APHRS Asia Pacific Heart Rhythm Society

News
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## CONTENTS



# Report:
# APHRS Summit Scientific Symposium

**Tachapong Ngarmukos, M.D.**

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Under collaboration from APHRS and the Thai EP club, the 2015 APHRS summit was held on April 4-5, 2015 at the Bangkok convention center at Central world. The venue is located in the center of Bangkok, which can be easily reach but the Bangkok mass transit system (BTS) or "sky train". The meeting has multiple aims.

1. The APHRS board members to prepare for APHRS 2015 in Melbourne.
2. The APHRS board member to work on the new APHRS office in Singapore, including signing up a new account.
3. The APHRS and the Thai EP club members to educate the Thai electrophysiologists, cardiologists and allied professionals.
4. The APHRS board member could evaluate a new potential site for future APHRS meeting.

*Dr. Kanchit Likitthanasombat, the president of the Thai EP club (left);Dr. Yoshinori Kobayashi, the Treasurer of APHRS (middle); Dr. Chu Pak Lau, secretary of general and the chair of global relations subcommittee of APHRS (right)*


*Dr. Young Hoon Kim, the president of APHRS, during the opening speech*

On the first day, scientific sessions were held. The sessions included knowledge update lectures, practical advices, controversial issues and cases discussion. There were 136 registered attendees. Among these are electrophysiologists, cardiologists, nurses and allied professionals from all regions of Thailand. There were also electrophysiologists from neighboring countries who attended the meeting.

*A view of APHRS summit scientific session*

*Dr. Pakorn Chandanamattha, the renowned member of the Thai EP club attending the meeting*

*Dr. Sirin Apiyasawat was giving the opening lecture on the AF demography for the summit in Thailand*


*Leadless pacemaker: (from right to left) Moderator Dr. Arisara Suwanagool; Dr. Pattarapong Makarawate , speaker Dr. Chu Pak Lau*

Concurrently, during the morning session the president professor Young Hoon Kim, president elect professor Wee Siong Teo and the treasurer professor Yoshinori Kobayashi went to sign for a new account for the APHRS new office in Singapore. During the afternoon sessions another meeting were held with some of the APHRS board members and our industries. This was to plan the Melbourne meeting, education supports for fellowships and various educational, hands-on or on line programs. Aiming to improve on patient's care in the Asia-Pacific region.

*Dr. Young Hoon Kim, the president, Dr. Wee Siong Teo, the president elect and Dr. Yoshinori Kobayashi, the treasurer of APHRS during the signature witnessing at the united overseas bank Siam square branch.*

On the second day, The APHRS board meeting was held. The past presidents professor Masayasu Hiraoka and professor Shih-Ann Chen, the president and the president elect were all present. Total 16 of the 21 members were presented. Professor Jonathan Kalman reported on the progress of the Melbourne meeting via teleconference. Subcommittee chairs presented update on the progression of each subcommittee including the progress on the new office in Singapore, requirement to have an official election for the new president. The issues of journal of arrhythmia were discussed extensively. We discussed ways to try to improve the number of APHRS members. Education and certification for our allied professionals in the AP region was what APHRS will try to achieve soon. We are continually establishing relationship with others electrophysiology societies and regional cardiology societies. The board members were keen to increase disease awareness program, mainly atrial fibrillation and sudden cardiac death. Look out for the APHRS social network, establishing soon.

The board members agreed that the second APHRS summit meeting in Bangkok was a success; we are looking forward to the third summit in Indonesia. Thailand is likely going to be the host of the APHRS 2019.

*From Left to right: The first president of APHRS, Dr. Masayasu Hiraoka. The president of APHRS, Dr. Young Hoon Kim. The immediate past president of APHRS, Dr. Shih-Ann Chen and the president elect Dr. Wee Siong Teo*


*Case presentation by Dr. Dujdao Sahasthas, (from left to right) Moderator Dr. Warangkna Boonyapisit, Dr. Buncha Sansaneewitthayakul, Panelist Dr. Kazuo Matsumoto, Dr. Yoshinori Kobayashi, Dr. Mohan Nair, Dr. Chun-Chieh Wang, Dr. Charn Sriratansathavorn, Dr. Chang-Sheng Ma*


*A group photo of board members and subcommittee chairs were taken after the summit meeting.*
*First line from left to right: Drs.Takashi Nitta, Wee Siong Teo, Young Hoon Kim, Masayasu Hiraoka, Shih-Ann Chen, Yoshinori Kobayashi, Kazuo Matsumoto*
*Second line from left to right: Drs. Muhammad Munawar, Yong Seon Oh, Mohan Nair, Chu Pak Lau, Chang-Sheng Ma, Juin Chueh Wang, Tachapong Ngarmukos*

# Clinical Characteristics and Catheter Ablation of Accessory Pathways Located Along the Coronary Venous System

**Yoshinori Kobayashi, MD, PhD**

*Department of Internal Medicine, Division of Cardiology, Tokai University Hachioji-hospital*

Wolff-Parkinson White (WPW) syndrome is still a target of catheter ablation, and must not be failed. We need to know how to ablate. The catheter ablation for the epicardial posterseptal and left posterior accessory pathways (Epicardial-APs) is still challenging in the clinical practice because of the difficulty in reaching to the ideal target site and high incidence of the procedure related complications. The prevalence of the Epicardial APs is shown to be approximately 20% of all left posteroseptal Kent bundles and 3-4% of the whole patients of WPW syndrome. The Epicardial-APs are composed of structural connections between the coronary sinus (CS) musculature which extends along CS, midcardiac vein (MCV), posterior coronary vein (PCV) and CS diverticulum, and the epicardial surface of the left ventricle[1]. Because the CS musculature (CS myocardial coat of sleeve-like configuration) is located near the epicardial site and the connection of sleeve muscle and the left atrium is extensive often showing an oblique course, the success rate of ablation by the endocardial approach has remained unsatisfied. Then the radiofrequency (RF) deliveries from the lumen of the coronary venous system have been applied and the acute success rate was improved. In this case, the ablation is usually targeted on the site at which a spiky accessory pathway (AP) potential preceding either QRS complex or earliest ventricular activation is recorded in the local electrogram. However even using the transvenous epicardial approach, the success rate of ablation remained in relatively low level, which was 60-80%[1,3]. Further the RF application from within the veins has potential risks of severe complications such as perforation of the CS, stenosis or occlusion of the coronary venous system and coronary arteries which is commonly located near the ideal ablation site[1,4]. Recently, a cryoablation is shown to decrease the incidence of the coronary artery injury, thus to be a preferred method of ablation to expect a greater safety[3]. For the refractory Epicardial-APs using the transvenous approach, the percutaneous epicardial approach have been introduced and shown to be an alternative method to achieve the successful results [5-7].

