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CSPE: THREE DECADES OF ADVANCING CARDIAC ELECTROPHYSIOLOGY AND PACING IN CHINA

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Introduction

Founded in Beijing in 1994 under the Chinese Medical Association, the Chinese Society of Pacing and Electrophysiology (CSPE) has played a central role in the development of heart rhythm medicine in China. Over the past three decades, CSPE has helped guide the clinical application of cardiac electrophysiology and device therapy, promote standardized professional training, develop Chinese guidelines and expert consensus documents, and strengthen academic exchange among heart rhythm professionals.

Its biennial scientific meeting has become one of China's most influential academic platforms in cardiac electrophysiology and pacing. More than a national congress, it reflects the changing priorities of the specialty and provides a shared forum for scientific discussion, technical education, professional development, and collaboration.



The First Committee of the Chinese Society of Pacing and Electrophysiology (Beijing, 1994)

CSPE2024: Celebrating 30 Years of Progress

The 15th Biennial Scientific Meeting of the Chinese Society of Pacing and Electrophysiology, CSPE2024, was held at the Beijing International Convention Center from 10 to 13 October 2024. The meeting coincided with the 30th anniversary of CSPE. Its theme, "Thirty Years of Inspiration, Moving Forward with Heart," recognized the achievements of several generations of Chinese electrophysiologists while looking towards the future of the specialty. Since its establishment, CSPE has witnessed and contributed to remarkable changes in arrhythmia care in China. Clinical practice has progressed from conventional pacing and basic electrophysiological studies to advanced three-dimensional mapping, complex catheter ablation, conduction system pacing, leadless pacing, remote device monitoring, and increasingly individualized rhythm management.



CSPE2024 provided an opportunity to review this development and consider how new technologies should be evaluated, standardized, and translated into better patient care.

- ***A Comprehensive Scientific Program***

The program was organized around the major domains of contemporary heart rhythm medicine. Sessions addressed new developments in the diagnosis and treatment of arrhythmias, atrial fibrillation, cardiac implantable electronic devices, ventricular arrhythmias and sudden cardiac death, antiarrhythmic drug therapy, non-invasive electrocardiology, innovation and translation, and basic electrophysiological research.

Live and recorded procedural demonstrations connected scientific discussion with clinical practice. These sessions allowed participants to examine procedural workflows, mapping strategies, implantation techniques, complication prevention, and clinical decision-making.

The program also highlighted technologies that are reshaping the field, including pulsed field ablation, high-density mapping, intracardiac imaging, leadless pacing, and conduction system pacing. Rather than focusing only on technological novelty, discussions considered patient selection, procedural endpoints, safety, reproducibility, and long-term outcomes.

- ***Structured Training Before the Congress***

An important feature of CSPE2024 was its structured pre-congress training program. Dedicated courses covered atrial fibrillation ablation, cardiac resynchronization therapy, His-Purkinje system and conduction system pacing, fundamental electrophysiology, and training for electrophysiology technicians.

A separate program on the emergency management of arrhythmias was designed for physicians working in primary and regional hospitals. This reflected CSPE's commitment to extending heart rhythm education beyond major academic centers.

The range of courses illustrated the Society's tiered educational approach. Training was provided not only for experienced electrophysiologists, but also for fellows, developing operators, technicians, and physicians who encounter arrhythmias in general clinical practice.

- ***Supporting Young Professionals***

The development of the next generation remains an important CSPE priority. The CSPE Young Electrophysiologists Group provides a platform for early-career physicians to participate in academic activities, case discussions, research presentations, and professional networking. At the biennial meeting, young physicians were given opportunities to interact with established experts and contribute to the scientific program.

This engagement is essential to the future of the specialty. Young electrophysiologists need more than procedural exposure. They also require mentorship in clinical reasoning, research methods, scientific communication, professional responsibility, and leadership.

- ***Women in Electrophysiology***

CSPE2024 also included dedicated sessions organised by women electrophysiologists. These sessions addressed clinically important topics while increasing the visibility and participation of women in the specialty.

Supporting women in electrophysiology contributes to a broader and more representative professional community. It also creates opportunities for mentorship and helps younger female physicians identify potential career pathways and role models.

- ***Guidelines, Consensus and Clinical Standards***

The work of CSPE extends beyond its scientific meeting. The Society has participated in the development and dissemination of guidelines, expert consensus documents, and technical standards relevant to arrhythmia diagnosis, catheter ablation, cardiac pacing, sudden cardiac death prevention, and device therapy.

These documents help translate international evidence into recommendations that reflect China's patient population, healthcare system, clinical resources, and patterns of practice. CSPE also contributes to the standardization of electrophysiology and pacing procedures through professional training and competency development. This work has become increasingly important as advanced technologies expand from major centers to a wider range of hospitals.

- ***International Collaboration***

CSPE maintains active relationships with major international and regional heart rhythm organizations, including the HRS, the EHRA and the APHRS.

Joint scientific sessions and international faculty participation allow Chinese clinicians and researchers to exchange experience with colleagues from different healthcare systems. CSPE has also contributed dedicated sessions to APHRS scientific meetings, presenting Chinese research and clinical perspectives to the wider Asia-Pacific community.

International collaboration supports more than the exchange of new technology. It encourages collaborative research, development of shared educational standards, and long-term professional relationships among young electrophysiologists.





Looking Ahead to Guangzhou in 2026

The 16th Scientific Meeting of the Chinese Society of Pacing and Electrophysiology will be held in conjunction with the Sun Yat-sen Cardiovascular Disease Conference in Guangzhou from 17 to 20 December 2026.

The meeting will provide the next major opportunity for CSPE to assess changes in electrophysiology and pacing since its 30th anniversary congress. Topics likely to shape the discussion include the expanding role of pulsed field ablation, new mapping and imaging technologies, advances in conduction system and leadless pacing, remote monitoring, artificial intelligence, and the growing importance of clinical quality and long-term outcomes. Equally important will be the continued development of young professionals, regional training networks, and multidisciplinary electrophysiology teams.



Conclusion

For more than three decades, CSPE has provided academic leadership for cardiac electrophysiology and pacing in China. Its contribution is reflected not only in scientific meetings and new technologies, but also in clinical standards, professional training, consensus development, and the growth of a national heart rhythm community. As CSPE prepares for its 16th scientific meeting in Guangzhou, its central mission remains unchanged: to connect scientific progress with standardized practice, develop the next generation of heart rhythm professionals, and improve care for patients with arrhythmias throughout China.

