Event Score in Brugada Syndrome: Worldwide Pooled Analysis With Internal and External Validation

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¹Massachusetts General Hospital Harvard Medical School, Boston, United States, ²Faculty of Medicine, Khon Kaen University, Thailand, Khon Kaen, Thailand, ³Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand, ⁴Mayo Clinic, Phoenix, United States

Objectives: Brugada syndrome (BrS) is an inherited arrhythmic disease associated with major arrhythmic events (MAE). Risk predictive scores were previously developed with various performances. We develop a novel score, Predict Arrhythmic evenTs (PAT), with internal and external validation.

Materials and Methods: A systematic review was performed to identify risk factors for MAE. The odds ratios (OR) of each factor were pooled across studies. The PAT scoring scheme was developed based on pooled ORs of only significant risk factors. The cut-off point was identified as the point that maximized the Youden index. The PAT score was internally validated with 105 published Asian BrS patients (mean age:52.2±12.0 years, follow-up 8.0±4.1 years) and externally validated with 164 unpublished multiracial (82.2% White, 14.6% Asian, 3.0% Black, mean age 46.5±14.3 years, follow-up 8.0±6.9 years) BrS patients. Performances were assessed and compared with previous scores using receiver operating characteristic curve (ROC) analysis.

Results: Sixty-one studies published between 2002-2020 from 23 countries (n=5,134 patients) were included. Pooled ORs were estimated, indicating that 15 of 18 risk factors were significant. The PAT score was then developed accordingly. In the external validation BrS cohort, a score ≥10 predicted MAE with a sensitivity of 100.0% and specificity of 82.6% and had significantly better discrimination (ROC:0.9611) compared to BRUGADA-RISK (ROC:0.7427;p=0.02), Shanghai (ROC:0.7204;p=0.007), and Sieira et al. (ROC:0.8213;p=0.02) scores. The PAT predicted MAE well in both primary prevention (ROC:0.9737) and recurrent shocks (ROC:0.8750).

SUPPORTING DOCUMENTS

Table 1: Basic characteristics of included Brugada syndrome patients for internal and external validation from Thailand and the United States

	Hospital			P-value
	Internal Validation	External Validation		
	Khon Kaen Thailand (N=105)	Mayo Clinic USA (N=150)	Ramathibodi Thailand (N=14)	
Age at diagnosis				0.002 ¹
Mean (SD)	52.2 (12.02)	46.8 (14.48)	42.9 (11.42)	
Median (IQR)	52.0 (46.0, 60.0)	47.0 (35.0, 58.0)	45.5 (33.0, 51.0)	
Range	21.0, 79.0	14.0, 79.0	24.0, 59.0	
Gender, n (%)				<.001 ²
Male	104 (99.0%)	118 (78.7%)	14 (100.0%)	
Race, n (%)				<.001 ²
Asian	105 (100.0%)	9 (6.3%)	14 (100.0%)	
Black or African American	0 (0.0%)	5 (3.5%)	0 (0.0%)	
White	0 (0.0%)	130 (90.3%)	0 (0.0%)	
Others	0	6	0	
Ethnicity, n (%)				0.06 ²
Hispanic or Latino	0 (0.0%)	7 (5.1%)	0 (0.0%)	
Not Hispanic or Latino	105 (100.0%)	131 (94.9%)	14 (100.0%)	
Others	0	12	0	
Syncope, n (%)				0.41 ¹
No syncope	76 (72.4%)	112 (74.7%)	7 (50.0%)	
Cardiac syncope	10 (9.5%)	16 (10.7%)	7 (50.0%)	
Vasovagal syncope	0 (0.0%)	15 (10.0%)	0 (0.0%)	
Unclear etiology syncope	19 (18.1%)	7 (4.7%)	0 (0.0%)	
Spontaneous type 1, n (%)	85 (81.0%)	93 (62.0%)	13 (92.9%)	<.001 ¹
Atrial fibrillation, n (%)	11 (10.5%)	23 (15.3)%	2 (12.5%)	0.23 ²
Sinus node dysfunction, n (%)	3 (2.9%)	6 (4.0%)	0 (0.0%)	0.84 ¹
Family history of SCD, n(%)				0.46 ¹
<35 years	3 (17.6%)	7 (36.8%)	0 (0.0%)	
35-40 years	4 (23.5%)	2 (10.5%)	1 (33.3%)	
>40 years	10 (58.8%)	10 (52.6%)	2 (66.7%)	
Unknown	88	131	11	
History of SCD/SCA, n(%)	71 (67.6%)	9 (6.0%)	2 (14.3%)	<0.001 ²
Follow-up duration				0.69 ¹
Mean (SD)	8.0 (4.10)	7.9 (7.06)	9.4 (4.54)	

¹ANOVA F-test p-value; ²Fisher Exact p-value;

(Abbreviations: IQR: inter quartile range; SCA: sudden cardiac arrest; SCD: sudden cardiac death; SD: standard deviation; USA: United States of America)

Table 2: Pooled odds ratio and 95% confidence interval of 15 significant predicting factors, their natural-log scale, and a linear combination of PAT scores

Predicting Factors	Studies (N)	Total Population (n)	Pooled OR	95% CI	p-value	ln(OR)	PAT Score
Major arrhythmic events							
History of SCD/SCA/VT/VF	18	2947	14.67	8.97-24.01	<0.001	2.69	8
VT/VF during drug challenge testing	3	776	3.73	1.77-7.86	0.001	1.32	4
Baseline ECG							
Type-1 in peripheral leads	2	438	8.29	1.69-40.63	0.009	2.12	6
T-peak T-end 100 msec	5	1045	4.99	1.99-12.54	0.001	1.61	5
aVR sign	4	323	4.72	2.19-10.21	0.001	1.55	5
Prolong PR 200 msec	3	692	3.40	1.82-6.35	<0.001	1.22	4
Fragmented QRS	13	2965	3.08	1.90-4.97	<0.001	1.12	3
Early repolarization in inferolateral leads	9	1524	2.66	1.65-4.28	<0.001	0.98	3
Spontaneous Type-1	15	2831	1.47	1.04-2.07	0.027	0.39	1*
History							
Arrhythmic syncope	7	2465	4.48	2.87-7.01	<0.001	1.50	5
Unclear syncope	5	455	4.71	1.34-16.57	0.016	1.55	5
Family history of SCD at < 40 years	3	807	2.03	1.11-3.73	0.022	0.71	2*
Atrial fibrillation	5	1678	1.60	1.01-2.55	0.045	0.47	1*
Laboratory							
Positive electrophysiology study	13	1844	1.71	1.10-2.73	0.017	0.55	2*
Positive SCN5A	11	1827	1.52	1.10-2.09	0.010	0.42	1*

*Low-impact significant predictor: SCD in the family at an age younger than 40 years old=2, positive electrophysiology study=2, spontaneous Type-1 ECG=1, atrial fibrillation=1, positive SCN5A mutation=1

(Abbreviations: CI: confidence interval; OR: odds ratio; PAT: predicting arrhythmic event for ICD therapySCA: sudden cardiac death; SCD: sudden cardiac death ;VF: ventricular fibrillation; VT: ventricular tachycardia)

Table 3: The sensitivity and specificity of Predicting Arrhythmic event (PAT) score ≥ 10 in predicting the overall major arrhythmic events in *external validation* Brugada syndrome patients (*primary prevention and recurrent shocks*)

Statistic	Estimate	95% Confidence Limits	
Sensitivity	1.0000	0.7820	1.0000
Specificity	0.8255	0.7549	0.8827
Positive Predictive Value	0.3659	0.2212	0.5306
Negative Predictive Value	1.0000	0.9705	1.0000

Figure 1: Performance comparison between Predicting Arrhythmic eventT (PAT) score and previously published scores by the receiver operating characteristic (ROC) curve analysis for the overall major arrhythmic events in *external validation* Brugada syndrome patients (*primary prevention and recurrent shocks*)

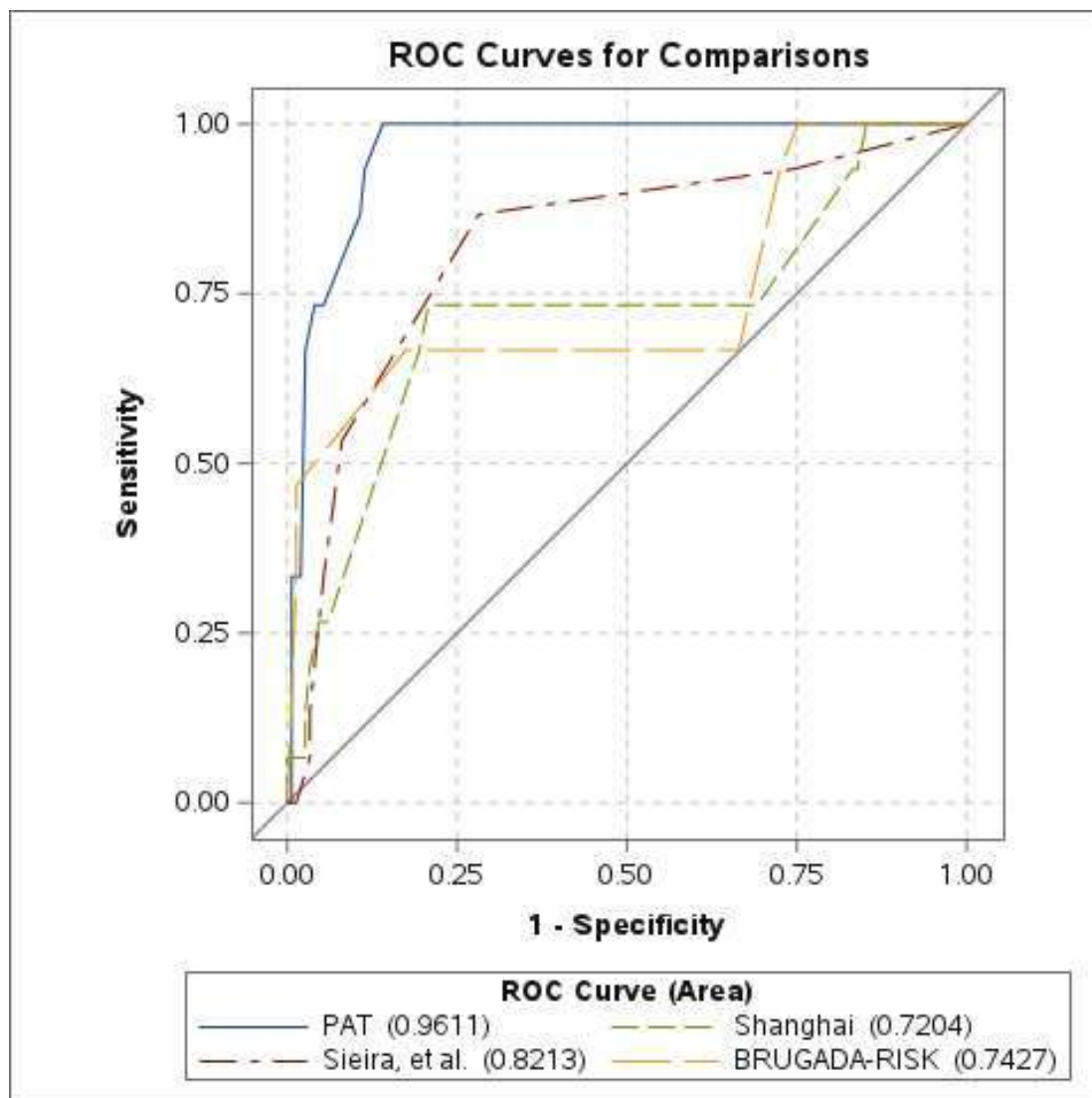


Table 4: Performance comparison between Predicting Arrhythmic eventT (PAT) score and previously published scores by the receiver operating characteristic (ROC) curve analysis for the overall major arrhythmic events in *external validation* Brugada syndrome patients (*primary prevention and recurrent shock*)

	ROC Statistics	ROC Contrast Estimation and Testing	
ROC Model	Area (95% CI)	Estimate (95% CI)	Chi-square p-value
PAT	0.9611 (0.9315, 0.9906)	Reference	-
Shanghai	0.7204 (0.5556, 0.8852)	-0.2407 (-0.4142, -0.0672)	0.007
Sieira	0.8213 (0.6998, 0.9427)	-0.1398 (-0.2603, -0.0193)	0.02
Brugada-Risk	0.7427 (0.5742, 0.9112)	-0.2183 (-0.3974, -0.0393)	0.02

Table 5: Performance comparison between Predicting Arrhythmic eventT (PAT) score and previously published scores by the receiver operating characteristic (ROC) curve analysis for the first major arrhythmic events in *external validation* Brugada syndrome patients (*only primary prevention*)

	ROC Statistics	ROC Contrast Estimation and Testing	
ROC Model	Area (95% CI)	Estimate (95% CI)	Chi-square p-value
PAT	0.9737 (0.9491, 0.9983)	Reference	-
Shanghai	0.8070 (0.6430, 0.9711)	-0.1667 (-0.3377, -0.0044)	0.06
Sieira	0.8289 (0.6801, 0.9777)	-0.1448 (-0.2965, -0.0069)	0.06
Brugada-Risk	0.8124 (0.6416, 0.9831)	-0.0912 (-0.3401, -0.0174)	0.08

Table 6: Sensitivity and specificity for all risk scores using overall patients (*combined internal and external validation*), stratified by patients with primary and secondary prevention. Using the following cutoffs for risk scores: BRUGADA-RISK ≥ 21 , Shanghai ≥ 7 , and Sieira et al. ≥ 5 , and PAT ≥ 10 .

Scores	Overall		Primary prevention		Secondary prevention	
	Sensitivity (95%CI)	Specificity (95%CI)	Sensitivity (95%CI)	Specificity (95%CI)	Sensitivity (95%CI)	Specificity (95%CI)
PAT	0.9467 (0.8958, 0.9975)	0.7784 (0.7199, 0.8368)	0.9333 (0.6805, 0.9983) ¹	0.8364 (0.7120, 0.9223) ¹	0.9455 (0.8488, 0.9886) ¹	0.2903 (0.1422, 0.4804) ¹
Shanghai	0.0667 (0.0220, 0.1488) ¹	0.9691 (0.9339, 0.9886) ¹	0.0667 (0.0017, 0.3195) ¹	1.0000 (0.935, 1.000) ¹	0.0727 (0.0202, 0.1759) ¹	0.8065 (0.6253, 0.9255) ¹
Sieira et al.	0.6267 (0.5172, 0.7361)	0.8711 (0.8240, 0.9183)	0.1333 (0.0166, 0.4046) ¹	0.9818 (0.9028, 0.9995) ¹	0.8182 (0.7162, 0.9201)	0.2581 (0.1040, 0.4121)
BRUGADA-RISK	0.3067 (0.2023, 0.4110)	0.7474 (0.6863, 0.8086)	0.9333 (0.6805, 0.9983) ¹	0.4727 (0.3365, 0.6120) ¹	0.1273 (0.0527, 0.2448) ¹	0.8387 (0.6627, 0.9455) ¹

¹Clopper-Pearson exact CI

(Abbreviations: CI: confidence interval; ROC: receiver operating characteristic curve)

Table 7: Summary characteristics of individual included studies for world-wide pooled analysis of patients with Brugada syndrome

Study/Year	Study Design	N	Country	Men (%)	Age (Years)	Brugada ECG Type	Symptomatic BrS (%)	Follow-up (Months)	Risk Factors Used in Analyses	Outcomes
Benito et. al., 2008	Prospective cohort	384	Canada	70.8	45.9±15.3	I, II, III	78.4	58.0±48.0	Male gender, AF, Spontaneous type 1 ECG, Hx of SCA	VF or SCD
Bigi et. Al, 2007	Case-control study	24	Iran	100.0	32.1±13.6	I	54.2	50	aVR signs, Hx of SCA	Clinical (syncope, aborted sudden death) and/or documented VT/VF
Calò et. al., 2016	Prospective cohort	347	Italy	78.4	45±13.1	I	20.5	48.0±38.6	Male gender, Hx of SCD, QRS interval≥120 ms, fQRS	VF or SCD
Castro et. al., 2006	Case-control study	29	USA	86.2	42.3±12.2	I	41.4	42.7±24.4	TpTe	Clinical (syncope, aborted sudden death) and/or documented VT/VF
Chinushi et. al., 2007	Prospective cohort	28	Japan	92.9	54±14	I, II	46.4	45.0±37.0	MAE	VT/VF
Conte et. al., 2013	Prospective cohort	503	Belgium	58.1	26±18	I, II	29.4	29.0±8.0	MAE	Ajmaline-induced sVAs
De Asmundis et. al., 2017	Retrospective cohort	289	Belgium	70.2	45±16	I	41.5	120.6±55.7	SCN5A, QRS interval≥120 ms, fQRS. ERP	VF or SCD
Deliniere et. al., 2019	Retrospective cohort	115	France, Romania, Switzerland and	91.3	45.1±12.8	I	39.1	N/A	positive EPS, ERP, TpTe, QRS interval ≥120 ms, SCN5A	VF or SCD
Delise et. al., 2011	Prospective cohort	320	Italy	80.6	48±6.1	I, II, III	67.2	41.8±13.6	Male gender, positive EPS, Spontaneous Type 1 ECG	VT/VF or SCD
Eckardt et. al., 2002	Case-control study	23	Germany	61	46±13.8	I	69.6	34.0±26.0	Hx of SCD	VT/VF or SCD or an appropriate ICD shock
Eckardt et. al., 2005	Prospective cohort	212	the Netherlands, Germany, and France	71.7	45±6	I	32.1	40.0±50.0	Positive EPS	VF or SCD
Furushima et. al., 2005	Case-control study	24	Japan	95.9	61±16	I, II	62.5	33.0±16.0	Positive EPS, Hx of SCD	VT/VF
Garcia-Iglesias et. al., 2019	Prospective cohort	337	Spain	70.33	41±14.4	I, II, III	32.6	55.8±39.35	Positive EPS, male gender, Syncope Hx, Spontaneous Type 1 ECG, SCN5A	VT/VF or SCD or an appropriate ICD shock