## Anatomical Substrate of the Epicardial-APs

The anatomy of the posteroseptal region has some complex features. This area includes the pyramidal space, which represents the confluence of all cardiac chambers, and the CS in their close proximity. APs in this region have a variety of courses as shown in the previous report[1,4]. Out of these, in about 20% of posteroseptal APs, the ventricular preexcitation results from CS musculature connections to the left ventricle and the left atrium. Approximately 70% of the Epicardial-APs occur in the patients with normal CS anatomy[1]. CS myocardial coat connects to left atrium with broad myocardial strand that renders the ablation targeted on the atrial interface of APs difficult to achieve (A schema is shown in Figure-1). The sleeve muscle extends along the MCV and PCV, and then connect to the epicardial surface of the left ventricle. Thus it is suggested that the Epicardial-APs without CS anomaly might be formed with these sleeve muscles and the connecting bundles to both the atrium

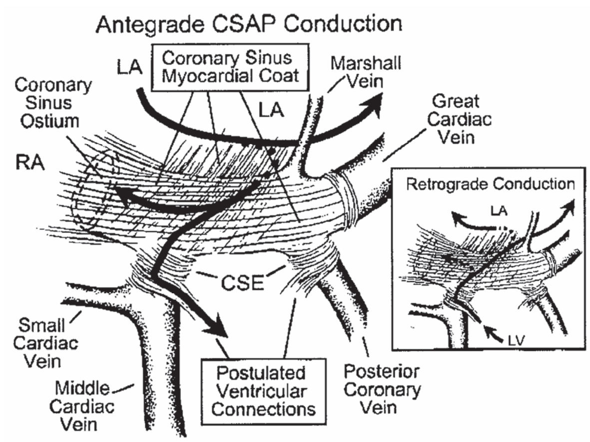


*Figure-1. Schematic representation of coronary sinus-ventricular AP formed by CS musculature.*
*CSAP: Accessory pathway formed by a connection between CS myocardial coat and the ventricle.*
*CSE: CS myocardial extensions (From the reference-1, Figure-1)*

and the ventricle. While in the remaining 30% of the Epicardial-APs, these are associated with the CS anomaly such as the diverticulum originating from true CS (75%) or MCV (25%)[1]. The most of the CS diverticula originate within 1.5 cm of the CS ostium. A representative cine-frames of the CS diverticulum are shown in Figure-2. In this patient, it is located in 1.0 cm from the CS ostium with a relatively simple structure. It is also shown that about 10% of the diverticula have multiple lobes and/or complex geometry[1].

## Electrocardiographic Diagnosis of the Epicardial-APs

Arruda et al.[8] previously constructed a diagnostic algorithm using surface electrocardiography (ECG) in 135 consecutive patients for identifying APs' ablation site in WPW syndrome (Figure-3). This algorithm was subsequently validated prospectively in 121 consecutive patients. It was also shown that this algorithm was particularly useful in correctly localizing the Epicardial-APs as well as anteroseptal and mid-septal APs. A representative ECG in a patient with an Epicardial-APs is shown in Figure-4. The delta wave of lead I is positive and there is no R waves in lead V1 (Step 1), then we can appreciate a deep negative delta wave in lead II. According to the proposed flow-chart (Figure-3), this AP is identified as an Epicardial-AP which can be ablated within the coronary venous system. Later, a larger study from the same institute 1 demonstrated that the sensitivity of the negative delta wave in lead II in identifying the Epicardial-APs was lower than the previous study[8]. In addition to the negative delta wave in lead II, a steep positive delta wave in lead aVR and a deep S wave in lead V6 were also shown to be predictors of the Epicardial-APs[9].

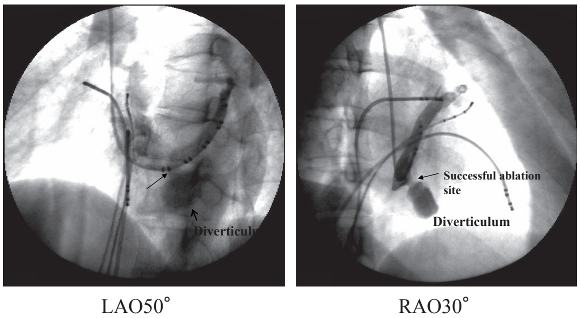


*Figure-2. A representative cine-flames of CS diverticulum A CS diverticulum of simple shape originates in <1 cm of CS ostium.*
*A radiofrequency delivery on the neck of the diverticulum 8For the local electrogram of this site is shown in Figure-5) eliminated the delta wave (Figure-4).*

## Electrophysiological Mapping and Catheter Ablation for the Epicardial-APs

If such electrocardiographic features are confirmed in the surface ECG, retrograde CS angiography is recommended to perform[1,4]. The technique of the retrograde CS angiography is described in detail[1]. As it is noted before, about 30% of the Epicardial-APs are associated with the CS anomaly including the diverticulum and fusiform enlargement. After obtaining the anatomical characteristics of the coronary venous system, the mapping along the coronary venous system should be carefully undertaken. The diagnostic criteria for the Epicardial-APs have been shown as follows[1,4].