CURRENT STATUS AND FUTURE DIRECTION OF PULSED FIELD ABLATION: HOW TO PREVENT ALH SYNDROME

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Introduction

Pulsed field ablation (PFA) has rapidly emerged as an important advancement in catheter ablation for atrial fibrillation (AF). By inducing irreversible electroporation through high-voltage, short-duration electrical pulses, PFA produces myocardial injury with less dependence on conventional thermal mechanisms. Its potential tissue selectivity has generated considerable enthusiasm, particularly because of the reduced risk of certain complications associated with radiofrequency (RF) and cryothermal ablation, including esophageal injury and pulmonary vein stenosis.

However, clinical studies have shown that PFA is noninferior, rather than clearly superior, to conventional thermal ablation in long-term efficacy. More importantly, accumulating clinical experience has revealed a new spectrum of potentially life-threatening complications, including severe hemolysis-related acute kidney injury (AKI), cerebral embolic events, coronary vasospasm, myocardial ischemia, ventricular fibrillation (VF), and sudden cardiac death.[1-4] These observations challenge the assumption that PFA is inherently safe simply because it is predominantly nonthermal. They also raise a fundamental question: Are we delivering more PFA energy than is necessary to produce durable myocardial lesions?

We have proposed the term **“ALH Syndrome” (Ablate Like Hell Syndrome)** as a conceptual framework highlighting the potential consequences of excessive or unnecessary PFA delivery.[1] ALH Syndrome is not an established clinical diagnosis, but rather a hypothesis-generating concept intended to promote safer, more rational PFA strategies.

Emerging Life-Threatening Complications of PFA

Hemolysis and acute kidney injury

Intravascular hemolysis has emerged as an important PFA-specific safety concern. High-voltage electric fields can disrupt red blood cell membranes, releasing plasma-free hemoglobin (Hb). Clinical studies have demonstrated that repeated PFA applications are associated with increased plasma-free Hb, hemoglobinuria, elevated serum creatinine, and, in severe cases, AKI requiring hemodialysis. Importantly, the extent of hemolysis appears to depend not only on the number of PFA applications but also on electrode–tissue contact, waveform characteristics, electrode configuration, and energy-delivery strategy. When PFA energy is delivered without adequate electrode–tissue contact, a greater proportion of the electric field may interact with circulating blood rather than myocardium. Consequently, unnecessary PFA applications may increase hemolysis without producing effective irreversible myocardial lesions.

Cerebral embolic events

Although PFA has been thought to avoid conventional RF-induced coagulation necrosis, silent cerebral lesions detected by diffusion-weighted magnetic resonance imaging remain a concern.[2] Potential mechanisms include microbubble formation, thrombus formation related to electrode-tissue interface overheating, and direct interactions between high-voltage electric fields and blood components. Importantly, these complications appear to be influenced by waveform design, electrode geometry, and saline irrigation strategies.

Coronary vasospasm, myocardial ischemia, and ventricular fibrillation

Perhaps the most concerning emerging observations involve delayed myocardial ischemia and malignant ventricular arrhythmias. In a recent international multicenter analysis involving 6,721 patients undergoing PFA for AF, 11 life-threatening delayed or prolonged ischemic and arrhythmic adverse events were reported.[1-4] These included delayed ST-segment elevation, intraprocedural VF requiring resuscitation, prolonged vagal reactions, and sudden cardiac death. Of particular concern, delayed diffuse coronary vasospasm and VF have been reported even when PFA was not delivered directly adjacent to the coronary arteries.[4] Although the precise mechanisms remain uncertain, these observations suggest that PFA-related cardiovascular complications may involve not only direct local tissue injury but also systemic vascular and autonomic effects.

Potential Mechanisms of PFA-Related Complications

1. Hemolysis, nitric oxide depletion, and endothelial dysfunction

Intravascular hemolysis may represent a potentially important link among several emerging PFA complications. Following red blood cell membrane disruption, cell-free Hb enters the circulation and rapidly scavenges nitric oxide (NO), an essential mediator of vascular relaxation and endothelial homeostasis. Reduced NO bioavailability may promote vasoconstriction, endothelial dysfunction, platelet activation, and microvascular impairment.[1,5] In addition, free heme and iron can induce oxidative stress and inflammatory responses, potentially contributing to renal and vascular injury. These mechanisms provide a biologically plausible explanation for why extensive hemolysis could contribute to systemic complications beyond AKI.

We hypothesize that PFA-induced hemolysis and subsequent endothelial dysfunction may contribute to delayed diffuse coronary vasospasm, myocardial ischemia, and malignant ventricular arrhythmias in susceptible patients.[1] However, a direct causal relationship has not yet been established and requires further experimental and clinical investigation.

2. Electrode–tissue interface heating and microbubble formation

Although PFA is predominantly nonthermal, high-voltage electrical pulses can produce localized Joule heating, particularly at the electrode–tissue interface. The degree of heating depends on waveform characteristics, current density, electrode configuration, pulse duration, repetition frequency, and saline irrigation flow rate.[2]

Microbubble formation during PFA may result from electrochemical reactions, localized heating, and cavitation-related mechanisms. Importantly, experimental observations demonstrate that waveform optimization can markedly reduce microbubble generation while preserving myocardial lesion formation. These findings indicate that PFA waveform design should be optimized not only for lesion efficacy but also for minimizing electrode–blood interactions and embolic risk.

3. Direct coronary vascular injury and autonomic effects

Experimental studies have demonstrated that PFA delivered near coronary arteries can produce acute vasospasm and, under certain conditions, vascular wall injury involving the intimal and medial layers. Although nitroglycerin can attenuate PFA-associated coronary narrowing, cases of clinically significant coronary vasospasm despite nitroglycerin administration have been reported.[3,4]

Furthermore, stimulation of cardiac autonomic ganglionated plexi during PFA may contribute to prolonged vagal responses and potentially arrhythmic complications. The relative contributions of direct vascular injury, hemolysis-related endothelial dysfunction, and autonomic mechanisms remain incompletely understood.

How Can We Prevent ALH Syndrome?

1. Avoid unnecessary and excessive PFA applications

The most immediate preventive strategy is to minimize PFA applications that do not contribute to durable lesion formation. Unlike conventional RF ablation, PFA produces a relatively broad zone of reversible electroporation surrounding the central irreversible lesion. Consequently, acute disappearance of intracardiac electrograms or achievement of conduction block does not necessarily indicate durable myocardial lesion formation. This creates a procedural dilemma: insufficient PFA may result in lesion recovery and arrhythmia recurrence, whereas excessive PFA may increase hemolysis and other complications. The objective should therefore be to deliver the minimum effective PFA dose required to achieve durable irreversible lesion formation, rather than simply minimizing the total number of applications.