Gasparini et. al., 2002	Case-control study	21	Italy	85.7	34±15	I, II	42.9	20.0±12.0	Hx of SCD	VT/VF
Giustetto et. al., 2009	Prospective cohort	166	Italy	83.0	45±14	I, II, III	38.0	30.0±21.0	Hx of SCD	VT/VF or SCD or an appropriate ICD shock
Giustetto et. al., 2014	Prospective cohort	560	Italy	75.7	44.8±14.2	I	23.6	62.5±29.5	AF	VT/VF or SCD or an appropriate ICD shock
Gonzalez Corcia et. al., 2017	Prospective cohort	95	Belgium	55.8	12.9±8.3	I	28.4	43.6±25.6	PR	VT/VF or SCD
Gray et. al., 2017	Prospective cohort	54	Australia	81.4	44±13	I	33.3	27.6±30	Male gender, Hx of SCD, SCN5A, Spontaneous type 1 ECG, fQRS, Syncope Hx	Clinical (syncope, aborted sudden death) and/or sustained VT/VF
Juang et. al., 2003	Case-control study	10	Taiwan	100.0	46±7	I	100.0	29.0±17.0	Hx of SCD, SCN5A	Appropriate ICD discharges
Juang et. al., 2013	Retrospective cohort	47	Taiwan	93.6	45.3±14.2	I	100.0	N/A	AF	VT/VF
Kamakura et. al., 2009	Prospective cohort	330	Japan	95.5	51.4±14.8	I, II	37.3	48.7±15.0	Spontaneous Type 1 ECG	VF or SCD
Kawazoe et. al., 2016	Case-control study	143	Japan	97.9	46±12	I, II, III	N/A	82.8±49.0	fQRS	VF
Kharazi et. al., 2006	Case-control study	12	India	91.7	46.5±11.8	I	83.3	27.8±11.3	Male gender, Syncope Hx, FHx of SCD, Spontaneous type 1 ECG	VF or SCD
Kyun Son et. al., 2014	Retrospective cohort	69	South Korea	98.6	46.2±13.5	I, II, III	79.7	59.0±46.0	Male gender, Syncope Hx, Hx of SCD, Spontaneous Type 1 ECG	Appropriate ICD shock for VT or VF
Leong et. al., 2018	Retrospective cohort	133	United Kingdom	68.4	44.5±14.8	I	53	42.0±26.0	Male gender, Positive EPS, Spontaneous Type 1 ECG, ERP, fQRS	VT/VF or SCD or an appropriate ICD shock
Letsas et. al., 2008	Prospective cohort	290	Germany, France	76.9	48.3±14.2	I	30.3	44.9±27.5	ERP	VT/VF or SCD or an appropriate ICD shock
Letsas et. al., 2019	Prospective cohort	111	Greece	77.5	45.3±13.3	I, II, III	33.3	55.2±42.0	fQRS, Syncope Hx, Spontaneous Type 1 ECG	VT/VF or SCD or an appropriate ICD shock
Makarawate et. al., 2014	Prospective cohort	90	Thailand	97.8	46±5.6	I	87.8	N/A	Male gender, Hx of SCD, Spontaneous Type 1 ECG	Appropriate ICD Shock
Makarawate et. al., 2017	Retrospective cohort	40	Thailand	97.5	43.5±12.7	I	100.0	28.3±11.3	SCN5A	Appropriate ICD Shock
Masaki et. al., 2002	Case-control study	13	Japan	92.3	52.4±11	I, II	23.1	34.0±32.0	Male gender	VT/VF or SCD
Maury et. al., 2013	Retrospective cohort	325	France	79.4	47±13	I	30.5	48.0±34.0	fQRS, Spontaneous type 1 ECG, PR, SCN5A	VT/VF or SCD or an appropriate ICD shock

Maury et. al., 2015	Retrospective cohort	325	France	79.7	47±13	I	27.7	48.0±34.0	TpTe	VT/VF or SCD or an appropriate ICD shock
Migliore et. al., 2019	Prospective cohort	272	Italy	82	43±12	I	30	85.0±55.0	Syncope Hx, ERP, AF, fQRS, Hx of SCD, PR	VT/VF or SCD or an appropriate ICD shock
Mok et. al., 2004	Prospective cohort	50	China	94.0	53±14.6	I, II	40.0	25.0±11.0	Male Gender, Hx of SCD, Positive EPS	VT/VF or SCD
Morita et. al., 2018	Retrospective cohort	471	Japan	94.9	46.8±13.8	I	30.8	91.0±64.0	ERP, fQRS, aVR sign, TpTe	VT/VF or SCD or an appropriate ICD shock
Nagase et. al., 2018	Retrospective cohort	209	Japan	96	45±14	I	38.3	56.0±48.0	ERP, fQRS	VF or an appropriate ICD shock
Nakano et. al., 2010	Prospective Cohort	52	Japan	94.2	42±3	I, II, III	53.8	39.0±4.0	Spontaneous Type 1	VF
Ouali et. al., 2011	Retrospective cohort	24	Tunisia	91.7	40.8±13.7	I, II	79.1	26.0±21.0	Male Gender, Hx of SCD, Spontaneous type I ECG	VT/VF or SCD or an appropriate ICD shock
Ohkubo et. al., 2007	Prospective cohort	34	Japan	97.1	52±13	I, II, III	33.4	47.1±33.7	Positive EPS,	VT/VF or SCD or an appropriate ICD shock
Okamura et. al., 2015	Retrospective cohort	218	Japan	96.8	46±13	I	39.9	78.0±49.0	Positive EPS	Appropriate ICD shock, SCD
Olde Nordkamp et. al., 2014	Retrospective cohort	342	Netherlands	59.9	44±14	I, II, III	41.2	57.5±17.3	Syncope Hx, Hx of SCD	Aborted cardiac arrest
Pappone et. al., 2018	Prospective cohort	191	Italy	78.5	39.9±11.6	I	46.1	N/A	Male gender	
Park et. al., 2003	Retrospective cohort	15	South Korea	86.7	44±10	I, III	86.7	19.0±14.0	Positive EPS	Appropriate ICD shock, syncopal VT/VF
Priori et. al., 2002	Prospective cohort	200	Italy	76.0	41±18	I, II	N/A	34.0±44.0	Positive EPS, SCN5A	SCD
Priori et. al., 2012	Prospective cohort	308	Italy	80.2	47±12	I	N/A	36.0±8.0	Male gender, fQRS, Syncope Hx	Appropriate ICD shock, SCD, VF
Probst et. al., 2010	Prospective cohort	1029	France, Germany, Italy, Netherlands	72.4	45±5.8	I, II, III	36.4	33.1±11.7	Male gender, Syncope Hx, Hx of SCA, Positive EPS, Spontaneous type I ECG	VT/VF or SCD or an appropriate ICD shock
Ragab et. al., 2017	Retrospective cohort	132	Netherlands	65.1	47±15	I, II	15.2	44.0±33.0	Male gender, SCN5A, aVR signs	VT/VF
Rivard et. al., 2016	Retrospective cohort	105	Canada	79.0	46.2±13.3	I	44.8	59.6±16.4	Male gender, Syncope Hx, fQRS, TpTe, ERP	Appropriate ICD shock, SCD
Rosso et. al., 2008	Retrospective cohort	59	Israel	89.8	44.1±14	I, II, III	71.2	45.0±35.0	Hx of SCD	Appropriate ICD shock
Sacher et. al., 2008	Prospective cohort	58	France, Germany, Netherlands	86.2	47±11	I	100.0	48.0±36.0	Male gender, Syncope Hx	Appropriate ICD shock, SCD, VT/VF

Sakamoto et. al., 2016	Case-control study	129	Japan	94.6	52±12	I	20.2	68.0 ± 37.0	Spontaneous Type 1	VF
Sakamoto et. al., 2017	Prospective cohort	81	Japan	96.3	51±12	I	24.7	69.6±33.6	Positive EPS	Appropriate ICD shock, VT/VF
Schukro et. al., 2010	Prospective cohort	26	Austria	76.9	43.2±11.6	I, II, III	42.3	60.7 ± 44.2	Male gender, Spontaneous Type 1 ECG	Appropriate ICD shock
Sieira et. al., 2015	Prospective cohort	363	Belgium	55.1	40.9±17.2	I, II	0	73.2 ± 58.9	Male gender, Positive EPS, Spontaneous Type 1 ECG	Appropriate ICD shock, SCD, VT/VF
Sieira et. al., 2017	Prospective cohort	400	Belgium	58.3	41.1±17.8	I, II	32.8	80.7 ± 57.2	Syncope Hx, Hx of SCD	Appropriate ICD shock, SCD
Subramanian et. al., 2019	Retrospective cohort	103	India	86.4	44.5±12.7	I	11.7	72.1±29.2	positive EPS, ERP, fQRS, Male gender, Syncope Hx	VT/VF or SCD or an appropriate ICD shock
Takagi et. al., 2007	Prospective cohort	188	Japan	94.7	53±14	I	47.9	37.0 ± 16.0	Syncope Hx	SCD, VF
Tse et. al., 2018	Retrospective cohort	51	China	90.2	56±2	I, II, III	N/A	N/A	Spontaneous Type 1 ECG	Appropriate ICD shock, VT
Uchimura-Makita et. al., 2014	Prospective cohort	45	Japan	97.8	45.1±15.3	I	40.0	45.2 ± 37.9	Hx of SCD	Appropriate ICD shock, SCD, VT/VF
Ueoka et. al., 2018	Prospective cohort	245	Japan	98.0	46.2±13	I, II, III	37.1	113.0 ± 57.0	MAE	Appropriate ICD shock, SCD, VT/VF
Yamagata et. al., 2017	Prospective cohort	415	Japan	97.1	46±14	I	45.1	98.5±71.6	Male gender, Syncope Hx, Hx of SCD, AF, SCN5A, QRS interval≥120 ms	Appropriate ICD shock, ACA, SCD

(Abbreviations: AF: atrial fibrillation; CI: confidence interval; ECG: electrocardiogram; EPS: electrophysiology study; ERP: early repolarization; FHx: family history; Hx: history; ICD: implantable cardioverter-defibrillator; MAE: major arrhythmic events; OR: odds ratio; N/A: not applicable; PAT: predicting arrhythmic event for ICD therapy; SCA: sudden cardiac death; SCD: sudden cardiac death; TpTe: T-peak to T-end; VF: ventricular fibrillation; VT: ventricular tachycardia)

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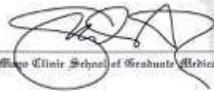
Mayo Clinic College of Medicine and Science
Scottsdale, Arizona

Certifies that

Pattara Rattanawong, M.D.

completed a thirty-six month program
from July 1, 2019 to June 30, 2022
as a Fellow in

Cardiovascular Disease



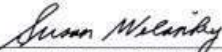
Dean, Mayo Clinic School of Graduate Medical Education



Executive Dean for Education, Mayo Clinic



Director, Education, Mayo Clinic Arizona



Senior Associate Dean, Mayo Clinic School of Graduate Medical Education, Mayo Clinic Arizona



Program Director

Curriculum Vitae and Bibliography

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Personal Information

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Present Academic Rank and Position

Assistant Professor of Medicine - Mayo Clinic College of Medicine and Science 04/01/2021 – 6/30/2022

Education

Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand - MD 04/2006 - 03/2012
University of Hawaii, Honolulu, Hawaii - Resident, Internal Medicine 07/2016 - 06/2019
Cardiovascular Diseases Fellowship, Internal Medicine, Programs in Arizona, Mayo 07/01/2019 - 06/30/2022
School of Graduate Medical Education, Mayo Clinic College of Medicine, Scottsdale, Arizona – Fellow
Clinical Cardiac Electrophysiologist Fellowship, Massachusetts General Hospital, Harvard 7/1/2022 – 6/30/2024
Medical School, Boston, Massachusetts

Certification

Other Certifications

Mayo Clinic Quality Academy

Mayo Clinic Quality Fellow: Bronze Level Certification 2019

Licensure

Thailand	(Medical)	2012 - Present
Hawaii	(Medical)	2016 - 2019
Arizona	(Medical)	2020 - Present

Honors and Awards

Medical Student Reputation Award - Faculty of Medicine Ramathibodi Hospital, Mahidol 2011
University
Reputation Award - Ramathibodi Medical Alumni Association 2013
Ramathibodi Abstract Travelling Grant For American College of Cardiology 2015 - 2015
Ramathibodi Medical Alumni Association
Certificate of The Highest-ranking Abstract - American College of Cardiology Annual 2016
Scientific Session & Expo 2016
Excellence in Research Award - Internal Medicine Residency Program, University of 2016
Hawaii
Team Player Award - Internal Medicine Residency Program, University of Hawaii 2016
Best Poster Paul Dudley White International Scholar Award - American Heart 2017
Association Scientific Session 2017
Excellence in Research Award - Internal Medicine Residency Program, University of 2017
Hawaii

Productive Research Award - Internal Medicine Residency Program, University of Hawaii 2018
Travel Scholarship - Heart Rhythm Society 2021

Previous Professional Positions and Major Appointments

Cardiovascular Researcher - Cardiovascular and Metabolic Center (CVMC), Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand 2015 - 2016

Service

Community Memberships and Services

International Federation of Medical Students' Associations (IFMSA)	
National External Vice President Assistance of IFMSA	
Local Officer	11/2008
Mahidol University	
Charity Musical Play	
Founder	06/2008
St. Vincent de Paul - Free Clinic	
Volunteer - Cardiovascular Physician	07/2019 - Present
Thailand Research Exchange of Faculty of Medicine Ramathibodi Hospital	
Local Officer	11/2008

Professional Memberships and Societies

Professional Memberships and Services

American College of Cardiology	
Member	2016 - Present
American College of Physicians	
Member	2016 - Present
American Heart Association	
Member	2016 - Present
American Medical Association	
Member	2016 - Present
Ramathibodi Medical Alumni Association	
Member	2012 - Present
The Medical Council of Thailand	
Member	2012 - Present

Journal Responsibilities

Journal Other Responsibilities

Acta Cardiologica Sinica	
Reviewer	2018 - Present
BioMed Research International	
Reviewer	2018 - Present
Cardiology Journal	
Reviewer	2018 - Present
Clinical Medical Review and Case Reports	
Reviewer	2018 - Present
Current Cardiology Reviews	
Reviewer	2018 - Present
International Journal of Heart Rhythm	

Reviewer	2018 - Present
Journal of Electrocardiology	
Reviewer	2018 - Present
Journal of the American College of Cardiology	
Reviewer	2018 - Present

Education Interests and Accomplishments

Teaching

Spontaneous Coronary Artery Dissection	09/04/2019
Cardiac Catheterization Fellow Noon Conference	
Mayo Clinic	
Phoenix, Arizona	
Syntax Score and Its Utilization for Revascularization Strategies in Multi-Vessel Coronary Artery Disease	09/18/2019
Cardiac Catheterization Fellow Noon Conference	
Mayo Clinic	
Phoenix, Arizona	
Optimizing Antithrombotic Therapy in AF Patients with ACS or Undergone PCI: A 5-Year Evolution from 2013 to 2019	12/04/2019
Cardiac Catheterization Fellow Noon Conference	
Mayo Clinic	
Phoenix, Arizona	
Transcutaneous Electrical Vagus Nerve Stimulation to Suppress Atrial Fibrillation (TREAT AF): A Randomized Clinical Trial	03/05/2020
Electrophysiology Journal Club	
Mayo Clinic	
Phoenix, Arizona	
Familial Cardiomyopathy	06/23/2020
Patient Management Conference	
Mayo Clinic	
Phoenix, Arizona	
Preventive or Deferred Ablation of Ventricular Tachycardia in Patients with Ischemic Cardiomyopathy and Implantable Defibrillator (BERLIN VT): A Multicenter Randomized Trial	08/05/2020
Electrophysiology Journal Club	
Mayo Clinic	
Phoenix, Arizona	
Congenital Diseases of the Aorta	12/02/2020
Cardiac Catheterization Fellow Noon Conference	
Mayo Clinic	
Phoenix, Arizona	

Mentorship

Putthapiban, Prapaipan (Internal Medicine Resident)	01/2017 - 01/2019
Description: Einstein Medical Center, Philadelphia, Pennsylvania. Research Projects	
Current Status: Cardiovascular Fellow, Loma Linda University, Loma Linda, California	
Outcome: Abstracts 16, 42	
Sukhumthamarat, Weera (Internal Medicine Resident)	01/2017 - 01/2019
Description: Einstein Medical Center, Philadelphia, Pennsylvania. Research projects	
Current Status: Geriatric Fellow, University of California at Los Angeles (UCLA)	
Outcome: Abstract 41	

Vutthikraivit, Wasawat (Internal Medicine Resident)	01/2017 - 01/2019
Description: Texas Tech University, Lubbock, Texas. Research Projects	
Current Status: Cardiovascular Fellow, University of Iowa, Iowa	
Outcome: Abstracts 4, 7, 9, 20, 23, 35, 37, 43, 44; Manuscripts 10, 41	
Prasitlunkum, Narut	01/2017 - Present
Description: University of Hawaii, Honolulu, Hawaii, Research projects	
Current Status: Cardiovascular Fellow, University of California at Riverside, California	
Outcome: Abstract 22, 30, 32, 38, 45 and article 15, 19, 21, 24, 29, 31, 33, 37, 44	
Mekraksakit, Poemlarp	01/2018 - 01/2019
Description: Research projects	
Current Status: Internal Medicine Resident, Texas Tech University, Lubbock, Texas	
Outcome: Abstract 29; Manuscript 35	
Kewcharoen, Jakrin	01/2018 - Present
Description: University of Hawaii, Honolulu, Hawaii, Research projects	
Current Status: Cardiovascular Fellow, Loma Linda University, Loma Linda, California	
Outcome: Abstract 47, 48, 59 and article 22, 28, 39, 41, 42, 43, 46, 52, 53	
Kittipibul, Veraprapas	01/2018 - Present
Description: University of Miami/Jackson Memorial Hospital, Miami, Florida, Research projects	
Current Status: Cardiovascular Fellow, Duke University, North Carolina	
Outcome: Abstract 12, 39 and article 30, 50	

Institutional/Departmental Administrative Responsibilities, Committee Memberships and Other Activities

Activities at Other Institutions

Mahidol University	
Alumni Association	
Member	2012 - Present
University of Hawaii	
Resident Firm Representative	
Elected Resident Representative	2016 - 2019

Presentations Extramural

National or International

Oral

Closed-looped Stimulation Pacing for the Prevention of Recurrent Vasovagal Syncope: a Systematic Review and Meta-analysis	2018
American College of Cardiology Annual Scientific Session & Expo	
Orlando, Florida	
Antibacterial Envelope is Associated With a Decreased Risk of Cardiac Implantable Electronic Device Infections: An Updated Meta-Analysis	2019
American Heart Association (AHA) Scientific Session	
Philadelphia, Pennsylvania	
The Prevalence of Type 1 Brugada Pattern at Mayo Clinic: A Large Population Study from the United States	2022
Heart Rhythm Society Scientific Session 2022	
San Francisco, California	
Case Challenges: Assessment and Diagnosis of Syncope	05/2022
American College of Cardiology	

Poster

- Increased Mortality Risk during Gravitational Transition in Heart Disease Model 2012
17th World Congress on Heart Disease: International Academy of Cardiology Annual Scientific Session
Toronto, Ontario, Canada
- Fever Induced Brugada Syndrome is More Common Than Previously Suspected: a Cross-sectional Study from an Endemic Area 2015
American College of Cardiology Annual Scientific Session & Expo
San Diego, California
- Frequency of Unidentified Cause of Death in Sudden Unexpected Death: a Post-Mortem Retrospective Study from an Asian Population 2015
American Heart Association Scientific Sessions
Orlando, Florida
- The Prevalence of Primary Hyperaldosteronism in Resistant Hypertension: an Experience from South Carolina 2016
National Kidney Foundation
Boston, Massachusetts
- Association between Atrial Fibrillation and Sudden Cardiac Death: a Systemic Review and Meta-analysis 2017
American College of Cardiology Annual Scientific Session & Expo
Washington, District of Columbia
- Atrial Fibrillation is Not Associated with Thromboembolic Complications in Patients with Continuous-flow Left Ventricular Assist Device: a Systematic Review and Meta-analysis 2017
American Heart Association Scientific Sessions
Anaheim, California
- Baseline Fragmented QRS Increases the Risk of Major Arrhythmic Events in Hypertrophic Cardiomyopathy: Systematic Review and Meta-analysis 2017
American Heart Association Scientific Sessions
Anaheim, California
- Coronary Heart Disease in Premature Sudden Cardiac Death: An Autopsy Study of Asian Population 2017
American Heart Association Scientific Session
Anaheim, California
- High Prevalence of Left Ventricular Hypertrophy in Sudden Cardiac Death: A Comparison Study of Two Populations 2017
American Heart Association Scientific Session
Anaheim, California
- Worldwide Prevalence of Brugada Syndrome: a Systematic Review and Meta-analysis 2017
American College of Cardiology Annual Scientific Session & Expo
Washington, District of Columbia
- Chronic Kidney Disease is Associated with Increased Mortality and Complications in Transcatheter Aortic 2018
Transcatheter Cardiovascular Therapeutics (TCT) Scientific Session
San Diego, California
- Gender Difference and Outcome after Percutaneous Intervention in Patients with Chronic Total Occlusion: A Systematic Review and Meta-analysis 2018
American College of Cardiology Annual Scientific Session & Expo
Orlando, Florida
- SCN5A Mutation Increases the Risk of Major Arrhythmic Events in Brugada Syndrome: Systematic Review and Meta-analysis 2018
American College of Cardiology Annual Scientific Session & Expo
Orlando, Florida