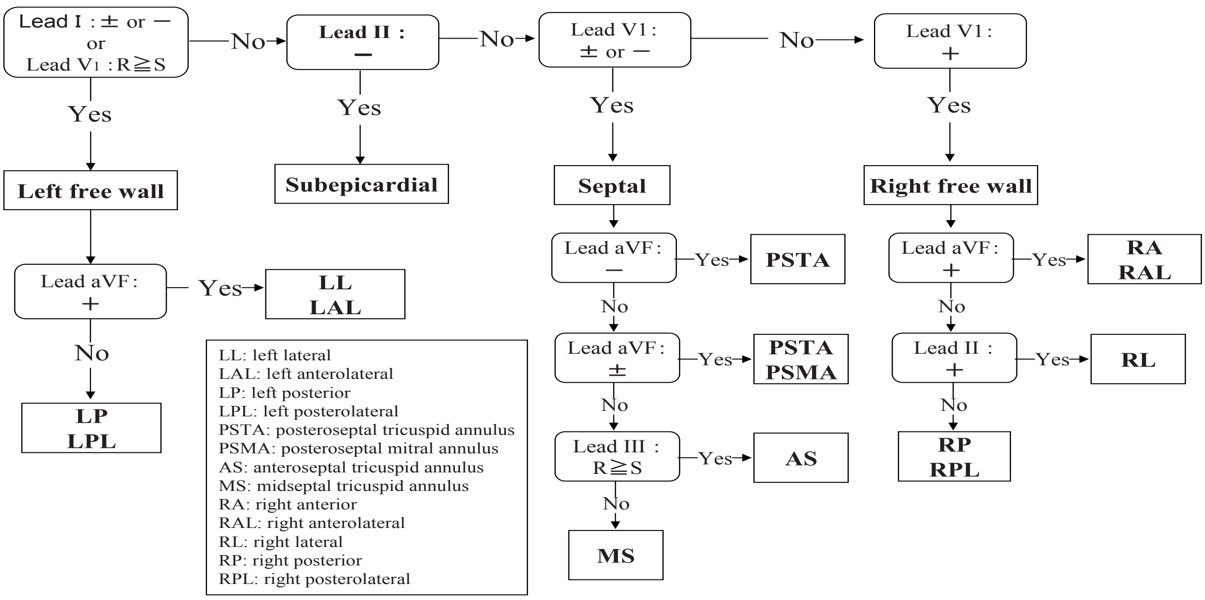


*Figure-3. Stepwise ECG algorithm for predicting accessory pathway location (From the reference-8, Figure-4).*

1) During antegrade conduction through APs
   a) A high frequency potential similar to AP potential can be detected at CS muscular extension recorded from MCV, PCV or CS diverticulum before ventricular activation (Figure-5).
   b) CS muscular extension potential can be dissociated from local atrial and ventricular activity by programed stimulation (for details see the references)
   c) Rapid downstroke in unipolar endocardial ventricular electrogram is seen >15 ms later than the onset of far-field ventricular potential recorded near the mitral or tricuspid annulus (for details, see the references).
2) During retrograde conduction through APs (for details, see the references)
   a) Earliest high frequency potential similar to AP potential recorded from MCV, PCV or CS diverticulum.
   b) CS muscular extension potential followed by activation of CS muscular coat near the orifice of the vein.
   c) CS muscular potentials propagate leftward, activation left atrium before right atrium.
   d) CS muscular extension potential can be dissociated from local atrial and ventricular activation.

The connections to the epicardial left ventricle most commonly occur in the MCV, followed by PCV. These are located 5 to 20 mm deep inside of the CS branches. Whereas in the patients with CS diverticula, the connections are commonly observed at the neck of the diverticula (Figure-2 and Figure-5).

The catheter ablation within the coronary venous system should be carefully done because there is a high risk of the impedance rise during RF application from within the veins and diverticula. Since the blood flow is scarce inside of the veins,

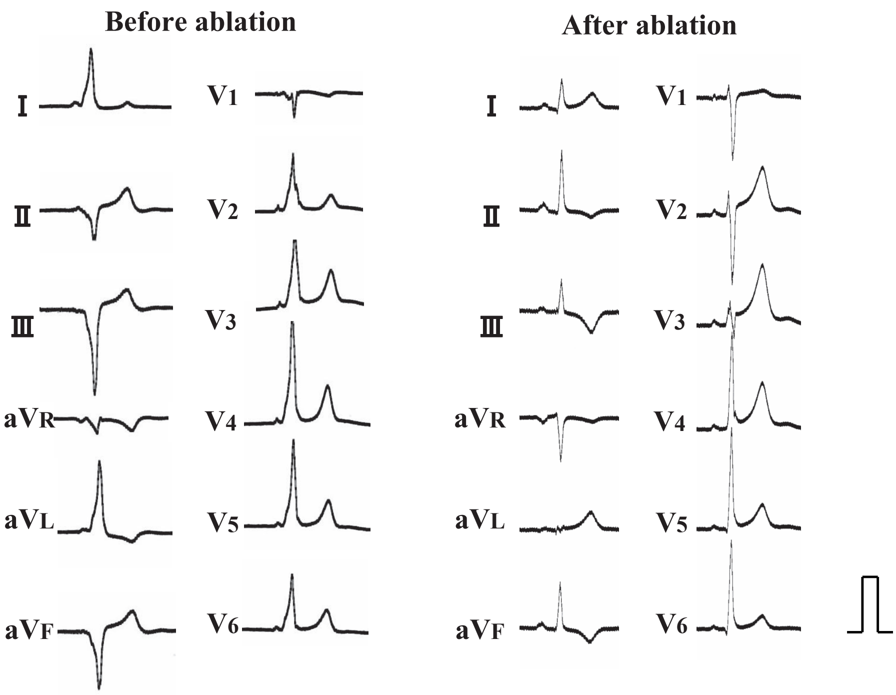


*Figure-4. A representative surface ECGs of an Epicardial AP comparatively shown before and after the successful catheter ablation.*