2. Ensure adequate electrode–tissue contact

Our experimental studies have demonstrated that electrode–tissue contact is a critical determinant of irreversible PFA lesion formation.[6,7] In swine beating-heart models, lesion depth increased significantly with increasing contact force and the number of delivered PFA pulses. In contrast, no irreversible lesion formation was observed when the ablation electrode was positioned only 1–2 mm away from the myocardial surface, despite repeated pulse delivery. [6,7] These findings challenge the assumption that PFA lesion formation is relatively independent of catheter contact. Importantly, delivering high-voltage energy without adequate tissue contact may increase blood exposure to electrical fields while providing little or no therapeutic benefit.

3. Optimize waveform, electrode configuration, and saline irrigation

PFA systems differ substantially in waveform characteristics, electrode geometry, and energy-delivery strategies. Consequently, efficacy and safety observations from one platform should not automatically be generalized to others. Waveform optimization may reduce microbubble formation, degree of hemolysis, and electrode–tissue interface heating without compromising lesion formation.

Saline irrigation is another potentially important modifiable factor. In a clinical study using a variable-loop PFA catheter, increasing irrigation flow from 4 to 30 mL/min was associated with a reduction in MRI-detected silent cerebral lesions from 33.3% (6/18 patients) to 4.8% (1/21 patients).[2] These findings emphasize that irrigation strategy may significantly influence the embolic safety profile of PFA. However, the optimal irrigation flow rate should be established for each catheter and waveform configuration.

4. Develop real-time prediction of irreversible lesion size

A major limitation of current PFA technology is the lack of a reliable real-time indicator of durable myocardial lesion formation.

Our experimental studies demonstrated that conventional procedural markers, including electrogram attenuation, impedance changes, and electrode temperature, correlate poorly with irreversible PFA lesion size.[6,7] To address this limitation, we developed a novel PF Ablation Index integrating contact force and the number of PFA applications to predict irreversible lesion depth.[6,7] In a prospective swine beating-heart validation study, predicted lesion depth was within ±1.0 mm of actual lesion depth in 97 of 106 lesions (92%). These findings provide proof of concept that quantitative, real-time lesion prediction may improve the precision of PFA delivery. Importantly, such technology could potentially reduce unnecessary applications, improve lesion durability, and minimize blood exposure to excessive electrical energy. Whether PF Ablation Index-guided strategies can improve clinical outcomes and reduce serious complications remains to be established in prospective clinical studies.

Future Directions: From Rapid Ablation to Precision PFA

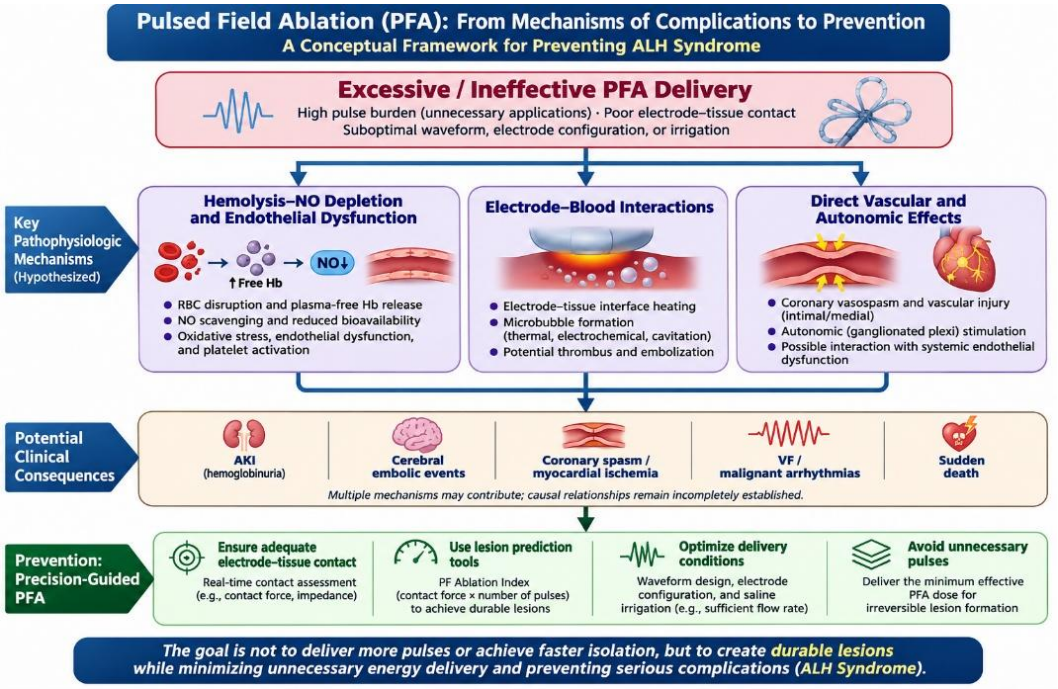
The next generation of PFA should focus on three interconnected objectives: predictable lesion durability, reduced systemic toxicity, and improved procedural safety.[1]

First, PFA systems should incorporate real-time assessment of electrode–tissue contact, electric field distribution, and irreversible lesion size. These capabilities may enable operators to deliver an appropriate energy dose for each anatomical target.

Second, systematic evaluation of PFA-induced hemolysis and endothelial dysfunction is needed. Measurements of plasma-free Hb, NO bioavailability, vascular endothelial function, and markers of platelet activation may help clarify the mechanisms underlying renal, vascular, and arrhythmic complications.

Third, waveform design, electrode configuration, and irrigation strategies should be optimized through rigorous preclinical and comparative clinical investigations. The goal should be to minimize unwanted blood and vascular interactions while preserving effective myocardial electroporation.

Finally, prospective multicenter studies and long-term surveillance are essential to determine whether emerging serious complications relate to specific PFA systems, procedural strategies, patient characteristics, or combinations of these factors.



Proposed Mechanisms of Complications Related to PFA.

Conclusions

PFA represents a major technological advancement in catheter ablation, but its rapid adoption has revealed important limitations and previously underrecognized complications. The concept of ALH Syndrome highlights the risks of excessive or unnecessary PFA delivery and the importance of balancing lesion efficacy with systemic and vascular safety. The future of PFA should move from empirical, repetitive energy delivery toward precision-guided ablation based on real-time prediction of irreversible lesion formation. Our ultimate goal should not simply be faster pulmonary vein isolation, but safer, more effective, and more durable catheter ablation. Preventing ALH Syndrome may be an essential step toward realizing the full clinical potential of PFA.