Impact of T-peak to T-end Interval and QRS Duration on the Risk of Ventricular Arrhythmia or Sudden Cardiac Death in Brugada Syndrome Patients: A Systematic Review and Meta-analysis 2019
American Heart Association (AHA) Scientific Session
Philadelphia, Pennsylvania

The Association of Frailty with All-Cause Mortality Among Elderly with Acute Coronary Syndrome: A Systematic Review and Meta-Analysis 2019
American Geriatric Society 19th Annual Scientific Meeting
Portland, Oregon

The Utility of Drug Challenge Testing in Brugada Syndrome: a Systematic Review and Meta-analysis 2019
American Heart Association (AHA) Scientific Session
Philadelphia, Pennsylvania

T-Peak to T-End Interval and the Risk of Major Arrhythmic Events in Brugada Syndrome Patients: A Systematic Review and Meta-analysis 2019
Asia Pacific Heart Rhythm Society (APHRS)
Bangkok, Thailand

Wide QRS Complex and the Risk of Major Arrhythmic Events in Brugada Syndrome Patients: A Systematic Review and Meta-analysis 2019
Asia Pacific Heart Rhythm Society (APHRS)
Bangkok, Thailand

Complications of Drug Challenge Testing in Brugada Syndrome: A Systematic Review and Meta-analysis 2020
Virtual Conference
American Heart Association Scientific Session 2020

High Power Short Duration and Low Power Long Duration in Atrial Fibrillation Ablation: A Systematic Review and Meta-analysis 2020
Virtual Conference
American Heart Association Scientific Session 2020

Electrophysiology Study and the Risk of Major Arrhythmic Events in Brugada Syndrome: An Updated Systematic Review and Meta-analysis 2020
Virtual presentation due to COVID-19
ACC.20/WCC American College of Cardiology Scientific Session 2020
Chicago, Illinois

Family History of Sudden Cardiac Death in Brugada Syndrome: A Systemic Review and Meta-analysis 2020
Virtual presentation due to COVID-19
ACC.20/WCC American College of Cardiology Scientific Session 2020
Chicago, Illinois

Surgical versus Catheter Ablation in Atrial Fibrillation: A Systematic Review and Meta-analysis of Randomized Controlled Trials 2020
Virtual presentation due to COVID-19
ACC.20/WCC American College of Cardiology Scientific Session 2020
Chicago, Illinois

Altercation of Wavefront Propagation by Reduction of Critical Mass Continuity: A Novel Method of Empiric Mid-purkinje Transection in the Purkinje-mediated Idiopathic Ventricular Fibrillation 2020
Virtual presentation due to COVID-19
Heart Rhythm Society Scientific Session 2020
San Diego, California

Complications of Drug Challenge Testing in Brugada Syndrome: A Systematic Review and Meta-analysis 2020

Virtual presentation due to COVID-19

Heart Rhythm Society Scientific Session 2020

San Diego, California

Prophylactic Ventricular Tachycardia Ablation in Ischemic Cardiomyopathy: An Updated Meta-Analysis of Randomized Controlled Trials 2021

Virtual Conference

American Heart Association Scientific Session 2021

Vaping Carboxy-tetrahydrocannabinol Unmask Brugada Pattern and Induced Ventricular Fibrillation in Brugada Syndrome 2021

Virtual conference

American College of Cardiology Annual Scientific Session and Expo 2021

Brugada Phenyl Carpi in COVID-19 Patient with Fever and Hyperkalemia 2022

American College of Cardiology Annual Scientific Session and Expo 2022

Washington, District of Columbia

First Case Report of Type 1 Brugada Pattern in the Transplanted Heart 2022

American College of Cardiology Annual Scientific Session and Expo 2022

Washington, District of Columbia

Pulmonary Vein Isolation with Wide Area Circumferential Ablation and Bilateral Carinal Ablation via Transhepatic Approach 2022

Heart Rhythm Society Scientific Session 2022

San Francisco, California

The Prevalence of Type 1 Brugada Pattern in African Americans: A Large Population Study from the United States 2022

European Heart Rhythm Association Scientific Session 2022

Copenhagen, Denmark

Regional

Oral

Mortality Risk of Heart Failure Guinea Pig During Parabolic Flight 2011

Joint Conference in Medical Science

Bangkok, Thailand

Clinical Practice, Interests, and Accomplishments

Clinical cardiology, Brugada syndrome, inherited arrhythmic syndrome, ventricular tachycardia, sudden cardiac death, atrial fibrillation, electrocardiography, and cardiac electrophysiology

Research Interests and Accomplishments

Brugada syndrome, inherited arrhythmic syndrome, ventricular tachycardia, sudden cardiac death, atrial fibrillation, electrocardiography, cardiac electrophysiology, systematic review and meta-analysis.

Syncope, clinical outcomes and risk stratification in heart failure. Mayo Clinic Arizona Cardiovascular Research Microgrant.

Research Grants Awarded

Active Grants

Foundation

Investigator	The Underlying Pathophysiological Mechanisms, Genomics and Management of Sudden Unexplained Death Syndrome. Funded by The Heart Association of Thailand under the Royal Patronage of H.M. the King	12/2019 - 12/2021

Completed Grants

Federal

Project Leader Heart Rate Variability During Gravitational Transition in Doxorubicin-Induced Cardiomyopathic Guinea Pig Cardiovascular Research under Simulated Zero Gravity Parabolic Flight. Funded by Japan Aerospace Exploration Agency 01/2010 - 12/2010

Mayo Clinic

Project Leader Family History of Sudden Cardiac Death in Brugada Syndrome: A Systematic Review and Meta-analysis. Funded by Mayo Clinic Arizona Cardiovascular Clinical Research Center 09/2019 - 09/2020

Investigator Guidance on Short-term Management of Atrial Fibrillation in Coronavirus Disease 2019. Funded by Mayo Clinic Cardiovascular Research Publishing Grant 09/2020

Other

Languages: Thai (native); English (advanced)

Page Break

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A Case of Recurrent Syncopal Attack Due to Sinus Node Dysfunction With Concomitant Brugada Syndrome

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Objectives: To report a commonly unrecognised case of Sinus Node Dysfunction with concomitant Brugada Syndrome

Results: We present a case of a young patient who had recurrent syncopal attack with Brugada syndrome and ventricular arrhythmias. During further investigation he was also found to have sinus node dysfunction.

A 36-year-old man was referred for recurrent syncopal attack for the past 4 years. It was associated with chest discomfort, dizziness and 'black-out' sensation that caused him to fall and sustained injury. There were no seizure symptoms. He had no past medical illness and was not taking any medications. There was no family history of sudden cardiac death. His physical examination and blood investigation were unremarkable.

His baseline ECG showed coved ST segment elevation and T inversion on leads V1, V2 consistent with Type 1 Brugada pattern. Echocardiogram findings were unremarkable.

During coronary study his ECG showed persistent bradycardia of heart rate <40beats per minute with recurrent long pause of > 4 seconds. This was associated with dizziness similar to what he had been feeling before. The coronary arteries were normal. The diagnosis of Brugada syndrome with Sinus Node Dysfunction was made. He was put on dual chamber Implantable Cardioverter Defibrillator (DC ICD) and was discharged well a few days later.

Conclusion: Sinus node dysfunction is not a rare concomitant disorder in Brugada Syndrome; although it is still under-diagnosed. Understanding the common genetic mutations and recognising the broad clinical manifestations of the condition will help physician in choosing an appropriate device therapy to the patient; as well as being vigilant of possible lethal cardiac arrhythmias that may arise.

SUPPORTING DOCUMENTS

The Amalgamation of Diagnostic Algorithm and HCM Sudden Cardiac Death Risk Score for ICD implantation

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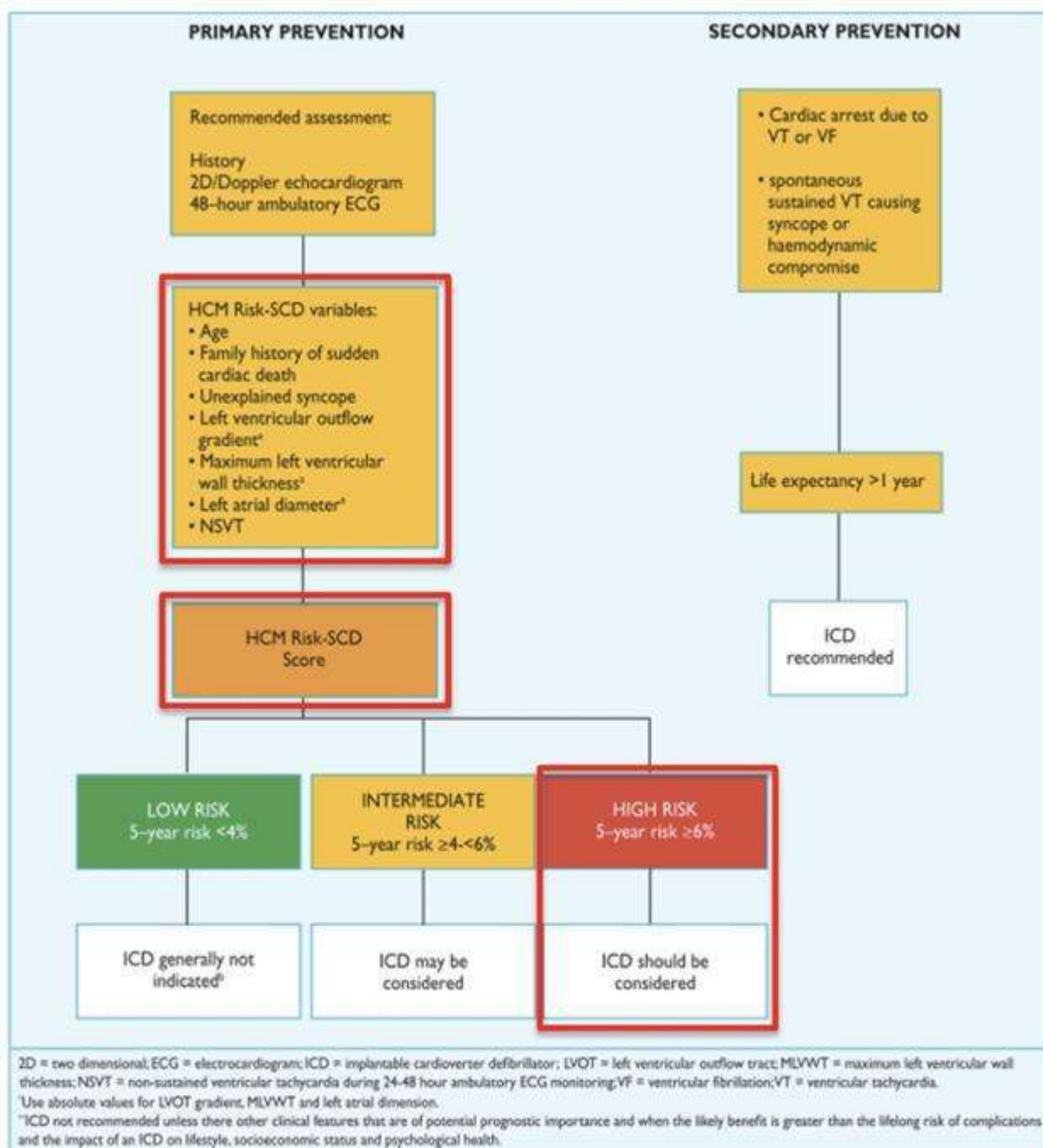
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Objective: To present the clinical background and steps of ICD implantation as considered management of HCM.

Case Illustration: A 22-years-old man experienced two syncopal episodes. For the past three years, he had made several visits with complaints of palpitation, and he was diagnosed with HOCM and treated with beta-blockers. In his recent visit, he underwent a re-assessment of ECG, TTE and stress echocardiography which revealed no LVOT obstruction with a provoked peak at mid and LVOT gradient less than 50 mmHg and was diagnosed with HCM (hypertrophic cardiomyopathy). According to the patient's history of syncope with HCM-SCD risk variables and having relatives with similar cardiac medical problems (younger brother with palpitation and diagnosed with cardiomyopathy; mother was a DCM patient with a history of CRTD implantation), the patient was referred to the arrhythmia division to undergo an EP study and considered to implant an ICD as patient's primary prevention.

Conclusion: HCM is defined as a genetic disorder of cardiac myocytes characterised by cardiac hypertrophy with the greatest involvement of the basal interventricular septum subjacent to the aortic valve. Thorough diagnostic approaches of HCM are needed to differentiate the diagnosis between HCM and HOCM. In addition to exercise restriction and appropriate drug therapy in HCM, ICD implantation was considered to prevent future syncopal episodes and sudden cardiac death in patients with HCM to improve patient quality of life.

SUPPORTING DOCUMENTS



Extensive Clinical Investigation for Patient With Recurrent Syncope to Establish Diagnosis of ARVC

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Case presentation: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is an uncommon and underdiagnosed cardiomyopathy characterized by the replacement of right ventricular myocardium with fibrofatty tissue. It may be asymptomatic or symptomatic and may cause abrupt cardiac death, particularly during physical activity. ARVC must be diagnosed and treated promptly in order to prevent adverse consequences such as sudden cardiac death. Here we presented 60 year old man with recurrent syncope and aborted sudden cardiac death.

A 60-year-old man was referred for recurrent five episode of syncope during activity without a firm etiological diagnosis. An electrocardiogram obtained at admission indicated sinus bradycardia with incomplete right bundle branch block, epsilon wave and frequent extra systole. During hospitalization patient experienced cardiac arrest due to polymorphic ventricular tachycardia (VT) and ventricular fibrillation (VF). Patient was admitted to secondary hospital given high dose beta-blocker and temporary pacemaker to override the extra systole.

Thus patient was referred into our cardiac center for further examination. Echocardiography, cardiac magnetic resonance and endomyocardial biopsy findings fullfilled with ARVC. The patient was diagnosed with ARVC and treated with high dose beta blocker and ICD. Follow up for in 1 week for ICD interrogation showed good result with sensing 3.8-6.8mV, impedance 53 Ω and treshold 1.25V with no event of ventricular arrhythmia.

Conclusion: Patients with recurrent syncope need to get vigourous examination immediately to find the etiology and determine the appropriate management. A diagnosis of ARVC entails management of life-threatening arrhythmias with ICD implantation for the associated increased risk of sudden death.

SUPPORTING DOCUMENTS

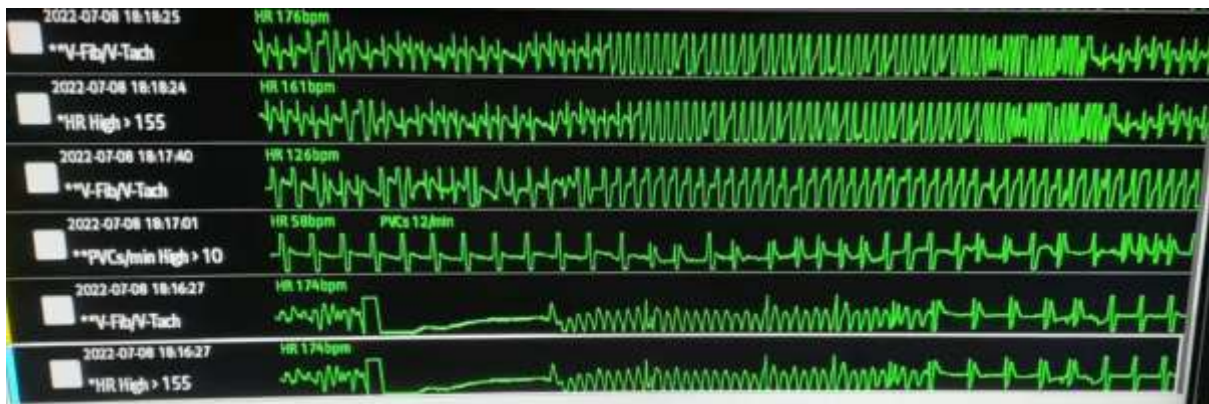


Figure 1. During hospitalization patient experienced cardiac arrest due to polymorphic ventricular tachycardia (VT) and ventricular fibrillation (VF).

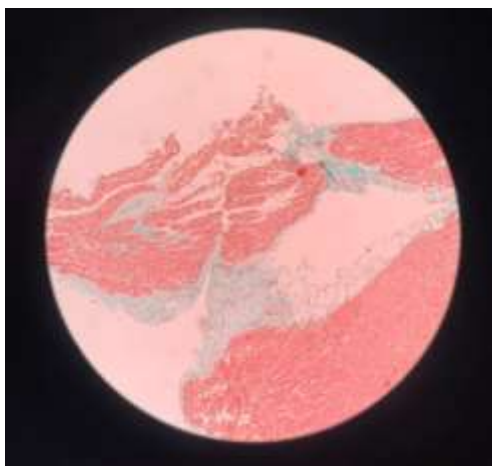


Figure 2. Myocyte degeneration and fibrofatty replacement in right ventricular mid-septal region biopsy samples.

Sensorineural Deafness and Refractory Seizures: a Missed Connection

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Background: Cardiac channelopathies, most commonly Long QT syndrome may be misdiagnosed as refractory epilepsy when in reality, these events represent convulsive syncope.

Clinical Case: A 6-year-old girl was referred to us in view of multiple episodes of loss of consciousness while running. The episodes were diagnosed as generalized tonic-clonic seizures and persisted on anti-epileptic medications. The patient also had bilateral sensorineural deafness. Her cardiovascular examination and routine blood investigations including serum electrolyte levels and transthoracic echocardiogram were normal. The initial ECG at presentation showed deep inverted T waves in the precordial leads V1-V4 with prolonged QTc of 576 msec. Beat-to-beat variability was noted in the T wave amplitude, consistent with macroscopic T wave alternans. Whole exome sequencing revealed a pathogenic homozygous splicing variation in the KCNQ1 gene. Hence the diagnosis of Jervell and Lange Nielsen syndrome was confirmed in the patient. The patient was initiated on oral propranolol. Repeat ECG showed a decrease in QTc with the resolution of T wave inversions. The patient did not have any episodes of seizures and syncope after the initiation of propranolol.

Conclusion: An ECG should be considered as a part of the evaluation of children with seizures especially if poorly responding to therapy

SUPPORTING DOCUMENTS

Figure legends:

Figure 1A: 12-lead ECG at presentation

Deep inverted T waves are present in the precordial leads V1-V4 (Vertical arrows) with prolonged QT interval. The corrected QT interval is 576 msec. Macroscopic T wave alternans is best seen in leads V3, V4 (angled arrows).

Figure 1B: 12-lead ECG on beta-blocker therapy

There is resolution of the inverted T waves. The corrected QT interval is 438 msec.