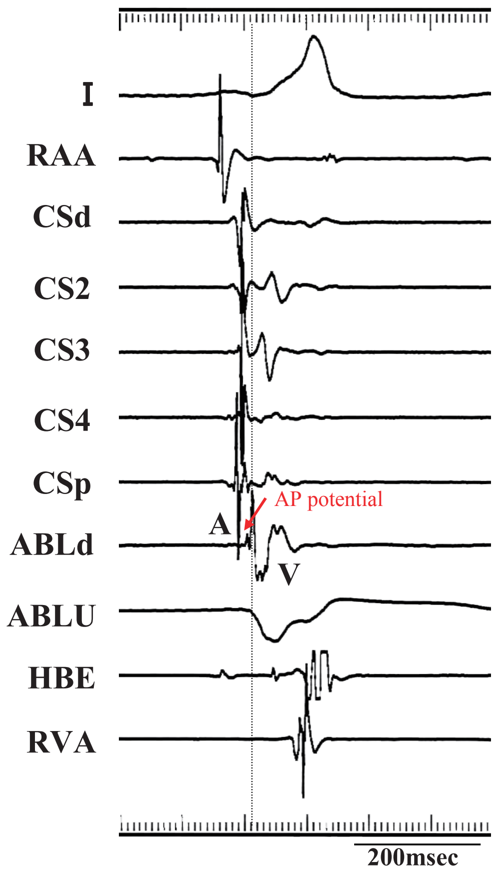


*Figure-5. Local electrogram of successful ablation site of the Epicaldial AP associated with CS diverticulum. A spiky potential (indicated by a red arrow) preceding the earliest ventricular activation is recorded at the successful ablation site (the neck of the diverticulum) (Figure-2)*
*RAA: right atrial appendage, ABL: local potential of the ablation site. (d: distal U: unipolar).*

the cooling effect is small, often resulting in the low power delivery and coagula formations. To get a greater power delivery and to avoid the coagula formations, an irrigation catheter system is recommended to use.

## Procedure Related Complications and Alternative Methods of the Catheter Ablation

Recently, it was demonstrated 3 that the incidence of coronary artery stenosis by the RF application from within the coronary venous system is quite high (50%), if the distance between the ablation site and the closest coronary artery (right coronary artery, left circumflex artery or these branches) is less than 2mm. A representative case is shown in Figure-6. Further, it should be noted that most of the ideal ablation site was located in the vicinity of the coronary artery <2mm (100 out of 169 patients) (59%). The coronary artery stenosis ranged from 25% to total occlusion (28% of the total) in which balloon angioplasty was applied. It was also demonstrated in the same report that in the high risk patients of coronary artery stenosis, that is, the distance between the ideal ablation site and coronary artery <5mm, the cryoablation is a preferred option to avoid this severe complication, although the single procedure success rate at the ideal site remains lower for cryoablation (77%) as compared with RF ablation (90%).

The percutaneous epicardial approach (subxiphoid approach) has been a possible alternative for catheter ablation of the Epicardial-APs in the previous failure cases using the transvenous approach[5,6]. The clinical role of this approach is reviewed in a recent report with a relatively large population (21 patients)[7].

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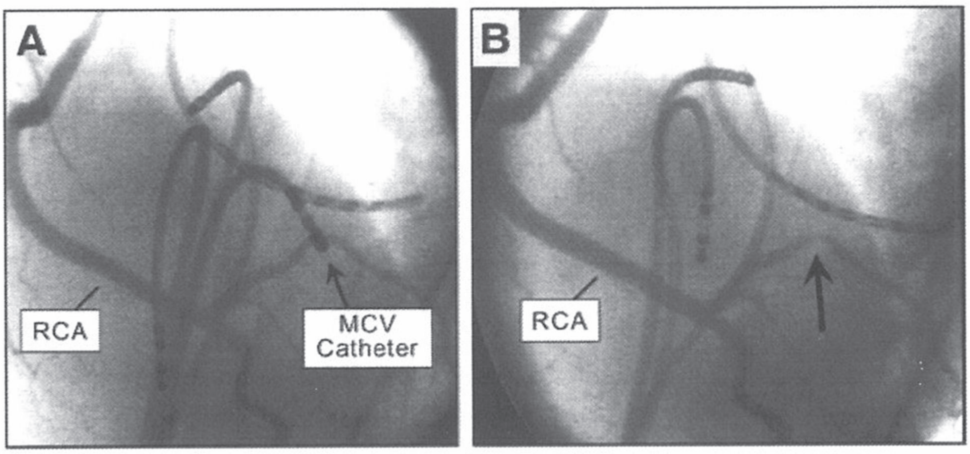


*Figure-6. Cine-flames in the LAO projection of RCA angiography.*
*A: Before the ablation, B: After the ablation applied in the MCV.*
*After the ablation there is a 90% stenosis of the posterolateral branch of the RCA From the reference-3, Figure-3).*

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# New Technology Spotlight: *Absorbable Antibacterial Envelope: More New Data from HRS 2015 at Boston*

**Hsiang-Chiang Hsiao, M.D.**
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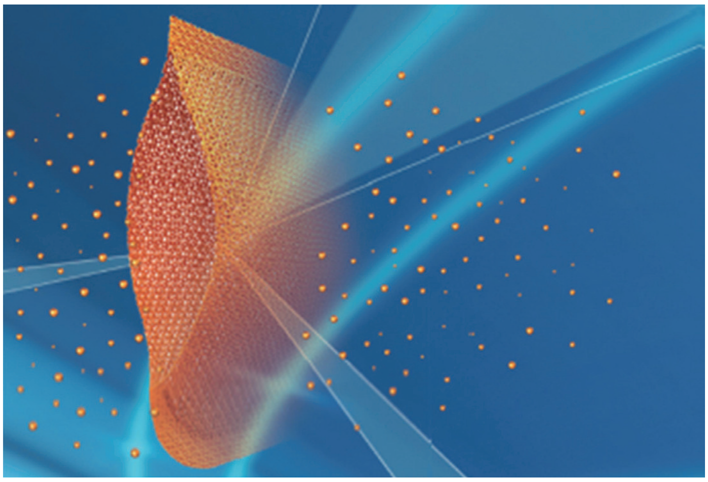
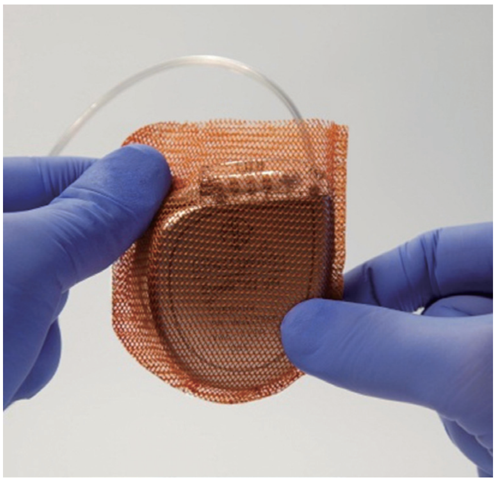