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ESC 2026: KEY TAKE-HOME MESSAGES IN ELECTROPHYSIOLOGY

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ESC Congress 2026, held from 28–31 August in Munich, presented a broad range of new cardiovascular science. For the electrophysiology community, several late-breaking clinical trials challenged established concepts in atrial fibrillation, stroke prevention, sudden cardiac death and rhythm monitoring. At the same time, rapidly evolving technologies such as pulsed-field ablation and digital rhythm care remained important hot topic s throughout the scientific program. Here, we highlight four key take-home messages from ESC Congress 2026 that may have particular relevance to clinical electrophysiology.

1. Anticoagulation in AF: expanding the boundary of treatment

One of the most clinically relevant late-breaking trials was SINGLE-AF, which addressed an area where randomized evidence has remained surprisingly limited: anticoagulation in patients with atrial fibrillation (AF) at intermediate stroke risk.

SINGLE-AF was an open-label randomized trial conducted at 18 centers in South Korea. A total of 1,803 patients with AF and a CHA_2DS_2-VASc score of 1 in men or 2 in women were assigned to direct oral anticoagulant therapy with apixaban or rivaroxaban, or to no anticoagulation. At 24 months, the primary composite endpoint of stroke, systemic embolism, major bleeding or cardiovascular death occurred in 0.5% of patients receiving anticoagulation compared with 1.5% without anticoagulation, representing a 69% relative risk reduction. The difference was largely driven by a reduction in ischemic stroke, without an increase in major bleeding. The study was presented in Hot Line 1 and simultaneously published in the New England Journal of Medicine.

The importance of SINGLE-AF lies less in the absolute event rate, which was low, and more in the population studied. Current ESC guidelines already recommend that anticoagulation should be considered in patients at intermediate stroke risk, but until now this recommendation has lacked direct randomized evidence. SINGLE-AF therefore provides important support for anticoagulation in this group and may influence future guideline recommendations.

At the opposite end of the spectrum, **ENRICH-AF** highlighted the continuing difficulty of stroke prevention after intracranial hemorrhage. In patients with AF and previous intracranial hemorrhage, edoxaban did not significantly reduce stroke or systemic embolism compared with no anticoagulation but increased major bleeding.

Taken together, SINGLE-AF and ENRICH-AF illustrate an important theme in contemporary AF management: the decision is increasingly not simply whether anticoagulation works, but which individual patient has a favorable balance between thromboembolic protection and bleeding risk.

2. AF ablation: rhythm control is clear, but what about symptoms?

One of the most provocative late-breaking EP presentations at ESC 2026 was PVI-SHAM-AF, a sham-controlled trial examining the symptomatic benefit of AF ablation.

Patients with symptomatic paroxysmal or persistent AF were randomized to catheter ablation or a sham procedure. AF-related quality of life improved substantially in both groups, but ablation did not provide a statistically significant additional improvement compared with the sham intervention. In contrast, catheter ablation clearly reduced AF recurrence. The trial was presented during Hot Line 8 and simultaneously published in The Lancet.

The finding is provocative because symptomatic improvement is one of the major reasons that patients are referred for AF ablation. However, the results should not be interpreted as showing that ablation is ineffective. Rather, PVI-SHAM-AF separates two outcomes that are frequently assumed to move together: objective rhythm control and patient-perceived improvement in quality of life.

Part of the symptomatic benefit following an invasive procedure may arise from placebo effects, medication optimization, closer clinical follow-up or greater reassurance after treatment. From a practical perspective, the trial emphasizes the importance of careful patient counselling and objective rhythm monitoring when assessing treatment efficacy.

Meanwhile, **pulsed-field ablation (PFA)** remained one of the major hot topics in the broader ESC scientific program. Discussion has clearly moved beyond whether PFA can achieve effective pulmonary vein isolation. Sessions at ESC 2026 addressed comparisons with thermal ablation, its use in persistent AF, strategies beyond the pulmonary veins, and even the potential integration of artificial intelligence into ablation workflows.

The rapid evolution of PFA suggests that it is transitioning from a novel energy source to a mainstream platform for AF ablation. However, as the technology expands, questions regarding optimal lesion sets, durability and patient selection remain highly relevant.

3. Beyond LVEF for sudden cardiac death prevention

Another important late-breaking study was **CMR GUIDE**, which revisited one of the most persistent limitations in sudden cardiac death prevention: reliance on left ventricular ejection fraction for selection of patients for primary-prevention ICD therapy.

CMR GUIDE evaluated patients with ischemic or non-ischemic cardiomyopathy, an LVEF of 36–50%, and myocardial scar identified by cardiac magnetic resonance imaging. Patients were randomized to ICD implantation or monitoring with an implantable loop recorder. The study was presented in Hot Line 1 and simultaneously published in JAMA.

ICD therapy did not significantly reduce the primary endpoint overall. However, younger patients appeared to derive greater benefit, and the trial again highlighted the fact that clinically important ventricular arrhythmias and sudden cardiac death occur in patients whose LVEF lies above the conventional ⩽35% threshold.

CMR GUIDE therefore does not establish myocardial scar as a replacement for current ICD criteria. Nevertheless, it reinforces a direction that has become increasingly important in electrophysiology: LVEF alone is an imperfect marker of arrhythmic risk.

Future risk stratification will likely combine ventricular function with scar characteristics, clinical phenotype, genetics and other markers rather than relying on a single numerical threshold. CMR GUIDE should therefore be viewed less as a definitive change in ICD indications and more as another step toward more individualized sudden cardiac death risk assessment.

4. Digital rhythm monitoring moves closer to routine clinical care

Digital rhythm management was another major hot topic at ESC 2026, supported by several important late-breaking studies.

The **ASPIRED trial** investigated whether immediate prolonged ambulatory ECG monitoring could improve outcomes after unexplained syncope. Patients presenting to an emergency department with unexplained syncope were randomized to immediate 14-day wearable ECG monitoring or standard care. Early monitoring did not significantly reduce recurrent syncope, but it substantially increased the detection of clinically significant arrhythmias, shortened the time to diagnosis and resulted in more patients receiving appropriate rhythm-directed treatment. ASPIRED was presented during Hot Line 10 and simultaneously published in the New England Journal of Medicine.

The message is clinically intuitive but important. In patients with intermittent arrhythmias, the major limitation of conventional assessment is often not diagnostic accuracy but failure to capture the rhythm at the appropriate time. Earlier and longer ECG monitoring directly addresses this problem.