Figure 2: Sanger Sequence Electropherogram of Proband and Parents showing Homozygous and heterozygous variants respectively

Figure 1A



Figure 1B

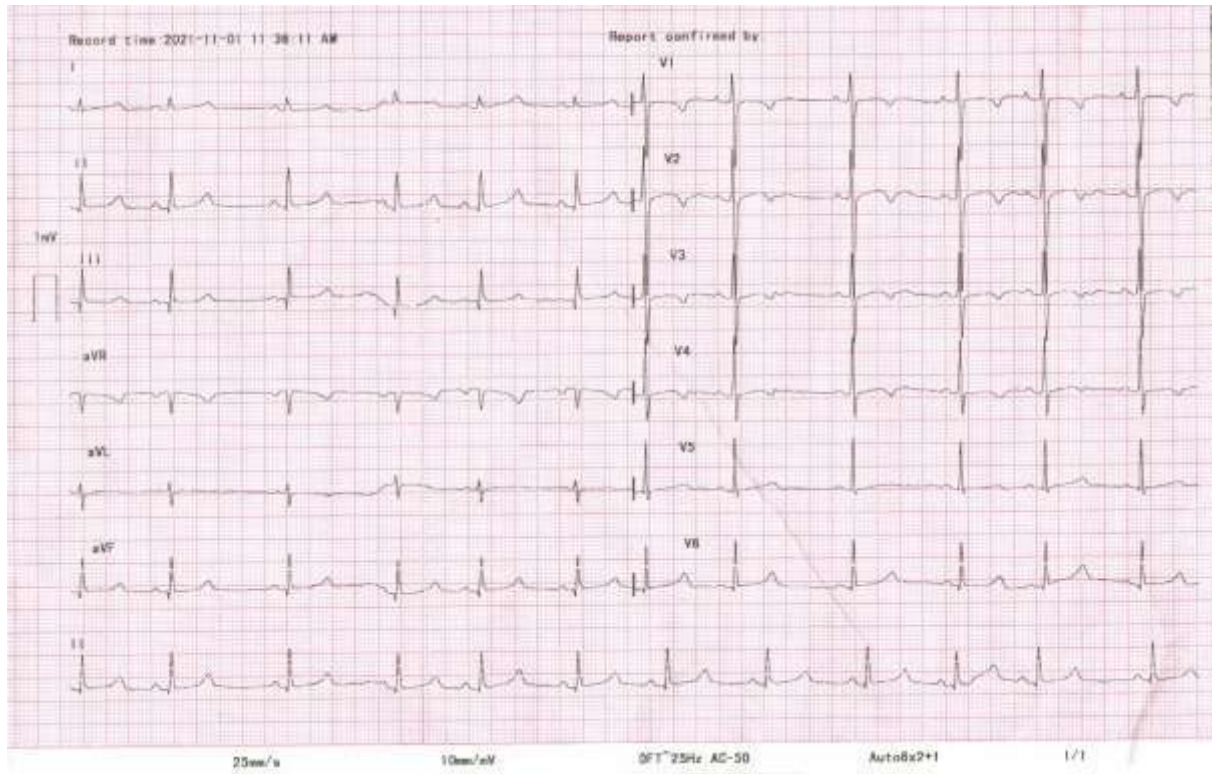
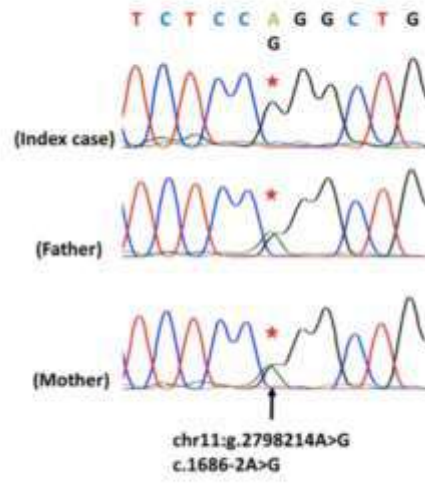


Figure 2



Second Degree Atrioventricular Block in an Accessory Pathway Related to (WPW) Syndrome and AVN Dysfunction

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Syncope related to an accessory pathway and atrioventricular (AV) dysfunction is a rare condition. This condition is usually related to conduction capacity along the pathway, which sometimes necessitates immediate ablation. Proper electrophysiology study (EPS) may contribute to the best patient management. A 64-year-old female with a preexcited QRS consistent with WPW syndrome was hospitalized for syncope. ECG monitoring indicated advanced AV block events. An EPS indicated a total block was found in the AV Node, with the conduction system being completely taken over by the accessory pathway. A DDD pacemaker was implanted without accessory pathway ablation

Refractory Vasovagal Syncope Treatment with Cardioneural Ablation: An Early Experience

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Background: Vasovagal syncope (VVS) is the commonest cause of syncope, mediated by the autonomic nervous system. A promising catheter-based approach for cardioneural modulation has emerged recently.

Objectives: We examined a series of 8 patients with refractory VVS who underwent cardioneural ablation (CNA) from July 2021 until July 2022.

Methods: 3D mapping system was used to create an electroanatomic map of both atria. The main ganglionated plexi were identified using anatomical assumptions and electrocardiogram analysis. These areas were then ablated. 24-hour Holter, tilt table test (TTT) and atropine challenge were performed at baseline and post-procedure to determine the outcome.

Results: 8 patients were analysed in this series (7 males, 1 female, mean age= 36.5+/- 14.8 years). Procedures were completed within 143.1+/-56.9 minutes. The response to TTT at baseline was type 1 (mixed) in 4 patients, type 3 (vasodepressor) in 1 patient and negative in 1 patient. Baseline Holter showed minimum heart rate (HR) of 38.0+/- 8.1bpm with average HR of 65.7+/- 15.8bpm, which increased to 58.3+/-12.8bpm and 78.0+/- 8.4bpm respectively post-procedure. Pre-procedure atropine response showed an average increase in HR of 12.8+/- 24.8% from baseline, which was less dramatic post-procedure with a change of 3.6+/- 5.9%. No acute procedural complication was observed in all patients. Resolution of symptoms was seen in 7 out of 8 patients. 1 patient was started on midodrine post-procedure with improvement in his vasodepressor syncope.

Conclusion: CNA is safe and effective in treating patients with refractory VVS. Patient selection is important to determine the outcome.

Diagnostic Yield of an Ambulatory Photoplethysmography (PPG) Monitor in Patients With Unexplained Syncope.

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Objectives: Diagnosis of underlying arrhythmia in patients with recurrent syncope remains a problem. We investigate the impact of photoplethysmography(PPG) monitors on diagnostic yield, event prevalence, and compliance in patients with unexplained syncope.

Materials and Methods: Prospective cohort study was conducted in a single tertiary hospital. 51 consecutive patients with unexplained syncope were followed with a ring-type smart wearable heart rhythm monitoring medical device which provides PPG signals to measure heart rate(HR) and spot atrial fibrillation or its burden. The data collected compared patients with newly diagnosed arrhythmias with undiagnosed patients.

Results: During the follow-up period for 1 month, arrhythmias were first diagnosed in 27 patients, and identified as the cause of syncope in 9 patients. The patients wore the device for average of 386.4 hours, and the average time available for signal analysis was 283.5 hours.

Patients with arrhythmia had higher rate(%) of irregular pulse (11.43 ± 16.31 versus 0.44 ± 1.33 , $p=0.0137$) than those without arrhythmias, and there was no significant difference in mean HR(bpm) between patients with and without arrhythmia (62.89 ± 9.31 versus 66.09 ± 9.02 , $p=0.2343$). Patients with arrhythmias as the cause of syncope had a lower minimum HR(bpm) (40.17 ± 0.37 versus 41.84 ± 2.24 , $p=0.0154$), and had higher rate(%) of irregular pulse (14.80 ± 24.25 versus 3.72 ± 10.56 , $p=0.0343$) than those without arrhythmias as the cause of syncope.

Conclusion: In patients with unexplained recurrent syncope, continuous PPG and ECG monitoring using medical device can be a useful monitoring tool for cardiac arrhythmia detection.

Apical Hypertrophic Cardiomyopathy and Sudden Cardiac Death: BENIGN INDEED?

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Background: Apical hypertrophic cardiomyopathy (HCM) is considered to have a benign prognosis in terms of cardiovascular mortality. Sudden cardiac arrest and ventricular fibrillation (VF) in patients with apical HCM is rarely reported.

Methods: Between July 2001 and May 2021, 96 HCM patients who had undergone ICD implantation from three tertiary hospitals were reviewed. We evaluated the prevalence of aborted sudden cardiac death and/or documented VF in apical HCM and known risk markers for sudden cardiac death in those populations.

Result: Fifteen patients (15.6%) were apical HCM in total population. Among apical HCM, seven patients (40.0%) presented with aborted sudden cardiac death or documented VF, therefore received ICD implantation for the secondary prevention. All seven patients had at least one risk marker suggested either 2020 ACC/AHA guideline or 2014 ESC guideline. One patient had three risk factors and two patients had two risk factors and four patients had one risk factor. Late gadolinium enhancement (LGE) on cardiac magnetic resonance (CMR), personal history of unexplained syncope and non-sustained ventricular tachycardia (VT) were the common risk factors.

Conclusions: Clinical outcomes in patients with apical HCM are not always as benign as previously thought. ICD implantation should be considered in high-risk patients with apical HCM as the same manner with the septal type of HCM according to the current guideline recommendations.

Gastrointestinal Dysfunction in Postural Orthostatic Tachycardia Syndrome and Its Association With Health-related Quality of Life.

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Objectives: Postural Orthostatic Tachycardia Syndrome (POTS) is a heterogenous disorder with frequently occurring symptoms beyond orthostatic intolerance, palpitations, and syncope. Here we aim to characterise the prevalence and severity of gastrointestinal symptoms and their impact on overall health-related quality of life.

Materials and Methods: Consecutive patients enrolled in a POTS patient registry (OzPOTS) were included in the study. A diagnosis of POTS was confirmed via internationally recognised criteria. The Gastroparesis Cardinal Symptom Index (GCSI) was utilised to assess the prevalence and severity of gastroparesis symptoms (GCSI score >2 indicates significant gastroparesis symptoms). Health-related quality of life was assessed by the EuroQol 5 dimensions (EQ-5D-5L) questionnaire. All data were analysed in R, version 4.1.2.

Results: A total of 149 consecutive individuals (mean age 30.7 ± 11.9 years old and 95.8% female) were enrolled into the study. There was a high prevalence of gastroparesis symptoms with 133 individuals (89.3%) scoring >2 on the GCSI questionnaire whilst 16 individuals (10.7%) scored ≤ 2 , reflecting an absence of significant gastroparesis symptoms. Overall health-related quality of life was significantly poorer in the group with GCSI score of >2 (43.6 ± 21.0) compared to those scoring ≤ 2 (58.3 ± 20.6); $p=0.02$).

Conclusion: Gastrointestinal symptoms are highly prevalent in POTS and significantly impact quality of life. Our data calls for multidisciplinary care of patients with POTS, beyond management of rate-control, volume expansion, lifestyle and exercise interventions.

Treatment of Exercise-Induced Neurocardiogenic Syncope In A Young Adult

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Objectives: Exercise-related neurocardiogenic syncope can be debilitating in young active patients as it may prevent them from engaging in sports. Available literature are mostly case reports on young Caucasian athletes. We present a local case of exercise-induced neurocardiogenic syncope in a young non-athlete adult.

Materials and Methods:

An 18-year-old Chinese male with no medical history presented with recurrent near-syncope post exercise since he was 14 years old. He had a syncope after resistance training with squats.

Physical examination, baseline electrocardiogram, echocardiogram and computed tomography coronary angiogram were normal. In view of his family history of sudden death, he underwent an exercise treadmill test. He completed the test with good cardiac workload, without electrocardiogram changes and arrhythmias. However, he developed near-syncope during recovery, without bradycardia or hypotension, and instead had tachycardia and hypertension during that period. He recovered spontaneously after 3 minutes with complaints of lethargy.

Results: The patient was diagnosed with exercise-induced neurocardiogenic syncope which was thought to be due to poor cardiovascular fitness and lower limb muscle strength. We devised a targeted progressive exercise prescription, including a graduated cool-down exercise regime. With this, we were able to minimise his post-exercise dizziness and prevent his exercise-induced syncope.

Conclusion: In the absence of structural heart disease, exercise-induced neurocardiogenic syncope should be considered. It is important to identify the exact pathophysiology and triggers to provide targeted management. We hope to share our experience in devising a patient-centered exercise prescription and hopefully conduct further studies to evaluate its effectiveness in treating exercise-induced syncope.

Characterization of Arrhythmogenic Substrates for Ventricular Tachycardia needing Surgical Approach in Patients with Non-Ischemic Cardiomyopathy

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Objective: Despite recent advances of medication and catheter ablation for ventricular tachycardia (VT), surgical approach is still necessary. The purpose of this study was to characterize arrhythmogenic substrates of VT refractory to non-surgical treatments.

Methods: We analyzed the etiology and perioperative features in 27 patients (50 ± 21 years, 6 females) with non-ischemic cardiomyopathy and refractory VT undergone VT surgery at our institute between 1990 and 2020.

Results: The major etiology indicated for VT surgery was hypertrophic cardiomyopathy (HCM) in 17 (63%) patients, followed by cardiac tumor in 6, arrhythmogenic cardiomyopathy in 3, and sarcoidosis in 1 patient. Their substrates were classified into three groups. First, the existence of large substrates including 6 aneurysms and 6 tumors was a reason why catheter ablations were failed. Removal of substrates and surgical cryoablation along the resection line were effective in suppressing VTs. Second, epicardial/intramural foci within left ventricular (LV) hypertrophy were observed as deep substrates of refractory VT originating from lateral/septal LV in 6 HCM patients. Finally, LV summit VTs in 8 HCM patients had a complex substrate. Their epicardial/intramural foci were located close to anatomical obstacles. The coronary artery and rich fat-pad disturbed epicardial ablations; hence, transmural lesion should be achieved by surgical cryothermia after removal of epicardial fat. During the follow-up period after surgery (10 ± 5 years), 4 patients developed documented/non-documented VT, which could be treated by additional catheter ablations and/or medications.

Conclusion: Large and deep arrhythmogenic substrates with anatomical obstacles were reasons for VT surgery.

Radiofrequency Catheter Ablation of Idiopathic Premature Ventricular Contractions From the Mitral Annulus

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Objectives: We previously reported the clinical benefits of radiofrequency catheter ablation (RFCA) of premature ventricular contractions (PVCs) from the right ventricular outflow tract. PVCs from the mitral valve (MA-PVCs) also often deteriorate the patients' clinical status. This study aimed to evaluate the effect of ablating MA-PVCs with RFCA from a trans-interatrial septal approach on the clinical status in symptomatic patients with frequent MA-PVCs without structural heart disease.

Methods: The frequency of PVCs per the total heart beats by 24-hours Holter monitoring and New York Heart Association (NYHA) functional class in 22 patients with MA-PVCs were evaluated before and 6 months after RFCA.

Results: Procedural success was achieved in 20 (91%) of 22 patients. Of the 22 patients, in 15 (68%) and 1 (5%) patient, a successful RFCA on the left ventricular side of the MA using the trans-interatrial septal approach and trans-coronary sinus approach was achieved. Interestingly, in four (18%) patients, a successful RFCA on the left atrial (LA) side of the MA using a trans-interatrial septal approach was achieved. Ablating MA-PVCs readily improved the NYHA functional class compared to that before. A ≥ 0.62 peak deflection index and ≤ 30 years old may be one of the important predictors of successfully ablated MA-PVCs from the LA side of the MA.

Conclusions: RFCA produces clinical benefits in patients with MA-PVCs. Further, it may be necessary to initially consider a trans-interatrial septal approach to ablate these PVCs.

Early Experience With Epicardial Access Facilitated by Carbon Dioxide Insufflation for Ablation of Ventricular Arrhythmias

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Objective: Epicardial access may be required in catheter ablation of ventricular tachycardias (VT). Recently, a novel method of intentional coronary vein (CV) exit with pericardial carbon dioxide (CO₂) insufflation to facilitate epicardial access was described. This study describes our initial experience with this technique.

Methods: Patients undergoing epicardial VT ablation between 1st February 2021 to 31st May 2022 at the Royal Prince Alfred Hospital were included. Via femoral venous access, a branch of the coronary sinus was sub-selected and intentional CV exit was performed with a high tip load coronary angioplasty wire. A microcatheter was advanced over the wire into the pericardial space, followed by pericardial CO₂ insufflation, facilitating subxiphoid pericardial puncture.

Results: Five patients underwent epicardial access for VT mapping and ablation. All patients had successful intentional CV exit and CO₂ facilitated epicardial access. The mean time to successful epicardial access was 37.2 ± 17.5 minutes. With increasing operator experience, the fifth case required only 13 minutes to achieve epicardial access. There was one case of inadvertent right ventricular puncture (without haemodynamic or ventilatory compromise) due to inappropriate CO₂ insufflation into the right ventricle. Epicardial access was successful on the second attempt.

Conclusion: This is the first case series of epicardial access facilitated by CO₂ insufflation in Australia. This technique enabled successful epicardial access in all patients in our early experience, with no adverse outcomes from epicardial access. With increasing operator experience, this technique may allow for more widespread adoption of up-front epicardial access for the treatment of VT.

Impact of de novo tachyarrhythmias in patients with prior acute coronary syndrome

Asst Prof Youmi Hwang¹, R.T Jae Hoon Kim¹

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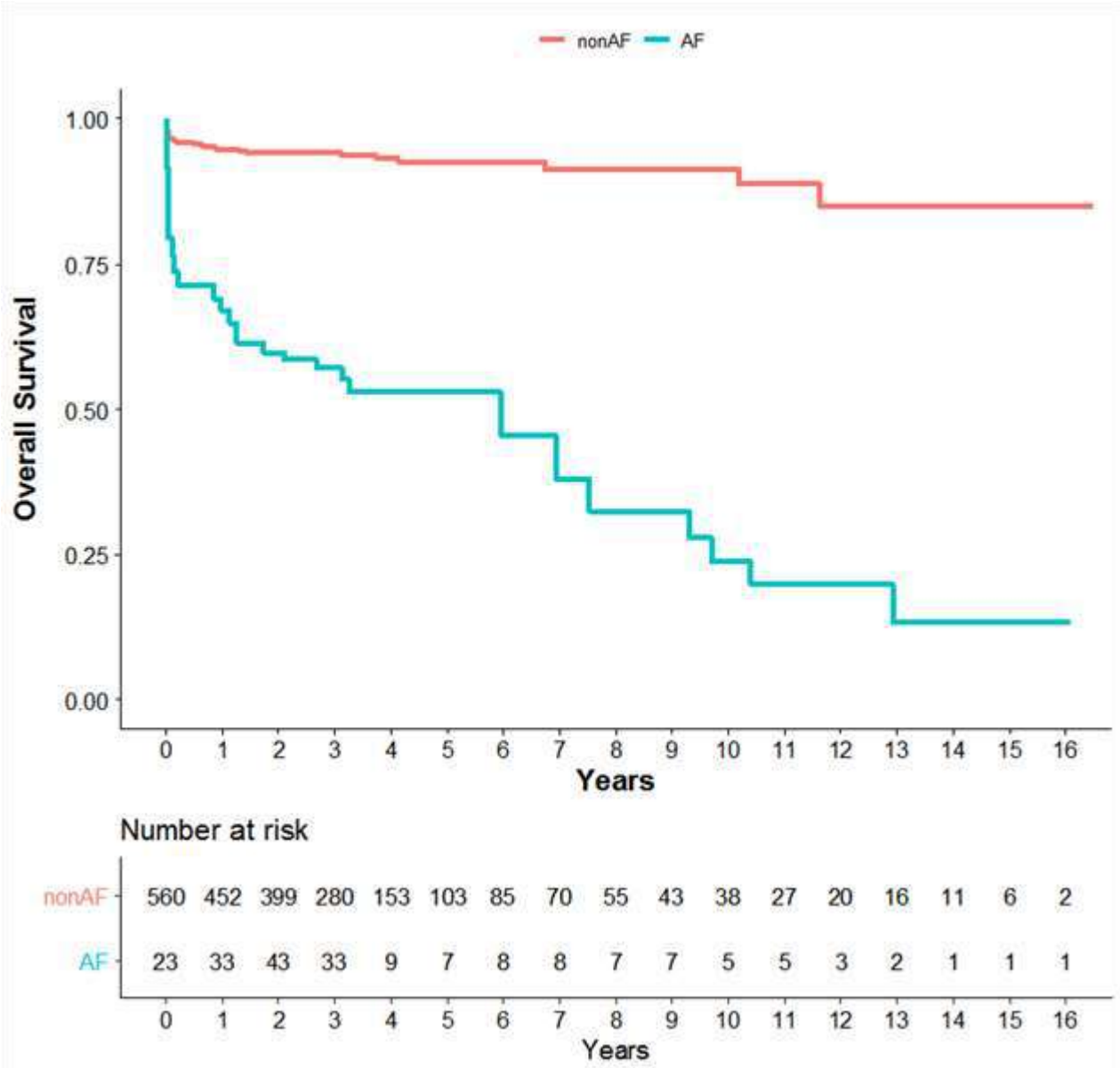
Background: Although the incidence of acute coronary syndrome (ACS) has increased over the decades, the overall prognosis has improved with newer stents, tailored medication, and better intervention techniques. Atrial fibrillation (AF) and ventricular arrhythmia at the time of ACS diagnosis are known indicators of a poor acute prognosis. However, there is a lack of data regarding the long-term arrhythmic impact on mortality in ACS patients. This study sought to elucidate the impact of tachyarrhythmia in patients with a history of ACS.