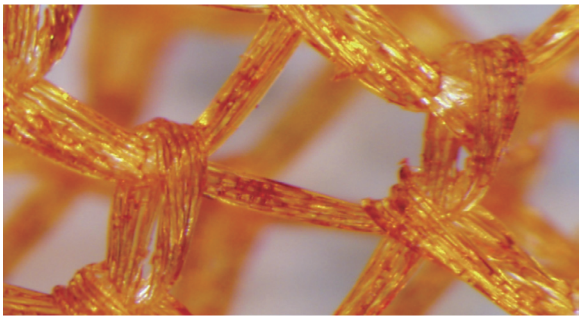


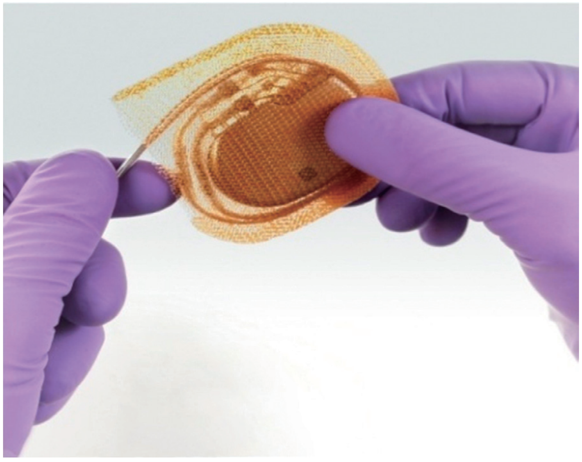
At the Heart Rhythm Society's 36th Annual Scientific Sessions in Boston, several study results of TYRX™ Absorbable Antibacterial Envelope have been published to demonstrate that the device is capable of cutting down on infections and complications in patients one year after they were implanted with a cardiac device, compared to individuals in a control group who did not receive an envelope. Less than 1% of individuals outfitted with the envelope developed an infection at the site of surgery, whereas 2.2% of individuals without the envelope reported infections or complications. The studies were carried out among 1,129 patients at 55 centers across the U.S by Vanderbilt University Medical Center researchers

*On the other hand, the* Citadel/Centurion trial based on high-risk infection patients is also encouraging by demonstrating a low surgical site infection rate of mere 0.44% observed in all of the patients implanted with the TYRX Envelope compared to a control group, at 12 months

As the APHRS 2014 held at Delhi, India last year had already provided a terrific forum to showcase this exciting technologies now available in the region. TYRX™ Absorbable Antibacterial Envelope, among others, is a novel product that is designed to stabilize placement of a Cardiac Implantable Electronic Device (CIED) such as a pacemaker or ICD, and helps reduce device related infections. The TYRX™ Absorbable Antibacterial Envelope, currently manufactured by Medtronic, was originally developed by TYRX, Inc. in the U.S. Medtronic acquired TYRX, Inc. in December 2013 and has recently launched the second generation, fully absorbable product in several countries around the world, including the U.S., European Union, Canada, the Middle East, and Southeast Asia. The TYRX™ Absorbable Antibacterial Envelope is constructed from multifilament knitted mesh that is coated with a bioabsorbable polyarylate polymer. The envelope contains two antibiotics, rifampicin and minocycline, which elute into the tissue pocket for a minimum of 7 days after implantation.

The TYRX™ Absorbable Antibacterial Envelope has been shown to help reduce CIED infections from 70%-90% in high-risk patients in four U.S. clinical studies.[1-4] Medtronic announced first enrollments in the WRAP-IT (**W**orld-wide **R**andomized **A**ntibiotic Envelo**P**e **I**nfection Preven**T**ion) Clinical Study in January 2015, which will provide the first prospective, randomized, global evaluation of the technology.[5] Several sites across Asia Pacific will participate in the study, including Institut Jantung Negara (IJN) National Heart Institute (Kuala Lumpur, Malaysia). Datuk Dr Razali Omar, Consultant Cardiologist & Electro Physiologist at IJN National Heart Institute, was the first to implant this novel technology in Asia and will be participating in the WRAP-IT Study.





*"We are excited to have this new technology available in Malaysia and across the region. Device infections are a severe and costly complication. We have adopted the TYRX Absorbable Envelope into our practice for high-risk patients, including CRT-D implants or device replacements. We look forward to participating in the WRAP-IT study to better understand the benefit to our patients here at IJN, and around the world."*

The TYRX™ Absorbable Antibacterial Envelope has also been implanted in Brunei, Hong Kong SAR, and Singapore. Medtronic is currently in the process of launching the product throughout the region to be able to benefit more patients across Asia Pacific.

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5. Medtronic Announces First Patient Enrollment in the WRAP Infection Trial, January 7 2015. http://newsroom.medtronic.com/phoenix.zhtml?c=251324&p=irol-newsArticle&ID=2004687


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# ECG Quiz

**The model commentary will be provided in the next issue No.20**

**Chang-Sheng Ma, MD**

*Professor of Medicine,Department of Cardiology, Beijing Anzhen Hospital, Capital Medical University, Beijing, China*

A 62-year-old man was admitted because of recurrent episodes of palpitation at 3 months after catheter ablation for symptomatic atrial fibrillation. The 12-lead electrocardiogram (ECG) recorded during the episode of palpitation is shown below. Please answer following questions.