The **VIRTUES trials** examined another aspect of digital EP care: follow-up of patients with pacemakers and ICDs. A virtual e-health system incorporating remote device monitoring was shown to be as safe and effective as conventional in-clinic follow-up while reducing healthcare utilization and costs and maintaining high patient satisfaction.

Together, ASPIRED and VIRTUES reflect a broader transition within electrophysiology. Rhythm care is progressively moving beyond episodic hospital-based assessment toward continuous, remote and digitally integrated monitoring. Wearable ECGs, CIED remote monitoring and eventually AI-assisted interpretation are likely to become increasingly integrated into routine arrhythmia care.

Final thoughts

The major EP messages from ESC Congress 2026 did not revolve around a single breakthrough. Rather, the meeting highlighted several areas in which familiar clinical assumptions are being refined.

SINGLE-AF provided randomized evidence supporting anticoagulation in patients with AF at intermediate stroke risk, while ENRICH-AF reminded us that anticoagulation cannot be applied uniformly in patients at very high bleeding risk. PVI-SHAM-AF challenged the assumption that suppression of AF necessarily translates directly into symptomatic benefit. CMR GUIDE again questioned whether LVEF alone is sufficient for sudden cardiac death risk stratification. Finally, ASPIRED and VIRTUES demonstrated how digital monitoring may reshape both diagnosis and long-term follow-up.

At the same time, PFA continued its rapid evolution from an emerging ablation technology toward a routine component of contemporary EP practice.

Taken together, the presentations at ESC 2026 suggest that electrophysiology is moving toward more individualized patient selection, more objective assessment of treatment benefit, and increasingly technology-enabled care.

BEHIND THE LAB: THE JOURNEY, THE STRUGGLES, THE SUCCESS

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Why did you choose to enter medicine and above all, prefer to specialize in Electrophysiology?



I chose medicine because I wanted to do something meaningful for people and make a difference through my work. During my cardiology training, I became increasingly fascinated by cardiac electrophysiology because it combines physiology, anatomy, technology, and procedural skills. I was especially attracted to the opportunity to understand the electrophysiology behind arrhythmias and then treat them precisely. EP is a field where every case teaches you something new, and I found that combination of intellectual challenge and direct patient impact deeply rewarding.

What is the EP practice condition in Myanmar?

EP practice in Myanmar is still developing, with relatively limited access to advanced electrophysiology services and trained EP specialists. Myanmar serves approximately 55 million people with only 8 EP labs, 1 Lab per 6.9 million. Historically, EP procedures were concentrated in only a few centers, and EP was not widely established as a separate subspecialty. In recent years, however, there has been growing interest and significant progress. More cardiologists and institutions are recognizing the importance of arrhythmia care, and new EP services are emerging. I believe Myanmar has great potential to develop a stronger national EP network through collaboration, training, mentorship, and sharing of expertise.

Can you talk about an accomplishment that you are particularly proud of?

One of the accomplishments I am most proud of is establishing **a new dedicated 3D EP lab** at No. 1 Defense Services General Hospital in Yangon. When I returned to Myanmar after completing my EP fellowship, I was transferred to the Medical Academy as a teaching staff and also worked as a cardiologist at its academic hospital under our institution. However, there was no EP lab at my new hospital, so there was no established facility where I could continue performing EP procedures.

With the support of my mentors, colleagues, and the Korean Heart Rhythm Society, I worked step by step to build the EP service. In October 2025, we initially started our EP service in a pre-existing cath lab using a 2D mapping system. Despite the limitations of sharing the old cath lab with other procedures, we gradually built our experience and performed around **120 SVT ablation cases**. In September 2026, we completed the setup of our dedicated new **3D EP Lab**, which marked an important new chapter in our EP program. With the 3D mapping system, we have now started performing more complex procedures, including **complex PVC ablation, ventricular tachycardia (VT) ablation, atrial fibrillation (AF) ablation, and atrial flutter ablation**.

This transition, from a shared cath lab with 2D mapping to a dedicated new 3D EP lab, has allowed me to expand beyond routine SVT procedures and begin developing a comprehensive EP service in Myanmar. For me, this represents not only a personal achievement but also a new beginning for EP development in Myanmar.



Initiation of 2D EP Services in the Existing Cardiac Catheterization Laboratory



From an Empty Space to a Dedicated EP Lab in 11 Months and Our First Atrial Fibrillation Ablation Under the Guidance of Dr. Chun Hwang

Why did you choose Korea for EP fellowship training?

I chose Korea (Seoul St. Mary's Hospital, The Catholic University of Korea) primarily for its **strong hands-on EP training**, with high procedural volume, advanced technology, and experienced EP specialists. I wanted to gain practical skills through direct exposure to a wide range of arrhythmias and modern mapping and ablation techniques.

What made the experience even more valuable was **the follow-up fellowship support program**. The continued mentorship from KHRS and my mentors - Dr. Chun Hwang, Prof. Oh Yong Seog, Prof. Kim Sung Hwan, Prof. Young Choi, Prof. So-Yoon Park allowed me to receive guidance even after returning to Myanmar. My goal was to bring this knowledge and experience back home and contribute to the development of EP services in Myanmar.

What was the most difficult part for Korean EP training preparation?

The most difficult part was preparing myself for a completely new environment while trying to make the most of a limited training period. I knew that I would be exposed to advanced EP procedures and a very different healthcare and training system, so I felt a strong responsibility to prepare myself adequately. There was also the challenge of adapting to a new language and culture. Looking back, that preparation helped me become more confident and focused during the fellowship.





What is the most impressive during Korean EP training?

What impressed me most was the combination of expertise, teamwork, and systematic approach of Seoul St. Mary's EP team to every procedure. I was amazed by how carefully the EP team prepared each case and how everyone in the laboratory understood their role. The high procedural volume allowed me to observe and learn from many different types of arrhythmias. I was also deeply impressed by the willingness of my mentors, including all technicians and nurses to teach, explain their reasoning, and encourage me to think independently. I realized that becoming a good electrophysiologist is not only about technical skills—it is also about discipline, teamwork, continuous learning, and patient-centered care.

What was the most challenging part of your EP training in Korea?

The most difficult period was probably the early stage of training, when I had to adapt to a completely different environment while trying to absorb a large amount of new knowledge and procedural experience. Sometimes I felt overwhelmed because there was so much to learn, especially when observing complex procedures and advanced mapping techniques. However, these difficulties taught me to be patient with myself, ask questions, observe carefully, and keep learning every day. My mentors and whole EP team were very supportive, and those challenges eventually became some of the most valuable parts of my training.