Methods: This study was conducted in a university hospital, and it evaluated the clinical outcomes, especially regarding cardiovascular mortality and readmission. The enrolled patients underwent percutaneous coronary intervention (PCI) for ACS between February 2004 and March 2018. Clinical information was attained by a thorough chart review.

Results: We retrospectively analyzed 560 ACS patients. We reviewed all electrocardiograms (ECGs) before and immediately after PCI, during hospitalization, and within 3 months of the index PCI. Three months after the index PCI procedure, any Holter monitoring / ECG was also reviewed for arrhythmia diagnosis. During follow-up, 91 patients were diagnosed with AF and 36 patients were diagnosed with VA. Overall mortality was related to the presence of anemia, low body mass index, low left ventricular ejection fraction after PCI, late diagnosed AF, and any VA during follow-up. Readmission was higher in patients with chronic kidney disease and newly diagnosed AF during the follow-up.

Conclusions: Diagnosis of late tachyarrhythmia during follow-up was associated with increased mortality in post-ACS patients.

SUPPORTING DOCUMENTS



Catheter Ablation of Ventricular Arrhythmia Originating from the Papillary Muscle by Semi-circumferential Isolation.

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Objective: The purpose of this study was to investigate the semi-circumferential ablation at the base of the ventricular papillary muscles (PMs) using an automated template matching.

Methods: A consecutive five patients with premature ventricular contractions (PVCs) originating from PMs enrolled in this study. Activation mapping for ventricle was performed during ventricular arrhythmias (VAs) using an electro-anatomical mapping system. Subsequently, pace mapping based on automated template matching algorithm using correlation coefficient was performed circumferentially at the base of the targeted PM to identify the potential pathway of PM VA. Radiofrequency was delivered at the best correlation site of the pacemapping. Moreover, continuous semi-circumferential catheter ablation were performed at the excellent correlation sites (correlation index $\geq 90\%$).

Results: The earliest ventricular activation sites during PVCs were detected at the left ventricular posterior papillary muscle in 3 patients, the left ventricular anterior papillary muscle in 1, and right ventricular anterior papillary muscle in 1. Perfect pacemaps were identified at the base of the targeted PMs in all patients. The maximal correlation index in each patient varied from 96.7 to 99.0% (mean 98.1 ± 0.8). The Purkinje potentials were always recorded at the perfect pacemap sites in all patients. During radiofrequency catheter ablation, a mean number of 9 ± 3.8 application were delivered. Radiofrequency catheter ablation was successful in all patients, and VA recurred in no patients during mean follow-up period of 15 ± 8 months.

Conclusion: This novel catheter ablation strategy could effectively eliminate PM VAs.

MRI Characteristics and Long-term outcomes of Patients with Left-Ventricular Papillary Muscle Arrhythmias Undergoing Catheter Ablation

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Objectives: Ventricular arrhythmias (VAs) originating from the left ventricular (LV) papillary muscles (PMs) can be targeted by catheter ablation (CA). However, the cardiac imaging characteristics and their relevance to the outcome of catheter ablation are not well defined.

Methods: Of the 89 patients with had PVCs activation and pace mapped to the LV PMs, 35 patients had cardiac magnetic resonance (CMR). The clinical characteristics, CMR imaging characteristics and outcomes of patients were investigated.

Results: Of the 35 patients, 21 pts (60%) had idiopathic VAs and in 14 pts (40%) the site of origin of VA was confined to endocardial scar tissue. Acute success was achieved in 85% of patients. During the 20 ± 3 months of follow up, VA free survival was 70% after a single procedure and 78% after repeat procedure. The volume of the arrhythmogenic PAP was significantly larger in the patients with failed versus as successful ablations (5.1 ± 2.1 g vs. 3.1 ± 0.8 cm³; $P < 0.001$). No significant difference was observed in the shape of arrhythmogenic PAPs in the patients with failed ablations (Conical 63% and 41% Broad apex) as compared to those with effective ablations (Conical 54% and 51% Broad apex) ($P = 0.89$). DEA were seen in 8 pts (22%) and were not different between those with successful versus failed ablation (3 vs. 5 pts).

Conclusion: Pre-procedural CMR imaging can help to assess the volume of the arrhythmogenic PM. A larger PM volume may be a predictor of more challenging ablation procedure.

Ventricular Tachycardia Originating Near the His-Bundle: Electrocardiographic and Catheter Ablation Characteristics

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Introduction: Premature ventricular contractions (PVCs) not uncommonly originate from the Para Hisian (PH) region. The clinical and electrophysiological (EP) characteristics of these PVCs are important to recognize given risk of injury to the conduction system.

Methods: 41 patients had PVCs activation and pace mapped to the PH region. The electrocardiographic and EP characteristics of these PH PVCs were compared in 50 patients with PVCs originating from right ventricular outflow tract (RVOT).

Results: Mean QRS width was narrower in PH PVCs ($P=0.01$) and the R wave amplitude was lower in the inferior leads ($P = 0.02$) as compared to RVOT PVCs. PH PVCs had an R wave amplitude greater in lead I ($P= 0.003$) and lead aVL ($P= 0.005$) than RVOT PVCs. For PH PVCs earliest in RV, the R wave amplitude ratio in leads II/III was greater than those in LV ($P= 0.02$). All left sided PH PVCs had early transition ($\leq$ Lead V2) while 18/26 Right sided PVCs had later transition ($\geq$ Lead V3). Radiofrequency ablation (RFA) was used upfront in 37 pts. Cryo-ablation used upfront in 3 pts and after RFA in 1 pts. In 29 pts (71%) PVCs were eliminated; 8 (19%) had significant suppression ($\leq 5\%$ total residual burden) and 4 (10%) had acute recurrence (<48 hours). During follow up of 328 ± 9 months, EF normalized in 38/41(92%).

Conclusions: PVCs originating near the His-bundle have distinctive ECG characteristics which aid in recognition and mapping. Catheter ablation can generally be performed safely and effectively.

Right Ventricular Pacing has Short And Long-term Deleterious Effects On Ventricular Physiology

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Objective: To evaluate short and long term adverse effects of RV pacing (apical and septal) on RV physiology.

Methods: Consecutive pts who underwent device implantation (permanent pacemaker and implantable defibrillator) were screened. Chart review was performed to determine patient demographics, procedural details and outcomes. In patients who underwent transthoracic echocardiography (TTE) before and after (12 months and 5 years) were included in this study. The images were assessed for tricuspid regurgitation (TR), RV size and systolic function, Left atrial (LA) volume and Left ventricular diastolic function.

Results: Between 2006 and 2016, out of 4108 patients with device implantation, 200 patients (71 % male, age 70 ± 14 years) had TTEs at baseline, 12 months and at 5 years. 170 pts. apical pacing and 30 pts had septal pacing. At baseline, 109 (54%) had no TR, 66 (33%) mild TR and 20 (10%) had moderate TR. In 160 (80%) RV size was normal with 40(20%) having mildly dilated RV. At 12 months, Mild TR was seen in 112 (56%), 39 (20%) moderate TR and 39 (9.5%) had severe TR. At 5 years, some worsening of TR in 90% with increase in RVSP and RV size was seen in 37% and 28% respectively (See table 1).

Conclusion: Long-term RV pacing has significant deleterious effects on tricuspid valve function, RV size and RV systolic function. An alternative pacing site such as His pacing can be attempted to avoid long term RV pacing complications.

SUPPORTING DOCUMENTS

	Baseline	12 months	5 years
RV Size and Function			
RV basal (mm) <41	36+/-4	39+/-6	41+/- 6
RV mid (mm) <35	35+/-4	36+/- 5	38+/-5
RV longitudinal (mm) <83	65+/- 2	67+/-7	72+/- 8
TAPSE >17	19+/- 3	18+/- 3	17+/-4
RV S'(mm) >10	13+/- 3	12+/-2	11+/-2
LV Diastolic Function			
LA volume (ml)	44+/- 13	53+/- 20	65+/- 27
E/A ratio	1.1+/-0.3	1+/-0.3	1+/- 0.5
MVDT (ms) 150-220	156+/- 46	167+/-56	208+/- 55
RV: Right ventricle; TAPSE: Tricuspid annular plane systolic excursion. MVDT: Mitral valve deceleration time. LA: left atrium			

Burden of Non-cardiac Symptoms in Postural Orthostatic Tachycardia Syndrome: Focusing on Pain and Autonomic Symptoms

Mr Eric Ong¹, Professor Dennis Lau¹, Mrs Marie-Claire Seeley¹, Dr Celine Gallagher¹, Ms Amy Langdon¹

¹*Flinders University, South Australia, Australia*

Objectives: Autonomic symptoms and pain are highly prevalent in patients with Postural Orthostatic Tachycardia Syndrome (POTS). We aim to delineate the prevalence and severity of these symptoms in a contemporary cohort of individuals with POTS and to identify factors associated with higher pain scores.

Materials/Methods: Individuals with a physician confirmed POTS diagnosis who provided informed consent were included. Data collected included demographics, comorbidities and questionnaires including health-related quality of life (EQ-5D-5L), the Hospital Anxiety/Depression Scale and COMPASS questionnaire to determine autonomic symptom burden. Pain was self-reported on a scale from 1-5 within the EQ-5D-5L questionnaire. 1 representing no pain or discomfort, 5 representing extreme pain or discomfort. A multivariate regression model was undertaken to determine the relationship between demographics, comorbidities, questionnaire data and pain levels. All statistical analysis was undertaken in R version 4.1.2

Results: A total of 162 individuals (mean 30±11.44 years, 90.8% female) were enrolled. 149 (92%) reported presence of comorbidities, 45.68% reported migraines. Majority reported significant pain, with 67% scoring ≥3, indicating moderate to extreme pain scores. Median reported pain score was 3. Median compass score was 50.92 indicating a moderate level of autonomic dysfunction. Multivariate regression analysis demonstrated that depression, migraine and COMPASS scores were significantly associated with pain, but the model had weak overall discrimination with an adjusted R² of 0.33.

Conclusions: Moderate to severe pain was highly prevalent in our POTS cohort. Factors contributing to high pain burden were unclear, establishing the need to understand reasons underpinning high pain scores in POTS.

THAT ONE SPOT, AND FINALLY!

Dr Mohanaraj Jayakumar¹, Dr Kantha Rao Narasamuloo¹, Dr Saravanan Krishinan¹

¹*Hospital Sultanah Bahiyah, Alor Setar, Malaysia*

We present to you a lady 65 years old, she presented with multiple episodes of palpitations and pre-syncope attack. She had history of Takotsubo cardiomyopathy in 2019. At the time, noted high burden PVC of 28% and episodes of non sustained VT from Holter.

During presyncope attack in 2021, ECG showed trigeminy with PVC morphology arising from outflow tract as inferior leads PVC were upright and earliest transition of R wave was at lead V3, which points towards LV summit or AMC region.

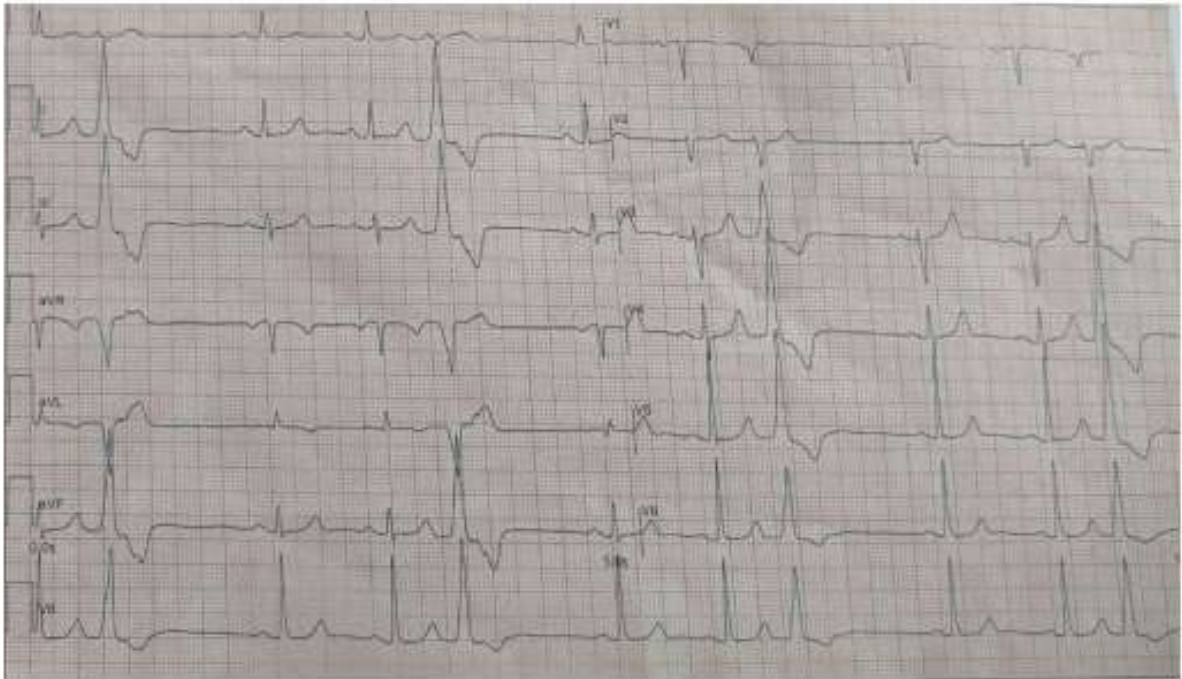
She was admitted and underwent ablation with Ensite 3D mapping system January 2022, her PVC was successfully terminated after mapping and noted earliest signal was at AMC region and thus ablated.

Four months later she represented with another episode of presyncope attack, 12 lead ECG showed PVC of similar morphology as previous.

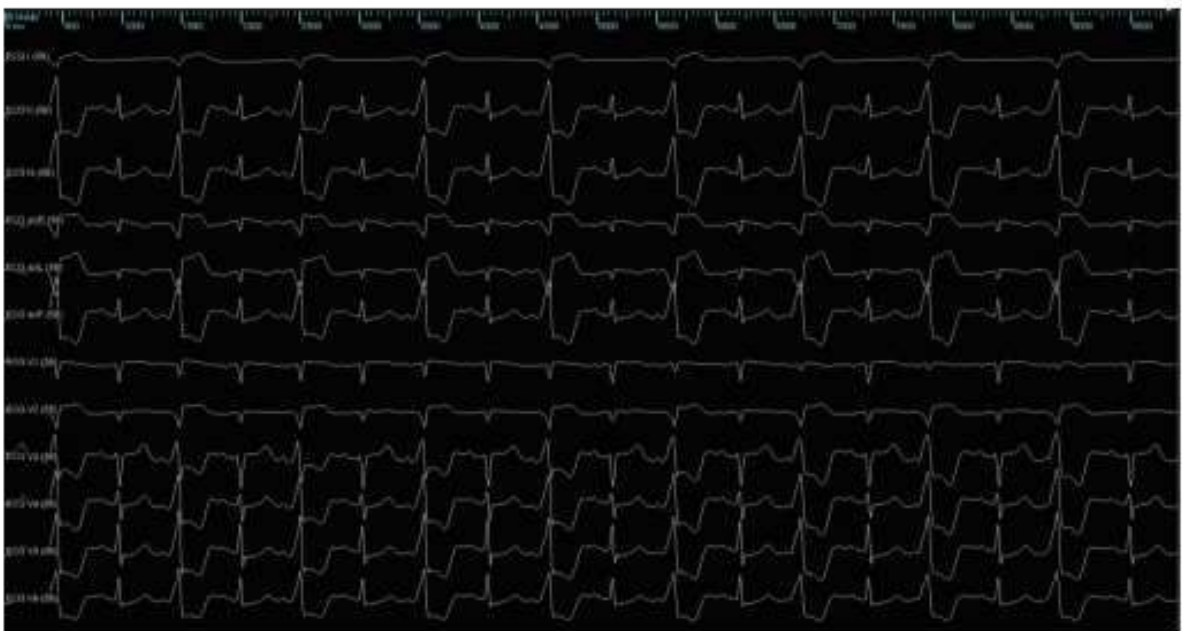
She was planned for another ablation procedure under 3D Ensite system. We mapped the RVOT first which showed earliest signal were -31ms presystolic and late potential signals and we ablated the areas, PVC still persistent. We mapped GCV and noted earliest signal was -41ms with presystolic and late potential signals and we ablated. The PVCs were still there.

From the maps, we saw both lesions were at opposite side. We then mapped the aortic cusps and this time we were able to connect both previous ablated lesions, we found the earliest signal between the LCC/RCC commissures at -71ms with late potentials. With one ablation, the PVCs disappeared and she has been keeping well till now.

SUPPORTING DOCUMENTS



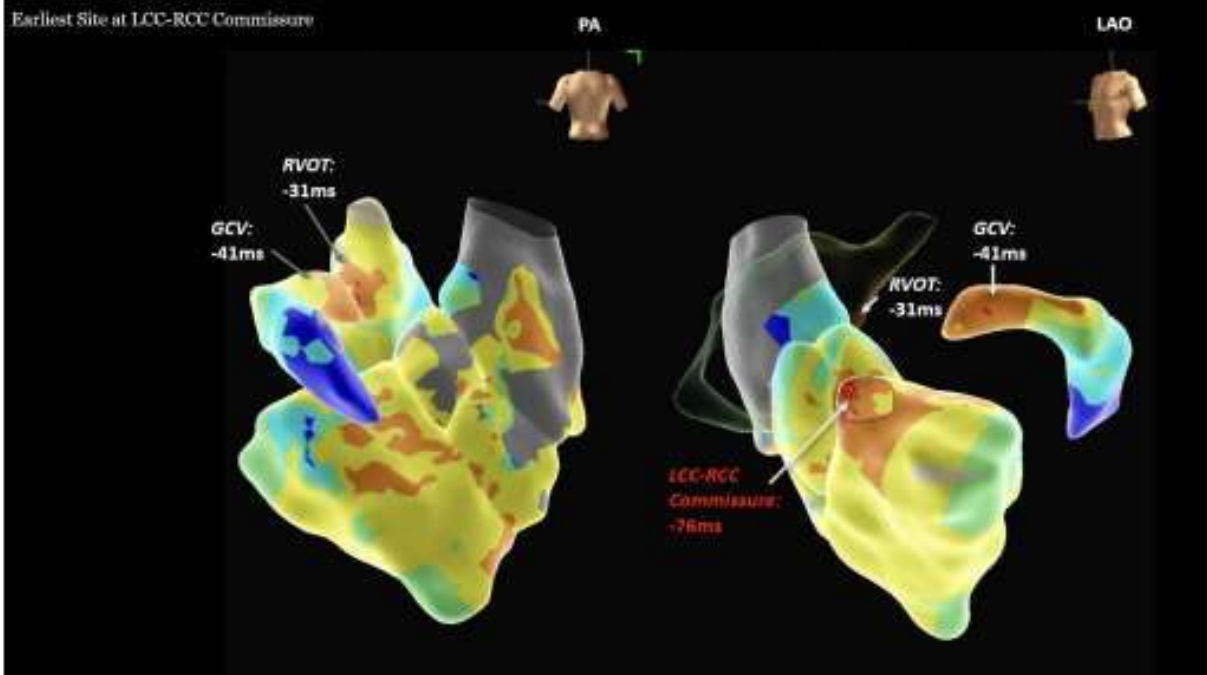
BASELINE ECG MAY 2022.