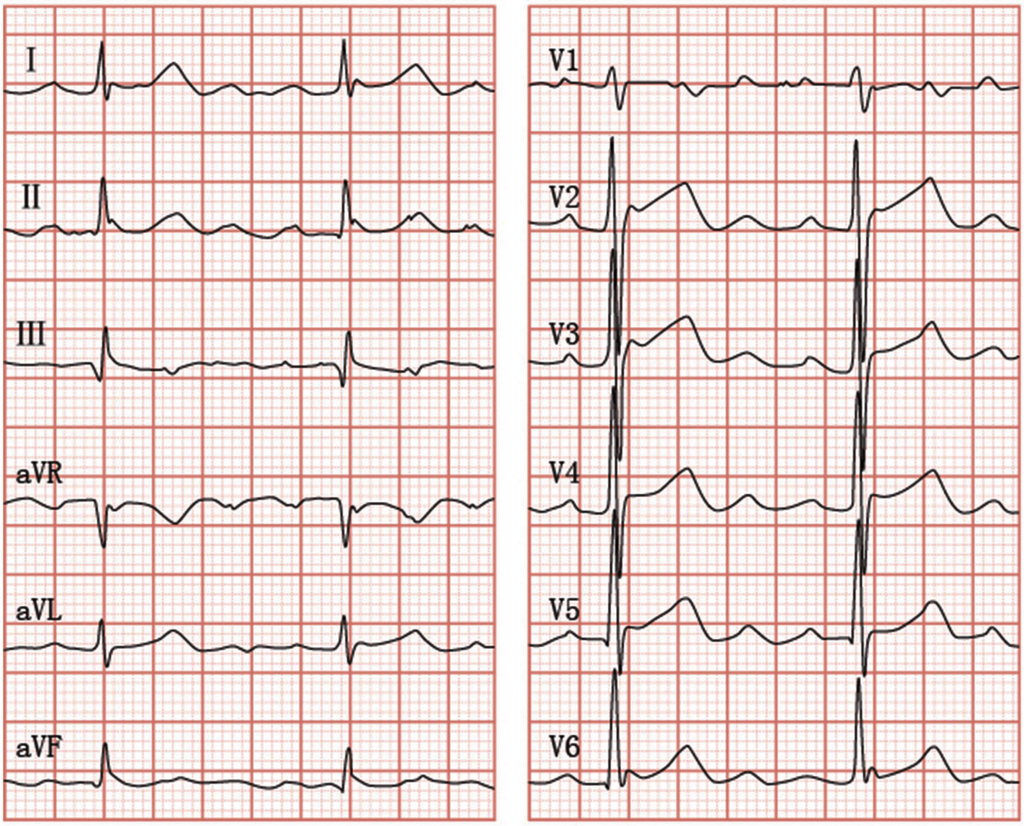


*Fig. 1. ECG during the episode of palpitation*

### Questions 1:

What is the diagnosis of this ECG ? (Select one)

1. Atrial fibrillation with III° AVB
2. Atrial flutter
3. Focal atrial tachycardia
4. Macro-reentry atrial tachycardia

### Question 2:

Where is the origin or main locus of the arrhythmia? (Selectone)

1. Right inferior pulmonary vein
2. Superior vena cava
3. Right superior pulmonary vein
4. Crista terminalis
5. Left inferior pulmonary vein

### Question 3 :

What are the possible mechanisms of this arrhythmia? (Multiple Answer possible)

1. Focal tachycardia originate from the left atrium myocardium near the previous circumferential lesions around the pulmonary veins (PVs).
2. Pulmonary vein tachycardia originates from the pulmonary veins PVs after incomplete lines of ablation and activates the left atrial through a reconnection gap between the left atrial and PVs
3. Cavo-tricuspid isthmus-dependent flutter
4. Mitral isthmus-dependent atrial flutter
5. Macro-reentrant atrial tachycardia

# EP Image: Pulmonary Vein to Esophageal Fistula after Staged Hybrid Totally Thoracoscopic Surgical and Percu-taneous Radiofrequency Catheter Ablation

**Dong Seop Jeong, M.D., Young Keun On, M.D.**

*Samsung Medical Center, Sungkyunkwan University School of Medicine*

A 37-year-old man was admitted to our hospital diagnosed with lone long-standing persistent atrial fibrillation refractory to medical therapy and several attempts of cardioversion. The patient underwent totally thoracoscopic epicardial ablation without any intraoperative or postoperative complications, followed by percutaneous postprocedural electrophysiologic confirmation including cavo-tricuspid isthmus block on the tenth postoperative day by the cardiology department. He was discharged home in sinus rhythm six days after the hybrid procedure.

About two weeks later after discharge, the patient was admitted to the emergency room showing right side motor weakness and paresthesia of both upper and lower extremities. Computed tomography (CT) of the chest (Figure 1) and brain was performed. Emergency echocardiography was performed to reveal many intracardiac floating microbubbles.

With the suspicion of a left atrial or pulmonary venous to esophageal fistula, urgent operation was decided. A small sized fistula about 2 to 3 mm in diameter was visualized between the right lower pulmonary vein and the anterior surface of the esophagus (Figure 2). The fistula opening on the esophageal side was carefully debrided and repaired.

Alert mentality was recovered on the third and he was discharged fully recovered without any sequelae.