What are your thoughts or impressions after completing your EP training in Korea?

My time in Korea changed my professional life and, in many ways, changed my vision for my future. I returned to Myanmar not only with new EP knowledge and procedural skills, but also with a much clearer goal—to contribute to the development of EP in my country. I am deeply grateful to my mentors, especially the Korean EP community, for believing in me and supporting my journey. The fellowship taught me that knowledge becomes more meaningful when we share it. I hope to continue building connections between KHRS and Myanmar and create more opportunities for the next generation of EP trainees.

What advice would you give to your younger self?

I would tell my younger self: **Do not be afraid of starting from nothing and never give up**. You may not have all the resources, opportunities, or answers at the beginning, but if you keep learning and continue moving forward, things can change. Be patient with your journey and do not compare your progress with others. Find good mentors, stay humble, and make the most of every opportunity to learn. Most importantly, when you finally have the opportunity to grow, remember to bring others with you. Your journey becomes more meaningful when your success can help create opportunities for others.

What advice would you give to other EP fellows for preparing foreign country training?

Before going abroad, build a strong foundation in EP fundamentals and try to understand the principles behind the procedures rather than simply memorizing techniques. Set clear learning goals and identify what you want to bring back to your own country. During training, observe carefully, ask questions, keep notes, and learn from every case—even the difficult ones. Be respectful of different cultures and training styles, and build genuine relationships with your mentors and colleagues. Finally, remember that fellowship is not only about learning for yourself. Think about how you can transfer that knowledge and experience back to your own EP community.

EP LAB SPOTLIGHT: THE ELECTROPHYSIOLOGY TEAM AT THE NATIONAL CEREBRAL AND CARDIOVASCULAR CENTER

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Hospital and EP Program Overview

The National Cerebral and Cardiovascular Center (NCVC), located in Suita, Osaka, is a national referral center specializing in cardiovascular and cerebrovascular diseases. Our institution provides highly specialized care for patients with complex cardiovascular disorders referred from throughout Japan and integrates advanced clinical care with clinical and translational research (Figure 1).

Our electrophysiology program currently includes approximately 25 physicians, including fellows, together with nurses, clinical engineers, radiological technologists, and other allied health professionals. The NCVC has three dedicated catheter ablation laboratories, among the largest dedicated EP facilities in Japan.

Each year, we perform approximately 1,200 catheter ablation procedures and 700 cardiac implantable electronic device procedures. Many patients are referred after previous unsuccessful procedures or because of particularly complex underlying cardiovascular disease. Accordingly, multidisciplinary collaboration with specialists in heart failure, cardiac surgery, congenital heart disease, transplantation medicine, cardiovascular imaging, pediatrics, and medical genetics is an essential part of our daily practice.



Figure 1. National Cerebral and Cardiovascular Center (Top) and members of the electrophysiology team (Bottom)

Catheter Ablation

Atrial fibrillation (AF) represents a major component of our ablation practice. Our laboratory has actively introduced new ablation and mapping technologies. More recently, pulsed-field ablation (PFA) has become an important part of our AF program.

Another major strength of our program is the management of complex ventricular tachycardia (VT) and ventricular fibrillation (VF) associated with structural heart disease. We perform approximately 60 ablation procedures for complex VT/VF each year, including patients referred for recurrent VT/VF after previous ablation at other institutions, those with inherited arrhythmia syndromes, and highly challenging cases involving left ventricular assist devices. For these procedures, we combine three-dimensional electroanatomical mapping and intracardiac echocardiography with advanced multimodality imaging. In particular, cardiac computed tomography and cardiac magnetic resonance imaging are integrated into the procedural strategy to facilitate image-aided substrate identification and ablation (Figure 2).

This integration of complex electrophysiology with advanced cardiac imaging is one of the distinctive strengths of our program and allows us to tailor the ablation strategy to the underlying structural substrate in each patient.

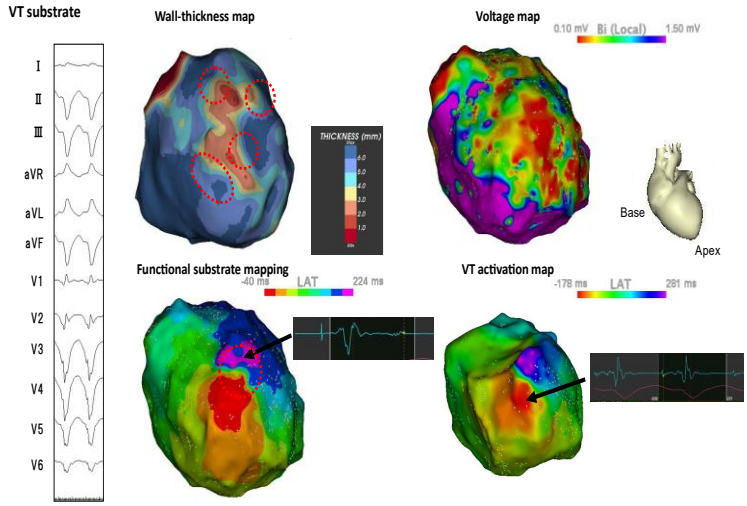


Figure 2. Multimodality image-guided ventricular tachycardia ablation integrating CT-derived wall-thickness mapping with electroanatomical substrate and activation mapping.

Device Therapy

Device therapy represents another major pillar of our program. Approximately 700 cardiac implantable electronic device procedures are performed annually, including pacemaker implantation, implantable cardioverter-defibrillator (ICD) implantation, cardiac resynchronization therapy (CRT), and transvenous lead extraction. In addition, our center performs percutaneous left atrial appendage closure procedures.

Our center is among the highest-volume centers for ICD and CRT-D implantation in Japan.

We are also actively engaged in contemporary device therapies, including leadless pacemakers, conduction system pacing (CSP), and extravascular ICD (EV-ICD) technology.

Complex cases are managed through close multidisciplinary collaboration. Pediatric and congenital heart disease patients are jointly managed with pediatric cardiologists, patients with advanced heart failure with the heart failure and transplantation teams, and challenging lead extraction procedures in collaboration with cardiac surgeons.

Remote monitoring has also become an integral component of device care. A centralized multidisciplinary system enables our team to provide longitudinal surveillance for a large number of patients and to respond efficiently to clinically important alerts.