BASELINE ECG DURING ABLATION IN JUNE 2022.

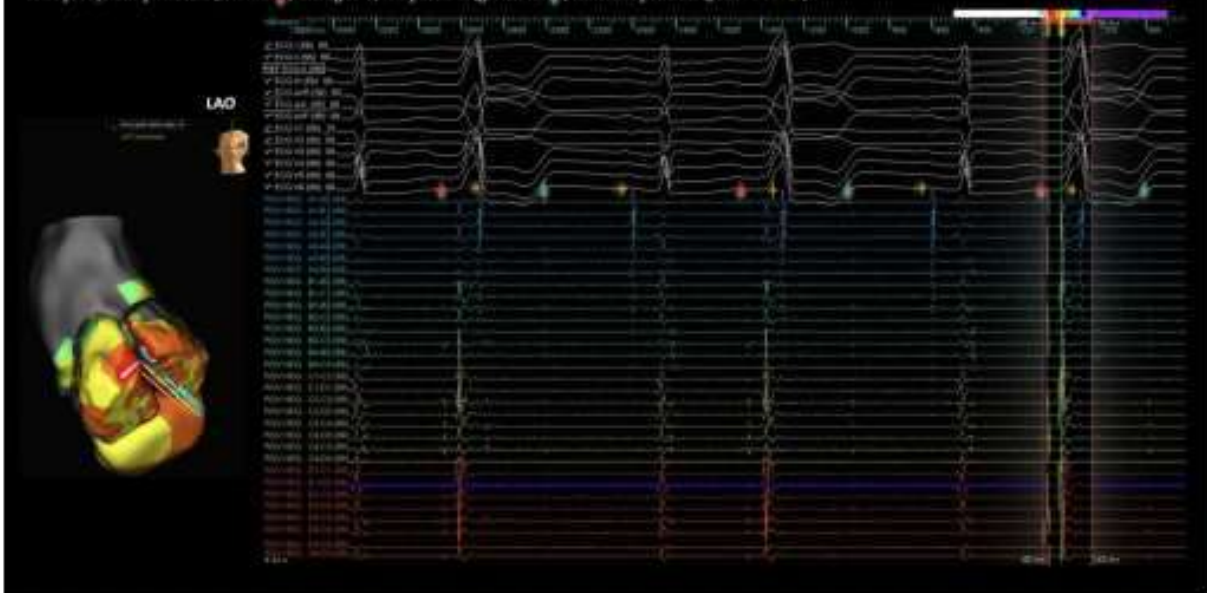
Combined LAT Maps

Earliest Site at LCC-RCC Commissure



Pre-Systolic Potentials and Late Potential

Intracardiac electrograms recorded by HD Grid at the RCC-LCC commissure showing: local pre-systolic potentials (red star ★) during PVC, late potential (green star ★) and atrial potential (yellow star ★).

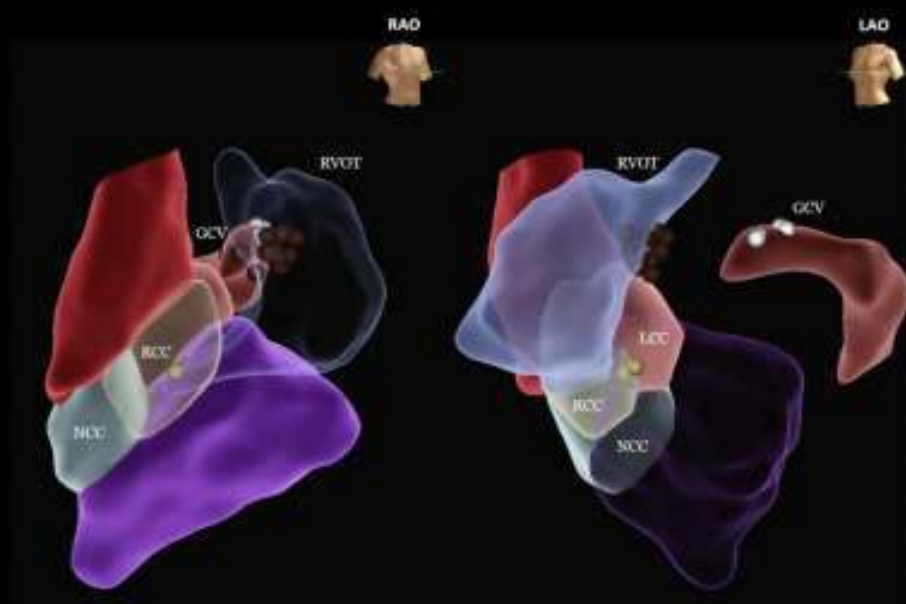


Successful Ablation

RFA at the LCC-RCC commissure successfully eliminate the PVCs within 10 seconds, using a power of 35 W and temperature cut-off setting at 45 °C. Video shows the stable position of TactiCath, maintaining a very good tissue contact (15-25g) during ablation, successfully ablated the PVC foci.



All Geometry Mapped



Prevalence And Circadian Variation Of Prominent J Waves In Idiopathic VF Without Structural Heart Disease

Dr Rahul Singhal¹

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Background: J point & ST elevation in right precordial leads known risk factors for increased arrhythmias in structurally normal heart like Brugada syndrome(BS). However, same findings in lateral leads now considered significant due to link between early repolarization (ER), J-point elevation and/ QRS slurring in inferior, lateral leads and risk of idiopathic VF(IVF).

Objective: To elucidate prevalence, circadian pattern of J wave IVF pts.

Methods: Study enrolled 30 pts. ;21 men; 38.3 years), SCA survivor, none had SHD, divided based on +/- of J waves. Risk stratifiers: late potentials (LPs)/24 hours, TWA & QT dispersion. Results compared to 12 control with VF and no J wave.

Results: J waves were present in 12 with IVF. In 8 - inferior leads while both inferior and lateral leads in 4. BS in 6 (41.1) and normal QRS in 6 (42.3).Incidence of LP in IVF with J-wave higher than in non J IVF(P = 0.01). Repolarization abnormality same among two. J wave + , dynamic changes in LPs , pronounced at night; not found in J-wave -. VF induced by PES from RVA/ OT in 7/12 J-wave syndrome pts., 4/6 BS, in all with normal ECG.

Conclusion: Showed increased prevalence of J-wave syndrome with history of IVF, consistent with previous studies. J wave was present in inferior or inferolateral leads compared to that in BS. Also, IVF patients with J waves had high incidence of LP with circadian variation and predominance in night and close association with depolarization than with repolarization abnormality.

Non-Fluoroscopic 3D Mapping/Navigation using Ensite™ NavX and RFA Idiopathic VT in a Pregnant Lady: Case Report

Dr Muhammad Izzad Johari¹, Yogesh Hiware², Dr Rohith Stanislaus¹, Zunida Ali¹, Noor Asyikin Sahat¹, Amirzua Ahmad Said¹, Azlina Daud¹, Gina Dayang Mani¹, Mohamad Halmy Aziman¹, Dr Low Ming Yong¹, Dr Suraya Hani Kamsani¹, Dr Surinder Kaur Khelae Atma Singh¹, Dr Azlan Hussin¹

¹National Heart Institute, Jalan Tun Razak, Malaysia, ²Abbott, Malaysia

Objective: To illustrate the feasibility of non-fluoroscopic catheter ablation in incessant ventricular tachycardia during pregnancy, guided by the Ensite NavX system.

Materials and Methods: We report our case of a pregnant lady who presented with incessant outflow tract ventricular tachycardia, which was successfully treated using non-fluoroscopic techniques

Results: A 37 years old woman, in the 26th week of her fourth pregnancy presented with recurrent syncopal episodes. ECG showed multiple runs of right outflow tract VT. Echocardiogram revealed structurally normal heart. She did not respond to treatment with beta blockers/Flecainide. Multidisciplinary consultations came to a mutual understanding that she required to undergo VT ablation.

The procedure was performed under local sedation. A multipolar mapping catheter, Advisor™ HD Grid Mapping Catheter, was tracked up the IVC into the RA and up the RV outflow tract using Ensite™ NavX Cardiac Mapping System. A voltage and Unipolar activation map was then constructed using the Advisor™ HD Grid Mapping Catheter and the Ensite™ NavX Cardiac Mapping System. The earliest activation point was subsequently mapped to right antero-septal outflow tract. A sensor-enabled ablation catheter, TactiCath™ Contact Force Ablation Catheter, was tracked upward by the Mapping System and non-fluoroscopically guided to the earliest activation point and the subsequent activation exit shifts were successfully ablated using radiofrequency energy. Post-ablation, she did not have any ventricular ectopics or VT despite augmentation with Isuprenaline.

Conclusion: The procedure has a safe outcome and we were able to totally eliminate radiation exposure to fetus.

Carbon Dioxide Insufflation Technique for Epicardial Ventricular Tachycardia Ablation After Failed Subxiphoid Surgical Approach

Dr Ming Yoong Low¹, Dr Surinder Khelae¹, Dr Khai Chih Teh¹, Dr Azlan Hussin¹

¹*National Heart Institute, Kuala Lumpur, Malaysia*

Objective: To demonstrate the feasibility of coronary vein exit and CO₂ insufflation technique to facilitate sub-xiphoid epicardial access for epicardial VT ablation in a patient with previous failed sub-xiphoid surgical approach.

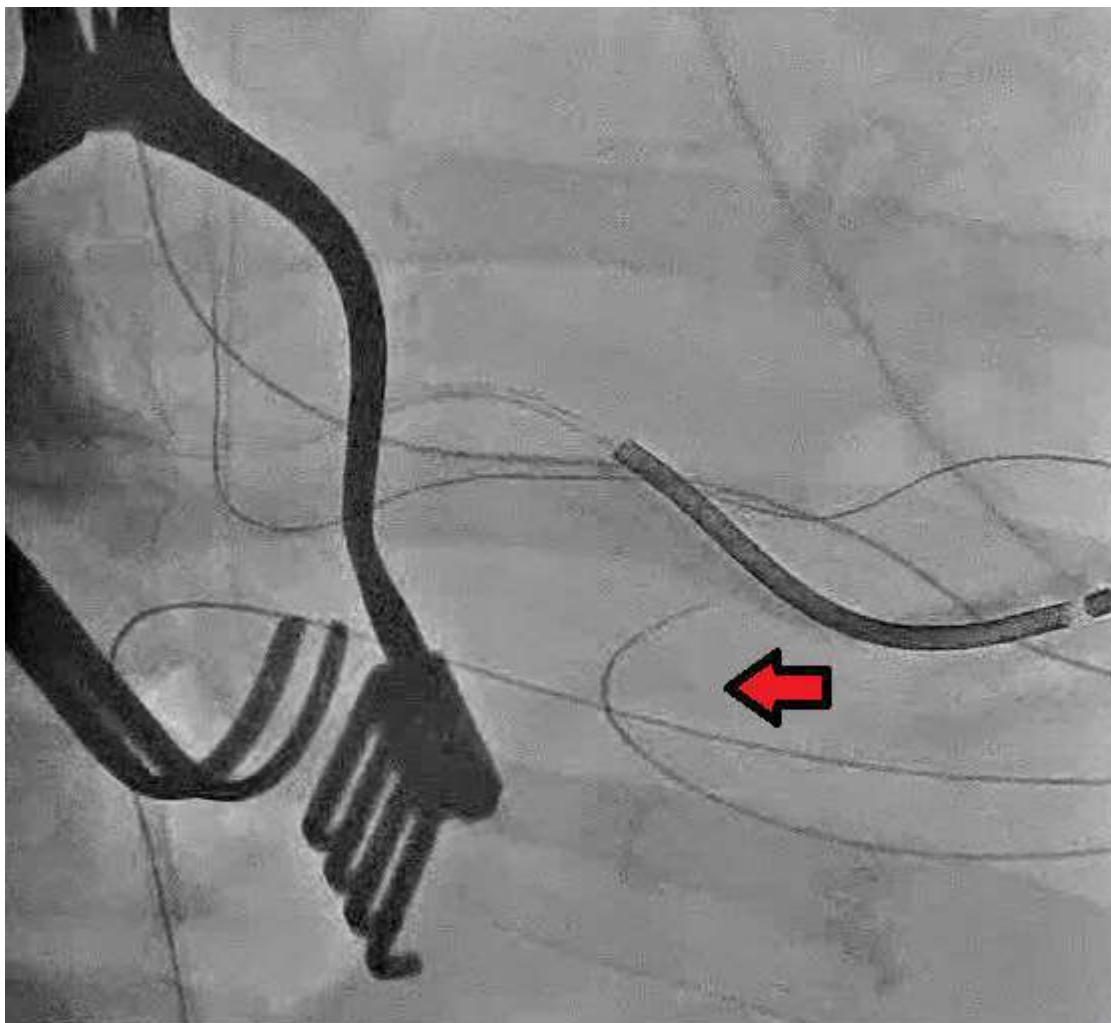
Material and Methods: A 49-year old gentleman with background non-ischemic dilated cardiomyopathy on a single chamber ICD for resuscitated VT and chronic kidney disease was referred for VT storm. We attempted the first VT ablation via endocardial approach, ablating at the base of antero-lateral papillary muscle. The tachycardia recurred within 24 hours and he was planned for re-do radiofrequency ablation (epicardial) 2 days later, via sub-xiphoid surgical approach. This attempt, however, failed as there were pericardial adhesions obstructing catheter placement. Hence, the endocardial approach was re-attempted, and the same area ablated. Patient was initiated on anti-arrhythmic agents and discharged.

He was admitted 4 months later with another VT storm. We attempted the coronary vein exit and CO₂ insufflation technique for epicardial access. The distal coronary sinus was punctured with a 0.014" guidewire and CO₂ was delivered via a microcatheter. A sub-xiphoid puncture with CO₂ tamponade as a marker successfully passed the ablation catheters into the pericardial space. Radiofrequency ablation was applied to the posterolateral area, with successful termination of VT.

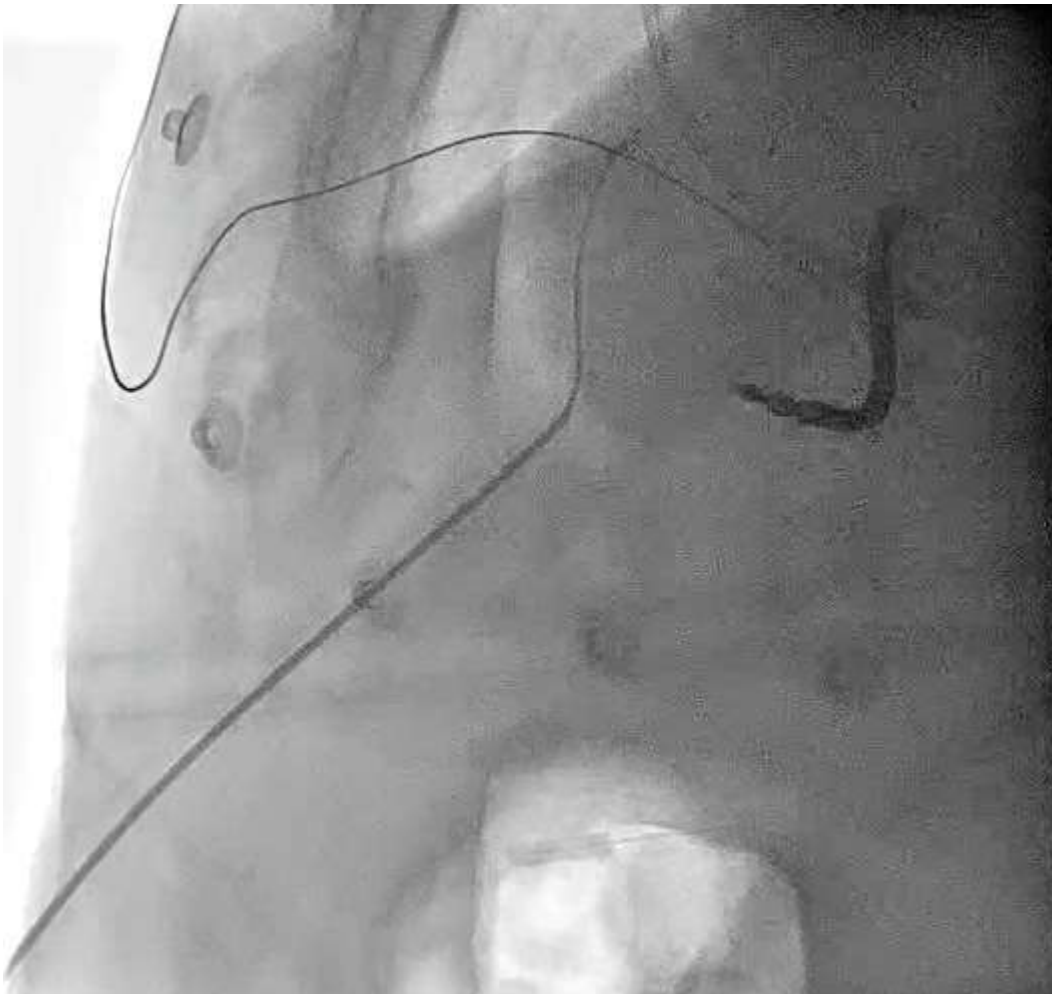
Results: The patient was arrhythmia-free on follow up and had no therapy delivered.

Conclusion: This case demonstrated that the coronary vein exit and CO₂ insufflation technique for access in epicardial VT ablation is a viable option in patients with previous failed sub-xiphoid surgical approach due to pericardial adhesions.