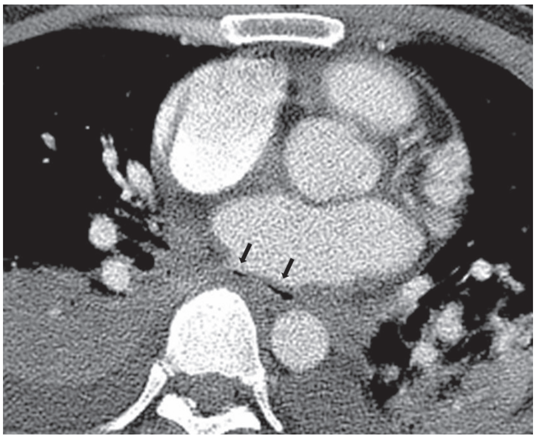

*Figure 1. Chest CT revealed a collection of loculated air measured up to 2 cm in diameter between the right side of the left atrium and the esophagus.*

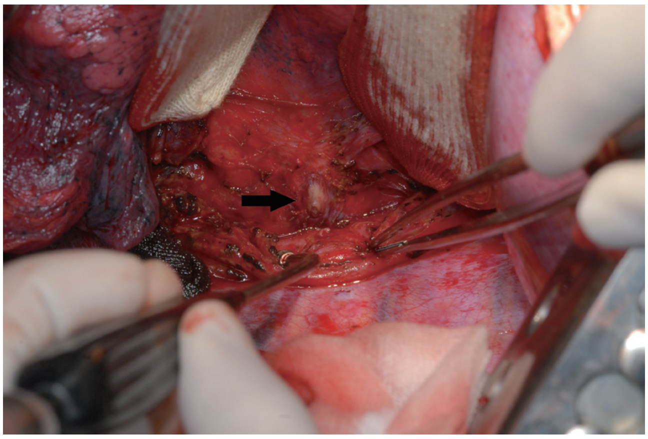

*Figure 2. Intraoperative photograph of the fistula between the anterior surface of the esophagus and the right lower pulmonary vein.*

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# EP World: Tokyo Medical and Dental University (TMDU) Hospital

**Kenzo Hirao, M.D., Ph.D.**

*Tokyo Medical and Dental University*

## Hospital Overview

Tokyo Medical and Dental University (TMDU) Hospital was found in 1928 and has been the core medical institute in central Tokyo region. TMDU consists of the Medical Hospital including Emergency Center, the Dental Hospital and Clinical/Basic Research facilities. TMDU hospital has provided the highest level of medical care for more than 550,000 outpatient visits and 250,000 inpatients.

## Hospital Information

| | |
|---|---|
| Address: | 1-5-45, Yushima, Bunkyo-ku, Tokyo, 113-8519, Japan |
| Telephone: | +81-1-3813-6111 |
| No. of beds: | 800 |
| No. of staff: | 2235 employees (including 468 physicians, 158 residents, and 738 nurses) |

## Heart Rhythm Center

Director: Kenzo Hirao, M.D. (Professor)
Sub-director: Masahiko Goya, M.D. (Associate Professor)
Clinical Electrophysiologyst: Mihoko Kawabata, M.D.
Takeshi Sasaki, M.D.
Susumu Tao, M.D.
Yasuhiro Shirai, M.D.
Takuro Nishimura, M.D.

## Access Information

### From Tokyo Station

Take JR Chuo line (rapid service) bound for Takao region; get off at Ochanomizu Station: walk within 3 minutes.

Or take Tokyo Metro Marunouchi Line bound for Ikebukuro; get off at Ochanomizu Station: walk within 1 minute.

### From Tokyo International (Haneda) Airport

Take Tokyo Monorail bound for Hamamatsucho-station; get off at Hamatsucho terminal; then take JR Yamanote line bound for Tokyo station; get off at Tokyo station; take JR Chuo line (rapid service).

### From New Tokyo International (Narita) Airport

Take JR Narita Express bound for Tokyo region; get off at Tokyo station; take JR Chuo line (rapid service) or Tokyo Metro Marunouchi line.

Heart Rhythm Center is leading electrophysiological and catheter ablation laboratory in Japan and characterized by a unique combination of electrophysiologist, scientists, pediatric doctors, cardiac surgeons, nurses and technicians. Heart Rhythm Center belongs to the Medical Hospital of Tokyo Medical and Dental University and collaborates with the department of Cardiovascular Medicine.

Heart Rhythm Center and Department of Cardiovasular Medicine provide for patients with heart disease, including prompt and reliable revascularization by PCI and endovascular therapy. There are 4 cath labs in the institute of which two rooms procedure suite designed to perform diagnostic, therapeutic and interventional cardiology and electrophysiology. Those labs are dedicated to catheter ablations with three-dimensional mapping system, CARTO and NavX.

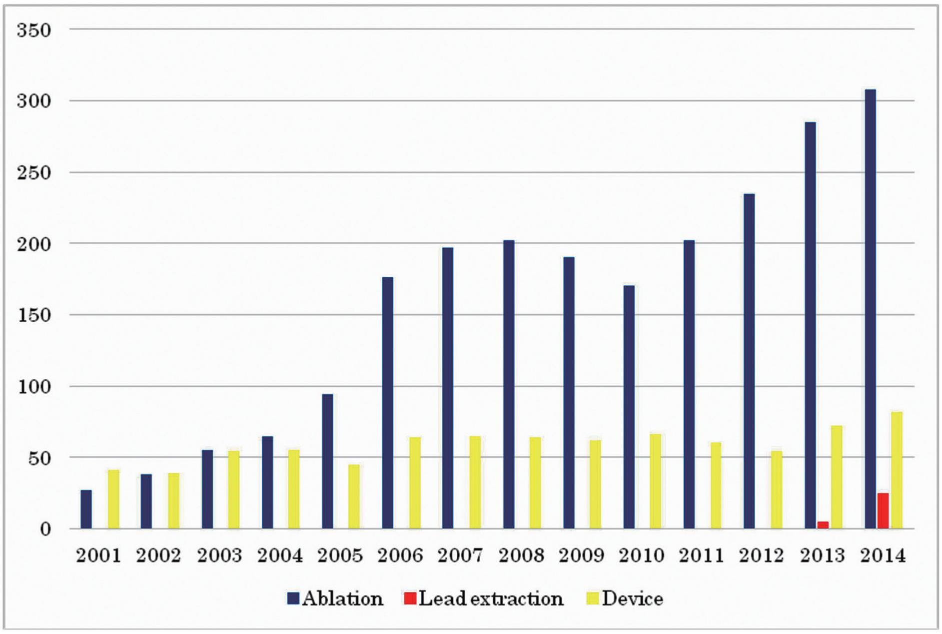
Heart Rhythm Center is dedicated in the

evaluation and management of all heart rhythm abnormalities. We provide invasive and non-invasive diagnosis and management including: ablation therapy, anti-arrhythmic drug management, pacemaker implantation & follow-up, defibrillator implantation & follow-up, Holter monitoring, cardioversion, cardiac resynchronization therapy (CRT), loop recorder implantation & follow-up, and sudden cardiac death risk assessment.

