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30th Atrial Fibrillation Symposium, Boston (MA), January 16 – 19, 2025

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Atrial fibrillation (AF) is the most common arrhythmia encountered in clinical practice. The estimated global prevalence in 2020 was 50 million, but with a continuously ageing world population, the prevalence of AF is expected to more than double by 2050. AF is associated with increased risk of stroke, dementia, myocardial infarction, heart failure and reduced quality of life. The cornerstone of treating AF is with catheter ablation. It seems Pulsed Field Ablation (e.g., ablation by irreversible electroporation) is taking the central stage.

I had the pleasure and privilege to attend the 30th AF symposium which has grown into a major event where cardiac electrophysiologists meet and discuss current and new strategies in treatment of atrial fibrillation (AF). My first time attending this meeting was in 2020 in Washington DC as a lecturer, presenting "Introduction to the Science of Pulsed Field Ablation". There was but one session devoted to electroporation-based cardiac ablation. In addition, Farapulse (a startup company) had a lunch time presentation of the technology, preclinical experience, and most importantly the results of the first clinical study, which was well attended (not sure if it was lunch or presentations that attracted the crowd) and Medtronic just announced their PULSED AF clinical study and successful first in human procedures.

I vividly remember the shy discussions about the future where many expressed their scepticism, but even those who somehow saw PFA as the potential future could probably not imagine the disruptive nature of this technology, and the eruption that happened within this short period.

Five years later, FDA has approved four PFA systems for treating (end of 2023 Medtronic PulseSelect, and in 2024 Farapulse by Boston Scientific, Affera Sphere-9 by Medtronic, and Varipulse by Johnson&Johnson MedTech. It needs to be said however that some of these and other systems have been approved in other geographies even before. Importantly, with little more than one year after FDA approval, collectively, more than 250,000 patients with AF have been treated by PFA – and the number continues to grow exponentially.

Superior safety, procedural efficiency and comparable 1-year efficacy of PFA compared to thermal ablation energies, i.e., radiofrequency and cryopreservation, continues to provide drive to be explored for treating other arrhythmias and serves as drive for more and more companies to develop their own device.

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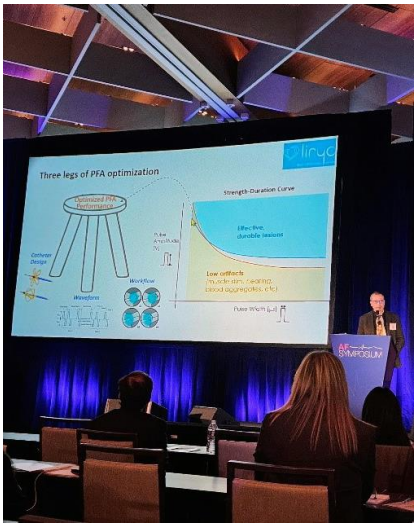
The "standard" side-effects and concerns in treating AF using thermal energies are disappearing from the sight of cardiac electrophysiologists, but new (somewhat unexpected) side effects are reported: haemolysis, cardiovascular spasms, transient phrenic nerve palsy, neuromuscular capture (i.e. electrical stimulation) causing muscle twitching and causing patient discomfort and intraprocedural complications due to patient movement. Some of these are addressed by modification of treatment workflow, and some have been minimized by waveform optimization. The understanding and knowledge of underlying mechanisms will be critical in further development of PFA for treatment of cardiac arrhythmias.

The level of understanding of PFA since 2020 has undoubtfully improved, but there is still much to learn. The interdependence of catheter, waveform, and workflow has been undoubtfully displayed in the literature and presentations and is being recognized as an ensemble that needs to be well orchestrated to achieve durable lesion and minimize risks for patients. Possible origins of bubbles observed by intracardiac echography during pulse delivery have been identified and we can see that the amount of bubbles observed during high voltage pulse deliveries is being minimized through careful design of electrodes on the catheter and waveforms. Other observed phenomena are being thoroughly investigated and discussed, but even these newly identified risks can not diminish the satisfaction of not seeing a single atrial-oesophageal fistula, the most dreaded and often fatal complication for the patient. Without special precautions to protect the oesophagus, there was not a single incidence observed and reported in the 250,000 procedures performed around the globe – the incidence according to a large survey The POTTER-AF Study – is 0.038% and 0.0015%, for radiofrequency and cryoablation, respectively. Which means there should be 3 or 4 occurring by now.

That alone is already a great achievement. Other reported side effects are also rare: 0.06% phrenic nerve paresis, 0.14% coronary spasm, and 0.03% haemolysis-related renal failure. But in hastily developing new systems or overtreating patients, we need to keep PFA safe as is or even safer by using caution and developing our knowledge and understanding further.



Pierre Jais (Central Hospital Bordeaux, France) during his lecture explaining the three pillars of clinically effective PFA: the catheter design, waveform and workflow optimization. While some companies seem to have achieved efficacy, efficiency and safety in treating AF, others are still struggling in multiparameter optimization of the treatment.

Forthcoming events

11th COURSE: Advances in Electroporation-Based Therapy: From Principles to Clinical Applications

Erice, May 2 – 7, 2025

http://www.eisbem.eu/index.php/2025-xi-course/

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