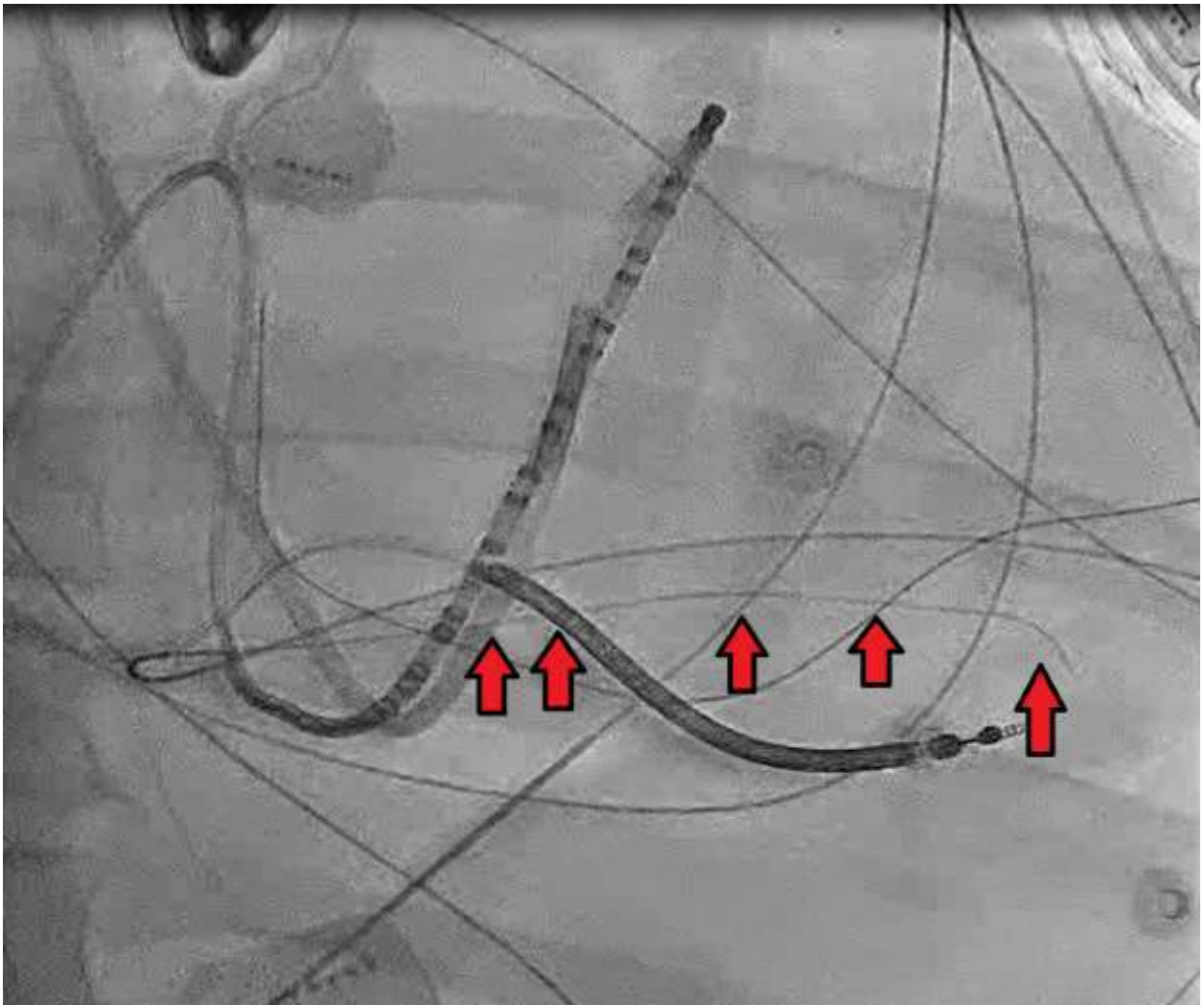
SUPPORTING DOCUMENTS



The guidewire passed after surgical sub-xiphoid approach showed an obstruction at the area annotated.



Sub-xiphoid puncture guided by CO2 tamponade from CO2 insufflation



After CO₂ insufflation, the guidewire could be passed via a sub-xiphoid puncture to the epicardial space.

Current status of stereotactic radiotherapy for ventricular tachycardia in the Czech Republic

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¹*Ikem, Prague, Czech Republic*, ²*Podlesí Hospital, Třinec, Czech Republic*, ³*University Hospital, Ostrava, Czech Republic*

Objectives: To describe experience with stereotactic body radiotherapy (SBRT) for VT in the Czech Republic.

Materials and Methods: Since 2014, a total of 36 patients (3 women, mean age 66 ± 9 years, 63 % ischemic cardiomyopathy) underwent SBRT after a median of 2 (range: 1-5) CA (epicardial access 42%). Seventy-seven % were on amiodarone. A dose of 25 Gy was delivered. Since 2020, 10/292 patients undergoing CA (3.4%) were enrolled in one center in a randomized trial comparing SBRT vs another CA for VT recurrences (NCT04612140).

Results: Twenty (57%) patients died during the mean follow-up of 22.5 ± 42.8 months, mainly due to the progression of heart failure, one death was SBRT-related. A total of 19 patients had a recurrence of VT during the first 3 months, 34/35 had any recurrence of VT. Overall, the number of DC shocks decreased significantly from 0.9 ± 1.9 per month in the period of 6 months before SBRT to 0.1 ± 0.3 per month in the period of 6-12 months after SBRT ($P=0.008$). However, 15 patients (42.8%) had to undergo additional CA due to VT recurrences at a mean interval of 11.6 ± 23.6 months after SBRT, and 3 of them also repeated SBRT.

Conclusion: SBRT in pts with structural heart disease and failed CA decreases the number of VT therapies from ICD, although the majority underwent another CA. This may suggest a synergistic effect of both treatment modalities. The need for SBRT in an expert center is low (3.4 %).

Periaortic Ventricular Tachycardia in a Patients With Aortic Valve Replacement and Biventricular Assist Device Support

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¹*Tri-Service General Hospital, Taipei, Taiwan*

Objectives: We present a case of drug-refractory periaortic ventricular tachycardia in a patient with biventricular assist device (BiVAD) mechanical support after aortic valve replacement.

Materials and Methods:

A 65-year-old male received a BiVAD for hemodynamic support due to ventricular tachycardia (VT) storm after coronary artery bypass surgery and aortic valve replacement. Electrophysiologist was consulted for further intervention.

Results: There were no substrate modifications required according to bi-ventricular substrate mapping result. After activation mapping and paced mapping, the earliest lesion located at basal posterior septum of right ventricle (RV) was ablated successfully.

The patient underwent implantable cardioverter defibrillator implantation 10 days after. BiVAD was weaned after that. Two months later, recurrent VT having the exact same QRS morphology with the previous clinical VT happened. Second ablation procedure was arranged.

A SL1 long sheath was placed at left ventricular (LV) outflow tract below the prosthetic aortic valve. Electrophysiologic ECG system could record couplet premature ventricular complexes (PVCs) with two QRS morphologies (PVC1 and PVC2). The activation map demonstrated PVC1 exit breakout through RV basal septum and PVC2 exit breakout through LV basal septum, para-hisian area. After the ablation of these sites, no PVCs was noted. Periprocedural intracardiac echocardiography showed no evidence of aortic valve injury.

Conclusion: We presented a case who had BiVAD mechanical support and underwent electrophysiologic study and ablation. Periaortic VT may happen within short period after valve replacement. It is practicable using SL1 long sheath to cross the prosthetic aortic valve without complications.

SUPPORTING DOCUMENTS

Figure 1.

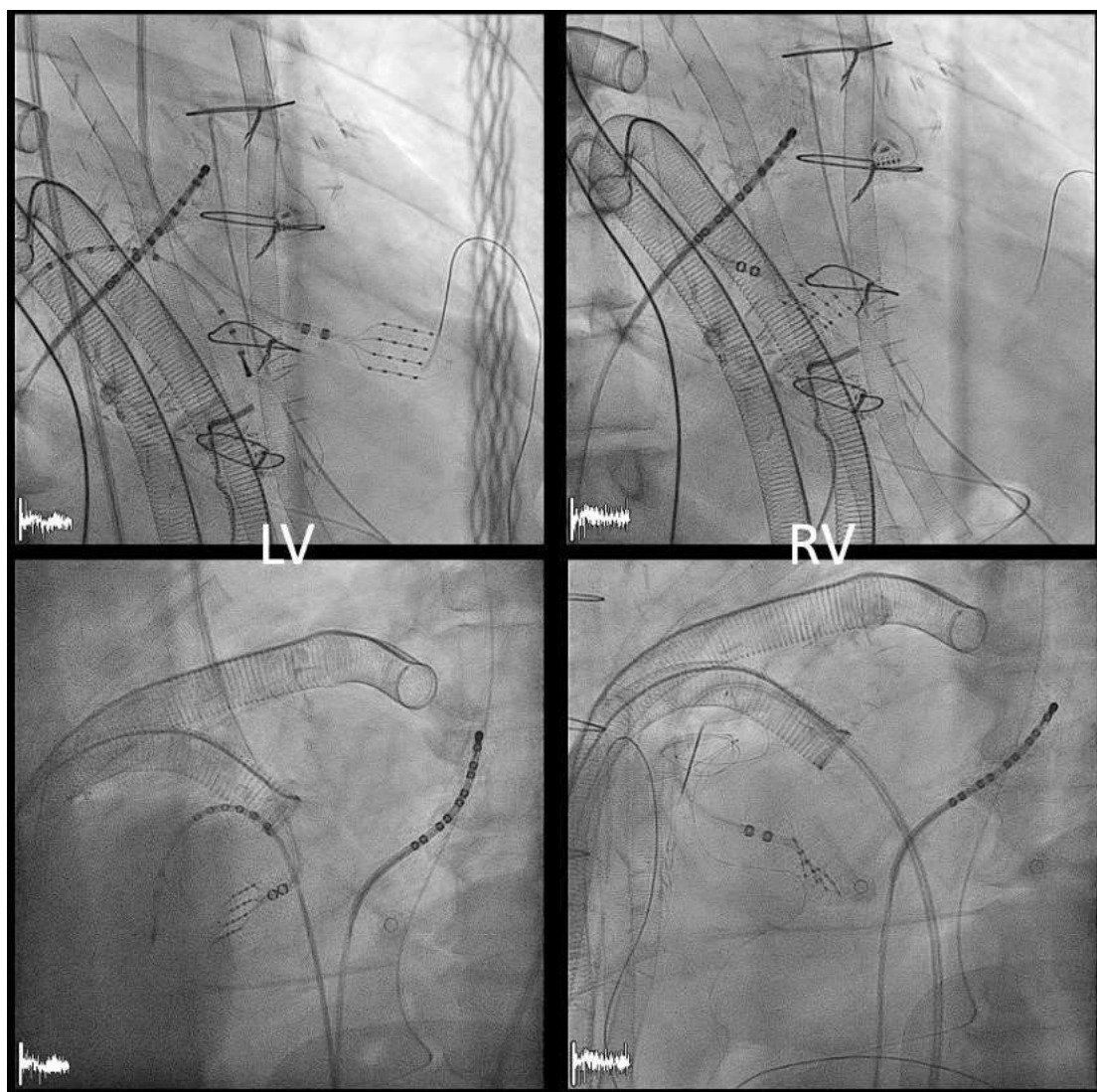


Figure 2.

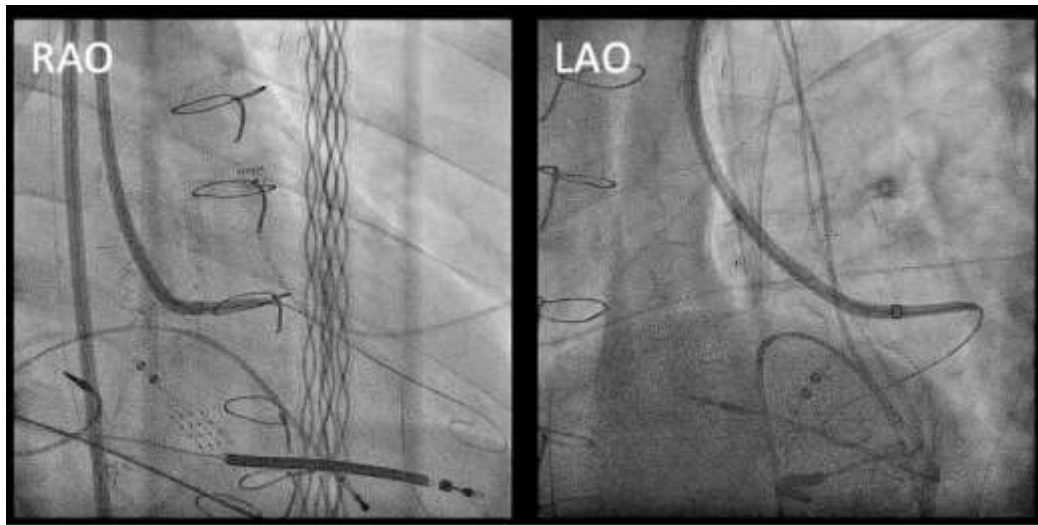
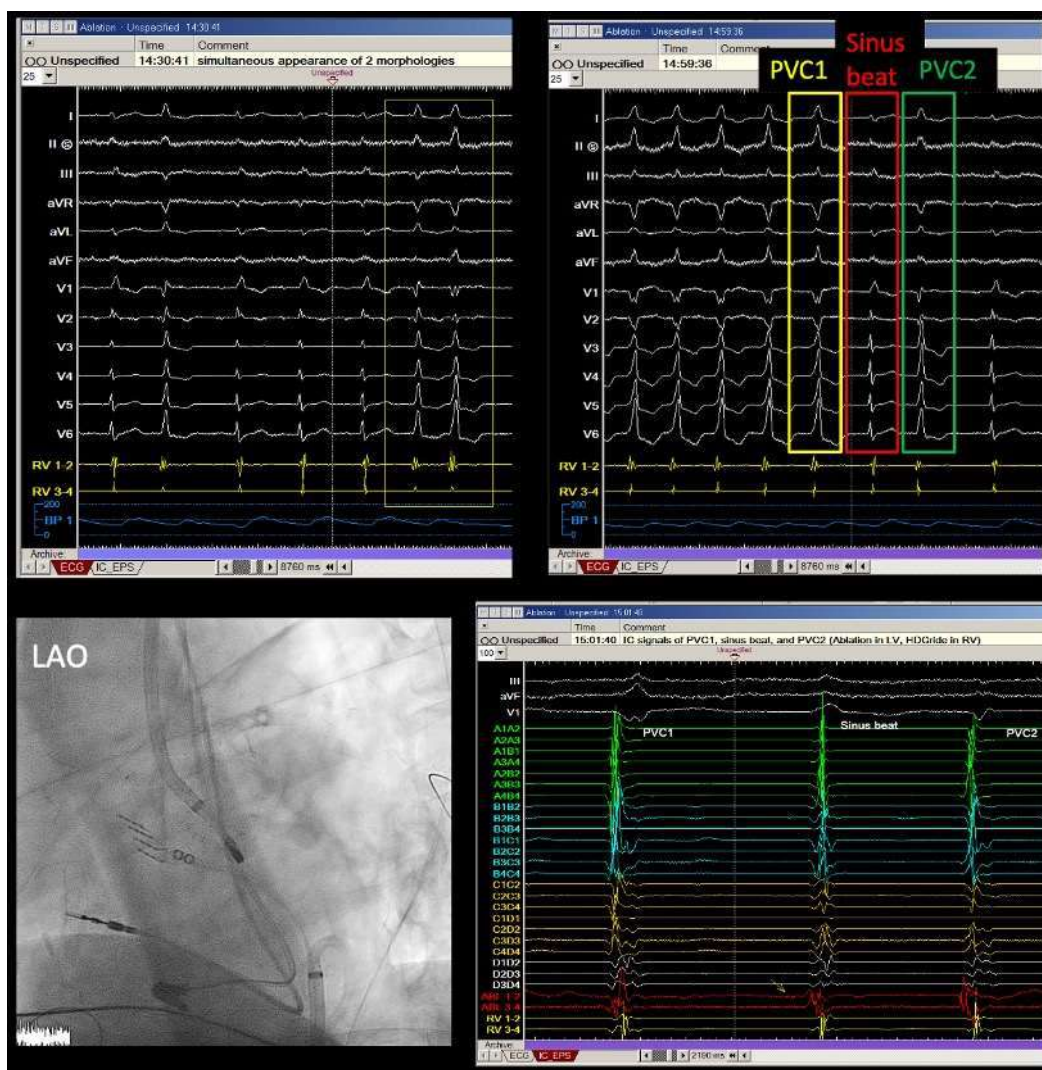


Figure 3.



Safety and Efficacy of Ventricular Tachycardia Ablation at a Nascent Unit; a Single Centre Experience

Dr Timothy Ryan¹, Dr Sohail Popal¹, Dr James Lambert¹, Dr Nikola Stoyanov^{1,2}, Dr Tim Gattorna¹, Dr Rafeeq Samie¹, Dr Anne Powell^{1,2}, Dr Vince Paul¹, Dr Ben King¹

¹*Department of Cardiology, Fiona Stanley Hospital, Perth,,* ²*Department of Cardiology, Royal Perth Hospital, Perth*

Objectives: We sought to examine the activity of a recently established ventricular tachycardia (VT) service and the safety and efficacy of VT ablation at our unit.

Materials and Methods: A retrospective observational study was performed on all patients referred to the VT service at Fiona Stanley Hospital, Western Australia from 2018 until 2021. Patients undergoing VT ablation were analyzed for cardiovascular-specific adverse events, acute periprocedural hemodynamic decompensation, 6-month rate of hospitalization for heart failure/VT and 6-month rate of shocks from implantable cardioverter-defibrillator (ICD).

Results: 100 patients were referred for management of ventricular tachycardia. Adjustments to antiarrhythmic drugs occurred in 59% and ICD programming changes occurred in 49% of patients with an existing ICD. A new ICD was implanted in 22 patients and cardiac-resynchronization therapy was provided in 16 patients. 55 VT ablation procedures were performed on 47 patients including 8 epicardial, 4 cardiac stereotactic body radiotherapy and 1 alcohol ablation. Of patients undergoing ablation, 64% had ischemic cardiomyopathy and 98% had structural heart disease. The mean PAINESD Risk score was 15.1/35. Acute periprocedural hemodynamic decompensation rate was 7.3% (4 of 55 ablations) and the cardiovascular-specific adverse events rate was 3.6% (2 of 55 ablations) with no deaths. Rates of ICD shocks and hospitalization for heart failure/VT decreased from 71% and 79% in the 6-months pre-ablation to 14.6% and 19% in the 6-months post-ablation respectively.

Conclusion: Ablation for ventricular tachycardia can be performed at a nascent service with safety and efficacy comparable to current published data.

Epicardial Ablation for Ventricular Tachycardia Using Sedation With Dexmedetomidine.

Dr Sergio Conti¹, Dr Francesco Sabatino¹, Antonio Cascino¹, Giuliano Ferrara¹, **Dr Giuseppe Sgarito¹**

¹*Arnas Civico Hospital, Palermo, Italy*

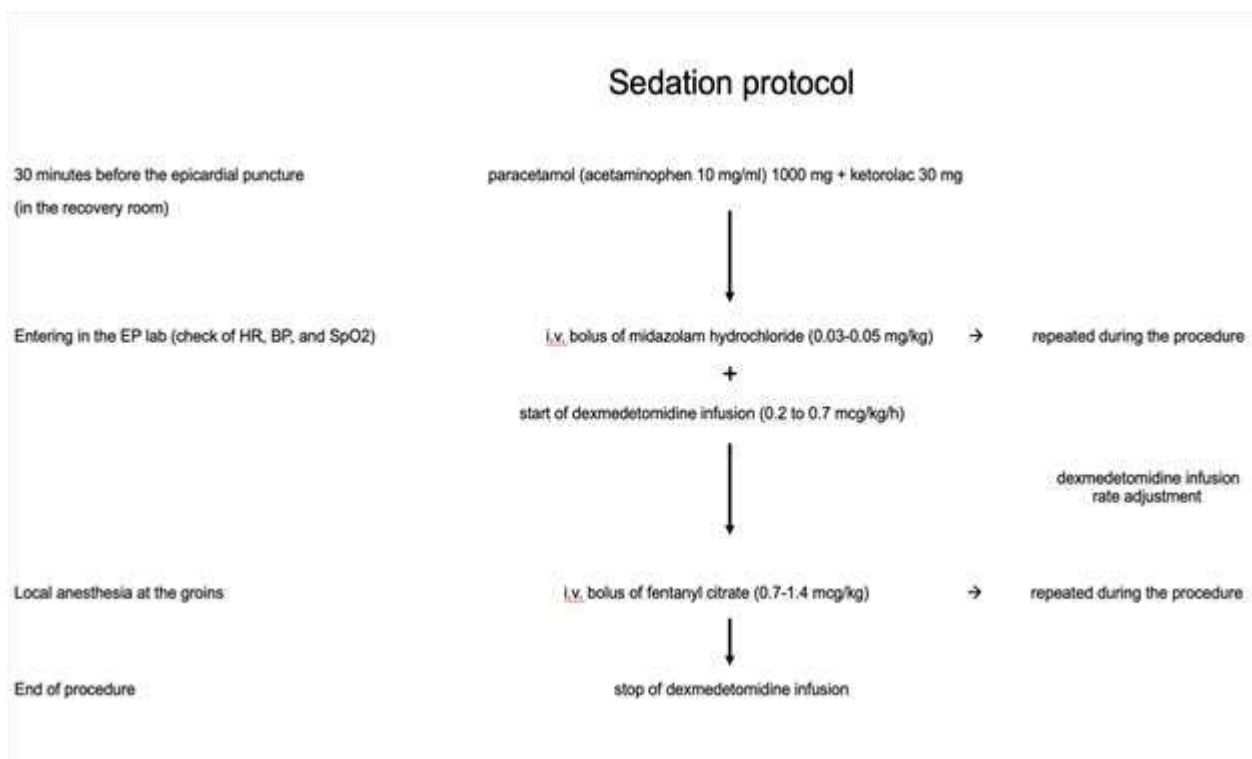
Background: Epicardial approach to ventricular tachycardia (VT) ablation is mainly performed under general anesthesia (GA). Although catheter manipulation and ablation in the epicardial space could be painful, GA lowers blood pressure, may interfere with arrhythmia induction and mapping, and the use of muscle relaxants precludes identification of the phrenic nerve. Moreover, an anesthesiologist's presence for the whole procedure may not always be possible. We evaluated the feasibility and safety of epicardial VT ablations using sedation with dexmedetomidine.