In 2014, 308 catheter ablations (176 of them were paroxysmal or persistent atrial fibrillation), 83 device implantations and 25 lead extractions were performed.

Prof. Kenzo Hirao has contributed to the development of Japanese interventional electrophysiology. He is not only a cardiologist, especially EP specialist, but researcher and educator. He is one of the frontiers who developed catheter ablation in Japan.

*Prof. Hirao (front row center) with his EP group members*

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# ECG Commentary Related to the Quiz in the No. 18 Issue

**Chiu Shuenn-Nann, MD**

*National Taiwan University Hospital*

## Commentary:

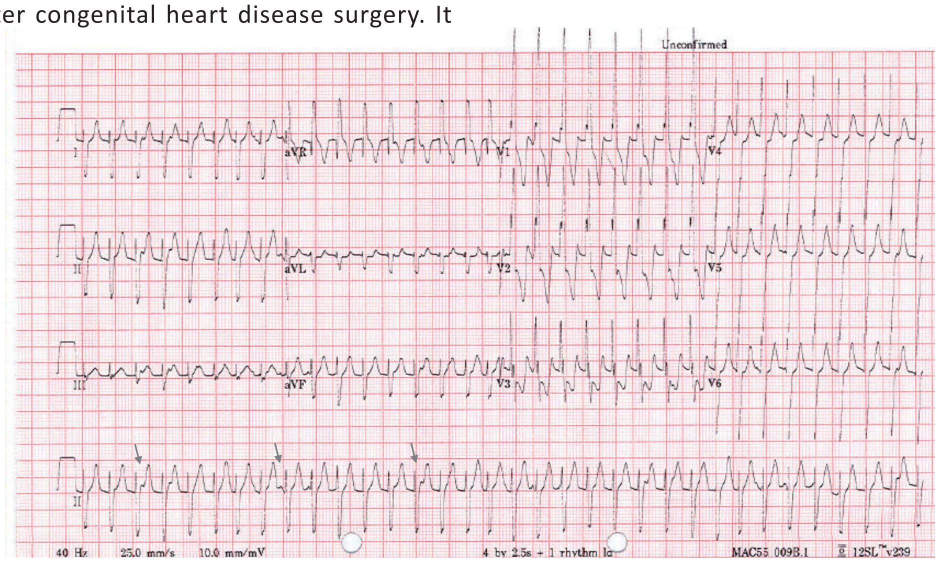
### Answer 1

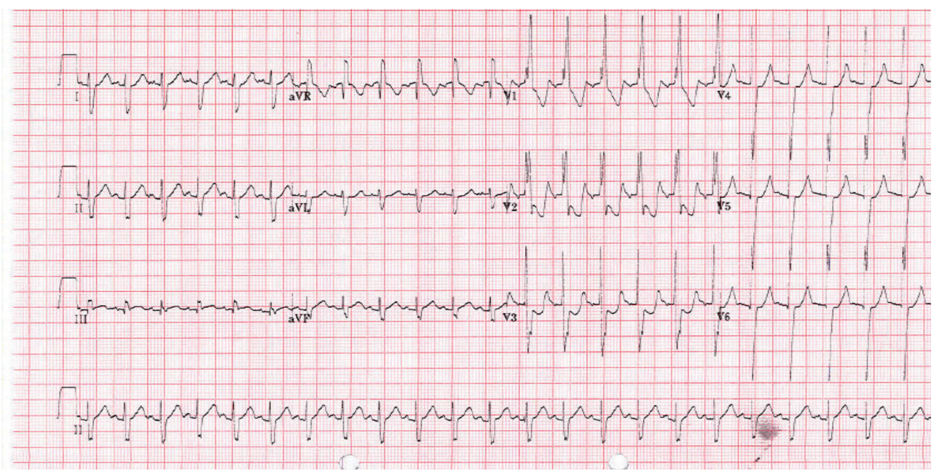
3. Junctional Tachycardia with CRBBB

### Answer 2

2. Echo-cardiography
5. Amiodaron infusion

The EKG showed wide QRS tachycardia with heart rate around 200bpm. VA dissociate could be identified at long lead II. The possible mechanisms include ventricular tachycardia and junctional ectopic tachycardia (JET) with bundle branch block. It is important to identify these two mechanisms as ventricular tachycardia often implied the underlying postoperative hemodynamic problem as myocardial damage or cardiac tamponade. It often associated with deteriorated condition, and rapid correction as DC cardioversion is often necessary. For the junctional ectopic tachycardia, it is relative benign and is a common complication after open heart surgery especially for the patients receiving ventricular septal defect repair. The right bundle branch block is a common postoperative EKG change after congenital heart disease surgery. It often resulted from the right bundle branch injury either during ventricular septal defect repair or after right ventricular outflow tract incision. Therefore, although JET associate with right bundle branch block is not common in general population, it is common in patients after congenital heart surgery. In this case, tracing back his EKG monitor, warm-up phenomenon could be identified. Therefore, JET with right bundle branch block is suggested. The postoperative JET is often controlled by cooling or intravenous amiodarone. Although it often subsided within 3-7 days after operation, it could sometime cause hemodynamic deterioration. The EKG below showed that after JET conversion by amiodarone, the right bundle branch block still existed during sinus rhythm.

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