Research, Education, and Evidence Generation

Clinical research is central to the mission of our EP program. In addition to observational studies and nationwide registries, we place particular emphasis on investigator-initiated randomized clinical trials designed to answer clinically relevant questions arising from daily electrophysiology practice.

In collaboration with Japanese professional societies, our team has led nationwide registry studies as principal investigators, including J-AB, J-LEX, JLAAO, and JPN-CRT. These registries provide large-scale real-world evidence on catheter ablation, lead extraction, left atrial appendage closure, and cardiac resynchronization therapy in Japan. We have also contributed to JROAD and conducted nationwide multicenter studies of cardiac sarcoidosis, including JACS and MYSTICS. In addition, we participate in the APHRS-Brugada Registry, led by principal investigator Takeshi Aiba..

We have also led multiple prospective multicenter randomized trials evaluating contemporary atrial fibrillation ablation strategies and emerging technologies.

Results from these studies have been presented at major international cardiovascular and electrophysiology congresses, including ESC, AHA, ACC, and APHRS, with several studies selected for Late-Breaking Clinical Trial sessions, reflecting our commitment to generating clinically meaningful evidence from Japan and sharing it with the international community (Figure 3).

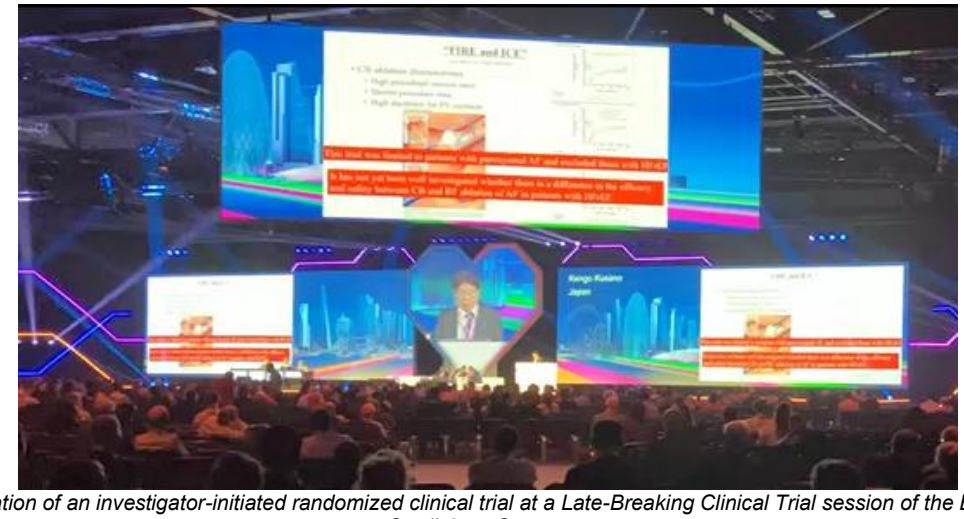


Figure 3. Presentation of an investigator-initiated randomized clinical trial at a Late-Breaking Clinical Trial session of the European Society of Cardiology Congress.

One example is the CRRF-PeAF trial, an investigator-initiated, prospective, multicenter randomized trial involving 500 patients with persistent atrial fibrillation at 12 centers in Japan. The trial demonstrated the non-inferiority of cryoballoon ablation to radiofrequency ablation for atrial tachyarrhythmia recurrence at 1 year, and the results were published in the European Heart Journal in 2025.

Education is a longstanding tradition at the NCVC. For more than 40 years, our residency and fellowship program has welcomed trainees from across Japan. Over its more than 40-year history, the NCVC arrhythmia training program has educated numerous electrophysiologists who have gone on to play leading roles in cardiac electrophysiology at institutions throughout Japan (Figure 4). Fellows are immersed in both procedural training and daily clinical care, gaining experience in the diagnosis and management of a wide range of arrhythmias while learning electrophysiological studies, catheter ablation, and device implantation. Research is closely linked to this clinical training. Fellows are encouraged to develop questions arising from daily practice and to participate in clinical research. Our goal is to train electrophysiologists who are not only technically skilled, but also capable of advancing the field through clinical investigation.



Figure 4. Distinguished alumni of the NCVC arrhythmia programme

What Makes Our EP Team Unique

We believe that the strength of the NCVC EP program lies in the integration of high-volume clinical practice, complex electrophysiology, advanced device therapy, multidisciplinary care, and investigator-initiated clinical research. Procedural volume is not our ultimate goal. Clinical questions encountered in daily practice frequently become the starting point for multicenter studies and randomized clinical trials. By translating these questions into rigorous research and presenting the results at major international scientific meetings, we aim to generate evidence that can influence clinical practice beyond our own institution. Through the close integration of clinical care, education, and national and international research, we hope to continue contributing to the advancement of cardiac electrophysiology in Japan and throughout the Asia-Pacific region

Hospital Information

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REPORT ON APHRS-EHRA IMMERSION PROGRAM

Written by: Jeremy William (MBBS), EP Fellow, The Alfred Hospital, Melbourne Australia

It was a true privilege and honour to be awarded the APHRS-EHRA Immersion Program award this year. With the support of this award, I had the opportunity to spend two weeks with the clinical electrophysiology team at the Hanover Medical School in Hanover, Germany. This was one of the most rewarding experiences of my career so far and I am excited to share my experience at this wonderful centre with the APHRS community.

The electrophysiology unit at Hannover Medical School is named the Hannover Herzrhythmus Centrum (HHC) and is led by Professor David Duncker. The city of Hannover is the capital of the German state of Lower Saxony and is home to 1.6 million people. The team led by Professor Duncker is among the most highly respected teams in all of Europe and handles the full breadth of EP and device-related procedures.





Professor David Duncker (right), head of the Hannover Heart Rhythm Centre

I arrived in Hannover in early September immediately following ESC 2026 in Munich. I was fortunate enough to meet Professor Duncker at ESC in Munich as he was chairing a variety of sessions at the conference. He greeted me warmly and was able to introduce me to the schedule at the hospital to ensure a smooth transition. Following ESC, I travelled by train to Hannover: it is a beautiful and historic city with an incredible story and local culture. I was fortunate enough to spend some time exploring the city in the evening and would highly recommend it to anyone traveling to Germany.