Methods: Between January 2018 and January 2022, patients who underwent epicardial VT ablation under continuous dexmedetomidine infusion were prospectively included. All patients received premedication 30 minutes before the epicardial puncture with paracetamol 1000 mg and ketorolac 30 mg. Sedation protocol included an intravenous bolus of midazolam hydrochloride (0.03-0.05 mg/kg) followed by continuous infusion of dexmedetomidine (0.2–0.7 mcg/kg/h). An intravenous fentanyl citrate bolus (0.7-1.4 mcg/kg) was given for short-term analgesia, followed by a second dose after 30-45 minutes. Sedation-related complications were defined in case of respiratory failure, severe hypotension, and bradycardia requiring treatment.

Results: Sixty-nine patients were included in the analysis. Mean age was 65.4±12.1 years; 46 patients were males (66.6%). Forty-seven patients (68.1%) had non-ischemic cardiomyopathy, 13 patients (18.9%) had ischemic-cardiomyopathy, and 9 patients (13%) had myocarditis. Standard percutaneous sub-xiphoid access was attempted in all patients. No sedation-related complications have been observed among the patients.

Conclusion: Continuous infusion of dexmedetomidine and administration of midazolam and fentanyl seems to be a safe and effective sedation protocol in patients undergoing epicardial VT ablation.

SUPPORTING DOCUMENTS



A Novel CALM1 Variant Associated with Long QT Syndrome

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Background: Calmodulin (CaM) is a kind of highly conserved proteins with identical 148 amino acids that encoded by three different CaM genes (CALM1, CALM2, CALM3) which exist in different chromosomes. CALM gene mutations can reduce the CaM-Ca²⁺ binding affinity and retard the calcium dependent inactivation of L-type calcium channels (LTCC) so that patients can present Long QT syndrome (LQTS) phenotype. It is also reported that CALM gene mutations can extended RyR2 channel opening and Ca²⁺ release that cause Catecholaminergic polymorphic ventricular tachycardia (CPVT).

Methods and Results: A new heterozygous CALM1 c.296 (exon5) A>T, p. N99I (p. Asn99Ile) variant in a 4year old Chinese girl was found, this girl was suddenly presented with repeated vomits, followed by convulsion and losing of consciousness. The ECG showed repetitive episodes of QT interval prolongation and caught ventricular fibrillation. Then, we analyzed the functions of this novel N98I mutant CaM and compared with other three unique mutant CaMs(N54I, F90L,N98S), N98I mutation had similarly effect on reducing the CaM Ca-binding affinity and effects on LTCC inactivation and APD when compared with N98S, but more effects than N54I and F90L. However, N54I had higher frequency in promoting spontaneous Ca wave and spark activity.

Conclusion: We discovered a novel LQT mutation in the CALM1 gene, which induced ICa.L dysregulation contributes to the long-QT phenotype.

Efficacy of Radiofrequency Catheter Ablation in Asymptomatic Patients With Wolff Parkinson White Syndrome

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¹Al Azhar Medical school, Naser City, Egypt, ²Al Zaqaziq Faculty of Medicine, Al Zaqaziq, Egypt

Introduction: Radiofrequency catheter ablation (RFA) was established in the treatment of symptomatic Wolff–Parkinson–white (WPW) patients, but it is still controversial in asymptomatic patients. We conducted this meta-analysis to show the efficacy of RFA in asymptomatic patients.

Method: We searched on PubMed, Cochrane library, Web of Science and Scopus databases using all identified keywords and index terms through 4 January 2022. We included all studies conducted on patients with WPW who were treated with ablation. We conducted the analysis using Revman software.

Results: We found 2268 unique articles. We included only six articles that meet our inclusion criteria. The pooled effect estimates showed that ablation was better than placebo in decreasing risk of All-cause mortality (RR = 0.61, 95% CI 0.51 – 0.73, P < 0.00001), supraventricular tachycardia (RR = 0.32, 95% CI 0.12 – 0.85, P = 0.02) and ventricular preexcitation (RR = 0.02, 95% CI 0.00 – 0.12, P < 0.0001).

Conclusion: RFA was useful in decreasing the risk of supraventricular tachycardia and ventricular preexcitation in asymptomatic patients.

Alcohol Septal Ablation as Bailout in Incessant Ventricular Tachycardia

Dr Yoon Kee Siow¹, Dr Nor Halwani HABIZAL¹, Dr Hartini MOHD YUSOF¹, Dr Abdul Raqib ABD GHANI¹, Dr Sathvinder Singh GIAN SINGH¹, Dr Chin Yung CHEA¹, Dr Wei Shen CHEE¹, Dr Aimaduddin MAT DAUD¹, Dr Kamaraj SELVARAJ¹, Dato' Dr Asri Ranga ABDULLAH RAMAIAH¹
¹*Serdang Hospital, Kajang, Malaysia*

Objectives: To report a challenging case of incessant ventricular tachycardia (VT).

Results: We reported a case of 32 years old male diagnosed with hypertrophic cardiomyopathy in 2020. In 2021, a single-chamber implantable cardioverter-defibrillator (ICD) was implanted for primary prophylaxis of VT. He experienced multiple ICD shocks in 2021 and early 2022 before referring to our centre. Cardiac MRI showed thickening and late gadolinium enhancement in focal basal to mid anterior and anteroseptal region. The patient was intubated with general anaesthesia. Three distinct morphologies of premature ventricular complexes (PVC) were identified during mapping: the first one was basal in origin with superior axis; the second showed pattern break which the earliest signal located at middle cardiac vein (MCV); the third one was inferior axis with transition at V3. Isochronal late activation mapping (ILAM) with HD-Grid showed deceleration zone at basal and mid-apical septal region. RFA was performed at MCV, anterobasal, mid-septum and apical region with steerable irrigated ablation catheter (TactiCath). However, the second PVC persisted and was easily induced and terminated by ventricular overdrive pacing. The procedure lasted for more than seven hours. He was then brought for alcohol septal ablation the next day. One of the septal branches was identified and total of 3 cc ethanol was introduced. VT was terminated soon after that.

Conclusion: Despite the advancement of three-dimensional mapping systems and ablation, this case is to highlight alcohol septal ablation as a bailout approach in a patient with incessant VT.

SUPPORTING DOCUMENTS

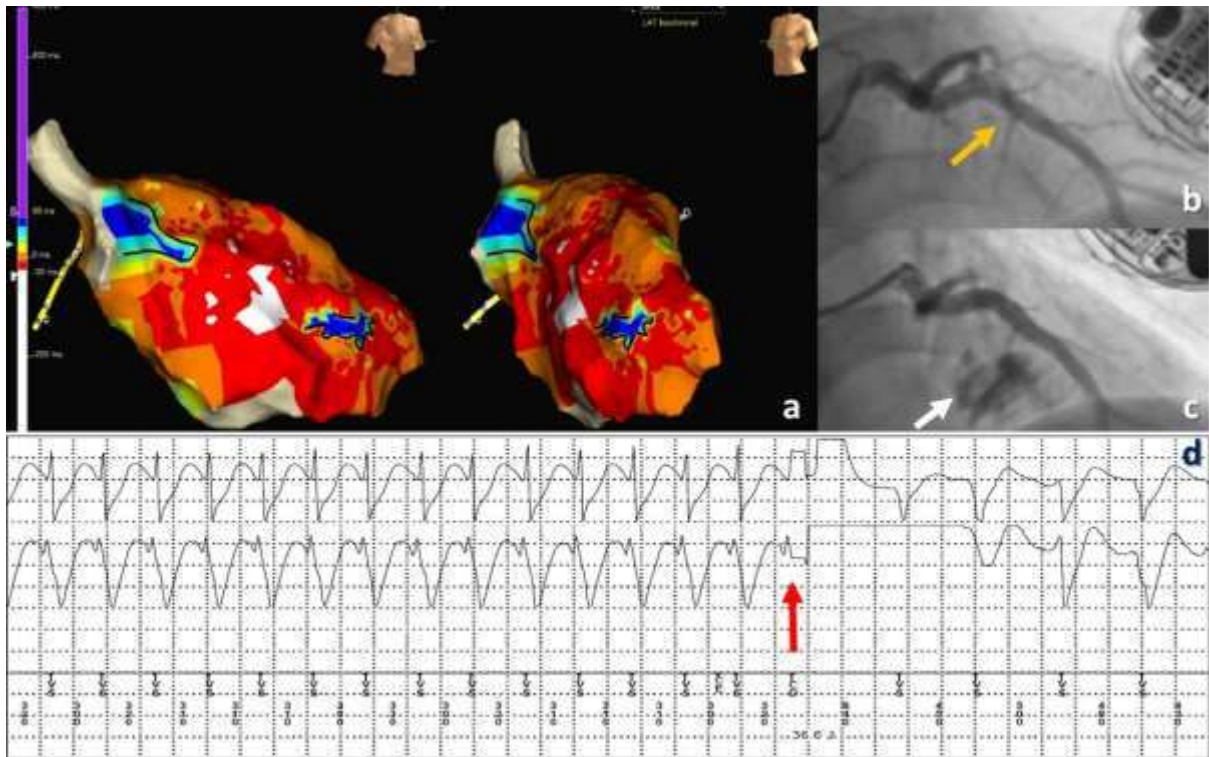


Fig 1, a: ILAM mapping; b: Targeted septal branch (yellow arrow) for alcohol septal ablation; c: Post alcohol septal ablation (white arrow); d: Device electrogram showed VT and ICD shock (red arrow) delivered.

The Correlation Between Mapping Catheters With Wavefront Propagation in Detecting Deceleration Zone

Dr Yoon Kee Siow¹, Dr Abdul Raqib ABD GHANI¹, Dr Nor Halwani HABIZAL¹, Dr Hartini MOHD YUSOF¹, Dr Sathvinder Singh GIAN SINGH¹, Dr Chin Yung CHEA¹, Dr Wei Shen CHEE¹, Dr Aimaduddin MAT DAUD¹, Dr Kamaraj SELVARAJ¹, Dato' Dr Asri Ranga ABDULLAH RAMAIAH¹, Datuk Dr Abd Kahar ABD GHAPAR¹

¹*Serdang Hospital, Malaysia*

Objectives: This case shows the correlation between different mapping catheters and propagating wavefront to detect deceleration zone of ventricular tachycardia (VT).

Results: 73 years old male, underlying ischemic heart disease and stented left anterior descending artery (LAD) in 2004. In 2020, he developed recurrent VT. Percutaneous coronary intervention (PCI) to stent restenosis of LAD was performed. Two weeks later, he was subjected to radiofrequency ablation (RFA) and subsequently implantable cardioverter-defibrillator (ICD) was implanted. One year later, he experienced multiple ICD shocks. PCI was done to mid-distal severe LAD lesion. During that admission, substrate mapping by Carto® system showed dense scar area over mid-apical anterior and basal inferior, with no area of deceleration zone. Seven months later, he was admitted again for multiple ICD shocks. During substrate mapping, HD-Grid® (HDG) demonstrated deceleration zone (isochronal crowding) (figure a) and fractionated signals (figure b) in apical septum. We noticed that there was rotational activation pattern described by Hattori et al. RFA was performed over apical, inferior and lateral region (figure c). Deceleration zone was eliminated post ablation (figure d).

Conclusion: Wavefront propagation is detected in parallel manner by conventional and multi-spline mapping catheters (figure e1 & e2). However, both catheters fail to detect the perpendicular wavefront propagation (figure e4 & e5). HDG catheter utilizes linear and orthogonal bipoles to detect highest amplitude wavefront for more reliable results (figure e3 & e6). Therefore, high-density mapping catheters and good tissue contact increase the detection of deceleration zone and successful rate of VT ablation.

SUPPORTING DOCUMENTS

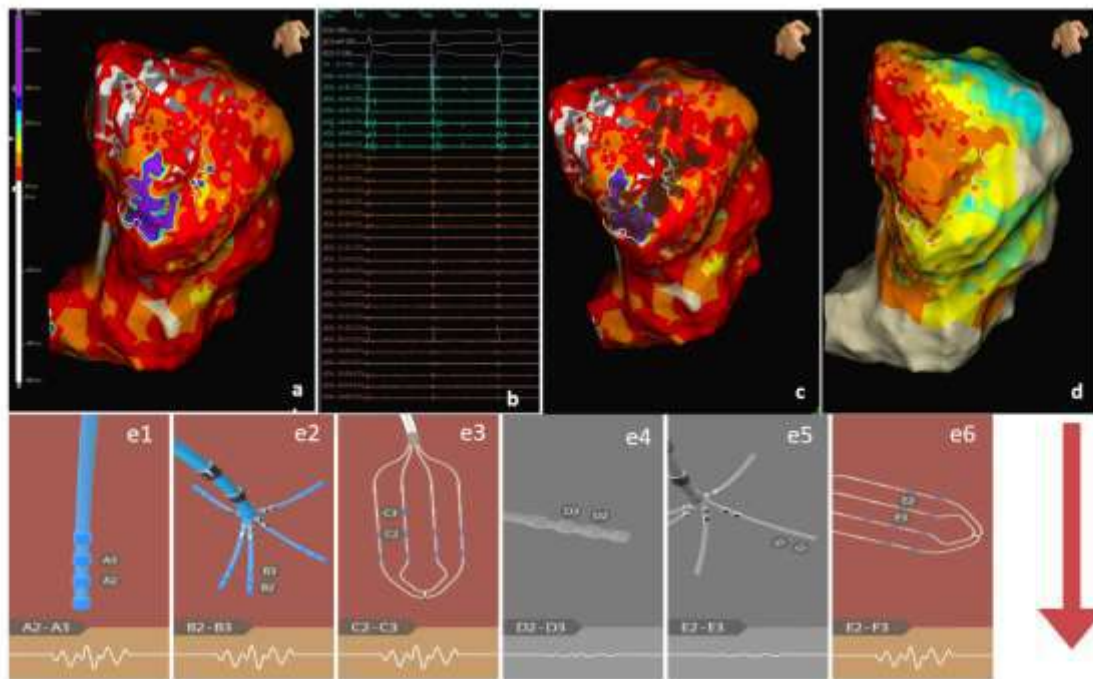


Figure 1. Refer texts for details. Red arrow (right lower corner) indicates the direction of wavefront propagation.

Health Economics of LV Summit versus Non-LV Summit VT: A Cost-Based Comparison of Non-Ischaemic Cardiomyopathies.

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Objective: Recurrent presentations with ventricular tachycardia (VT) represent a major cause of healthcare burden in non-ischaemic cardiomyopathy. The location of the VT exit whether at the left ventricular (LV) summit (i.e., the region at the bifurcation of the left main coronary artery) versus those elsewhere may have a different case-proposition. Understanding their cost implications can allow better financial planning for healthcare systems. We aim to characterise the costs of managing LV summit VTs versus VTs arising from other locations.

Methods: Patients with non-ischaemic cardiomyopathy and recurrent VT (11 patients) who underwent endo-epicardial mapping at a single centre from 2019 to 2021 were retrospectively reviewed. Three patients with LV summit VT were analysed against three comparable patients with clinical VTs from other locations. Data was obtained for inpatient stay costs (including bed days, allied-health services, medications, pathology), coronary care unit (CCU) days, emergency room (ER) and outpatient presentations, and cost of multiple ablation procedures (including surgical ablation).

Results: The median total cost for LV summit versus non-LV summit group was \$211,328 (range: \$143,637-\$268,087) vs \$78,495 (range: \$76,005-\$119,920). There was a similar cost pattern for CCU bed usage median \$92,929 vs. \$6,664; ER presentations: \$10,657 vs \$1,173; outpatient visits: \$14,476 vs \$6,897. The ablation costs were higher in the LV Summit group: \$29,320 (range: \$28,729-\$58,045) against \$15,451 (range: \$8,797-\$22,245).

Conclusion: There is higher healthcare economic burden for LV summit VTs, likely associated with the costs of recurrent presentations and multiple long inpatient procedures. Further large-scale studies are needed to validate these findings.

Hybrid Surgical Cryo-ablation and Endocardial Radiofrequency ablation in LVAD patients with Ventricular Tachycardia

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Objective

- Report efficacy and safety of cryo-ablation and endocardial radiofrequency ablation for ventricular tachycardia in patients with left ventricular assist device (LVAD).

Materials and Methods

8 LVAD patients underwent hybrid ablation for medically refractory VT. 4 presented with STEMI with LVAD implanted as INTERMACS I (Urgent group). 4 had chronic heart failure and received LVAD implant as INTERMACS II (Chronic group). Mean LVEF was 16%. All patients received amiodarone, lignocaine and mexiletine. One patient received stellate ganglion block, which failed to resolve the arrhythmia.

Intraoperative surgical epicardial and endocardial cryoablation at the time of LVAD implant were performed in 4 patients (Group U =3; Group C =1). All underwent endocardial VT ablation for recurrent VT (Group U 2.0 ± 2.8 months vs Group C 12.3 ± 7.5 months post LVAD).

Results

Intraoperative VT surgical and cryo-ablation successfully terminated incessant VT in 2 patients.

Radiofrequency

ablation achieved acute procedural success in all cases. 1 patient developed heart block requiring permanent pacemaker. 6-month VT-free survival was observed in 2 patients (Group U). 5 patients had recurrence within 30 days of procedure. At a mean follow-up of 26 months, transplant-free survival was observed in 4 patients (Group U 3 vs. Group C 1). The cause of death was non-arrhythmia-related.

Conclusion

High-risk (INTERMACS I) patients receiving LVAD implant and hybrid approach of intraoperative cryoablation followed by endocardial VT ablation appear to have favorable VT- and transplant-free survivals than their low-risk counterparts who did not receive intraoperative ablation procedure.

SUPPORTING DOCUMENTS

	Intraoperative cryoablation	6-month VT free survival	Transplant free survival *mean follow up of 26 months
Group U (n = 4)	3	2	3
Group C (n = 4)	1	0	1