Left: The 'Rathaus' (Town Hall). Right: Hannover Medical School and Hospital (MHH)

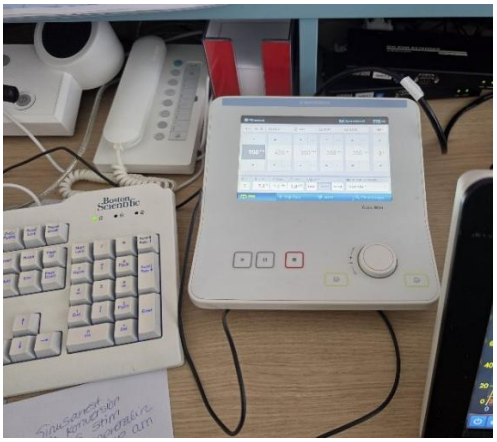
On my first day, I was introduced to the whole EP team, including three consultant electrophysiologists, three clinical EP fellows and a team of 5-6 dedicated EP nurses in the cathlab (the German for cathlab is 'Herzkatheterlabor': quite the mouthful!). The team informed me that the EP lab in Hannover is definitely a beautiful space: it is modern, spacious and the control room is very bright with very large windows. I changed into the hospital green scrubs and was given some bright green laboratory clog shoes and I was immediately thrown into the busy schedule of the EP lab.

Perhaps the most striking aspect of my observership was the ability of the Hannover EP team to function without an anaesthesiologist. In the two weeks I spent in the lab, I only saw an anaesthesia team once: every other day the lab functioned smoothly with EP-led sedation alone. This approach is used for almost every case: PFA AF ablation, radiofrequency AF ablation, atrial flutter ablation, ventricular tachycardia ablation and even subcutaneous ICD implantation. The approach relies on the EP nurses titrating a propofol infusion and providing simple airway support with a Guedel tube.




EP nurses setting up the lab without scrubbing. Right: EP nurses titrating propofol for sedation from the end of the bed.

This approach has a number of important advantages. Most importantly, it streamlines the procedural team substantially. The time required for intubation and extubation is eliminated, and patients move in and out of the lab much faster. As there is no anaesthesia team, the number of people in the lab for the case is very small (one fellow, one consultant, two nurses). As it's the same small team of people for almost all cases, everyone knows their part and the procedures become very streamlined. This really helps efficiency as well as comradery in the lab. Hannover certainly had the happiest and friendliest EP team I've ever met!

In Hannover, the EP recording software and stimulator are run by the EP doctors.

There are some important things to note about performing procedures without anaesthesia. For PFA cases where diaphragmatic stimulation occurs, this does require quite a deep level of sedation with propofol and can cause some minor apnoeic episodes. Also for VT cases with marked hemodynamic lability, it places more responsibility on the electrophysiologist to manage vasopressor support. However, I think there are some really valuable lessons to be learned from this workflow.

Like most hospitals, Hannover has a high-volume of de novo AF ablation cases performed with PFA. The procedural approach for these procedures was very interesting and different to what we do in Australia. Patients undergo a transesophageal echo on the morning of their procedure prior to arriving in the cathlab to clear the left atrial appendage. Then, the table is prepped by nurses: interestingly they don't scrub but instead set up almost everything while wearing sterile gloves. The procedure is performed with just two venous punctures: one for the coronary sinus catheter and one for the PFA catheter. The transseptal puncture is then performed without echocardiographic imaging, using a combination of fluoroscopy, blood pressure measurement and contrast shots. When the operators drop into the fossa ovalis, they check in RAO to estimate the antero-posterior plane of

to the CS. Then, a contrast shot is performed in LAO with the needle tented onto the septum where a faint triangular contrast outline confirms this tented position. Finally, the puncture occurs with pressure monitoring to show that LA pressure rather than aortic pressure is shown, and a second contrast injection confirms the needle is in the LA. This is an elegant approach that was safe, fast and effective in all the cases I observed. The operators had intimate familiarity with this approach and maneuvered very efficiently to the LA in every case I observed. Certainly, this is a valuable workflow that I will remember should I require this in Australia.

One of the highlights of my experience was observing three extravascular ICD implants in one day. Professor Duncker is one of the foremost experts in the EV-ICD system and has performed around 60 implants to date. At this centre, they perform a full day of EV ICD implants once a month. At our centre in Australia, we are the beginning of the learning process around EV ICDs and so this was definitely an incredible opportunity to learn close-up with an expert in the field. Reflecting on my experience, there are several important steps that may seem minor but are paramount to procedural success. Assessment of pre-operative imaging (CT, ECG and echo) is an essential planning step which was done the day prior to the procedures. The CT in particular examines the retrosternal space available for the device, the proximity of the lungs at each level and the height of the right atrial appendage (to estimate the risk of P wave oversensing).

Procedural preparation and draping is crucial: the operators first mark the sternal border, ziphoid process, height of the carina and plane of the left lateral heart border with a marker on the skin and drape to encompass a wide area with additional drape overhang to cover the C-arm in the RAO 90o position. These are the only cases in Hannover that require routine anaesthetic support. I learned about the subxiphoid incision, the technique to finger dissect to the retrosternal space, the tunnelling tool to advance to the height of the carina, the optimal sensing parameters, the special ‘constrictor’ knot to secure the lead to the rectus sheath, the lateral incision for the generator and finally the second tunnelling tool to deliver the lead from the subxiphoid incision to the lateral intercostal incision. Seeing three cases back-to-back was a wonderful way to reinforce the learning points. The operations were extremely streamlined and, again, the small focused cathlab team knew the procedure from start to finish.

A couple of small tricks I learned that I will document here partially for my own learning. First, flipping between AP and RAO 90 while tunnelling is crucial to ensure you are in the correct plane at all times. Second, asking the anaesthetist to deflate the lungs during tunnelling can help to minimize the risk of pneumothorax. Third, removing as much air as possible by pushing down on the chest with high PEEP from the ventilator can improve R wave sensing and lead impedance prior to defibrillation threshold testing. Fourth, the day 1 post implant check is meticulously performed including testing in five positions to determine the best sensing lead. These small tips and tricks will greatly help me in my first foray into EV-ICD implantation in Australia.

Documenting the lessons I learned in Hannover could probably fill many more pages but these were the most memorable and valuable experiences. I would like to sincerely thank Prof. David Duncker and the entire team at the Hannover Heart Rhythm Center for their generosity in hosting me and for so openly sharing their cases, workflows, and clinical reasoning over the two weeks. I am equally grateful to APHRS and EHRA for creating and supporting this Immersion Program. Opportunities like this, that let physicians cross continents to learn directly from one another, are exactly what our field needs more of, and I sincerely hope the program continues to grow in the years ahead.



Me (Jeremy William) after a rewarding experience with Professor David Duncker and the entire EP team at Hannover.

The 20th Asia Pacific Heart Rhythm Society Scientific Session

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