Evaluation of Pulsed Field Ablation Applications on Peri-Atrioventricular Node: Observations on Safety from Swine Model

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Background

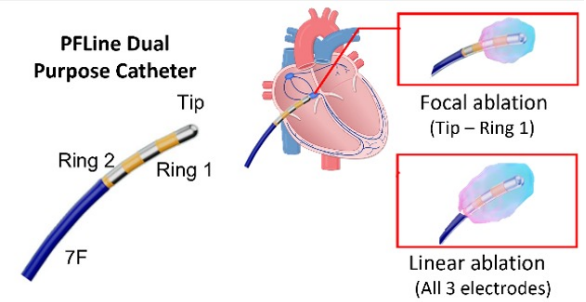
- Pulsed field ablation (PFA) is an emerging alternative to thermal-based ablation for the treatment of cardiac arrhythmias. [1]
- Data for the effects of PFA ablation on the peri-atrioventricular (AV) node are limited, and the optimal delivery protocol and electrode configuration remain undefined. [2]

Objective(s)

We aim to assess PFA delivery's electrophysiologic, imaging, and histologic characteristics on the peri-AV node.

Method

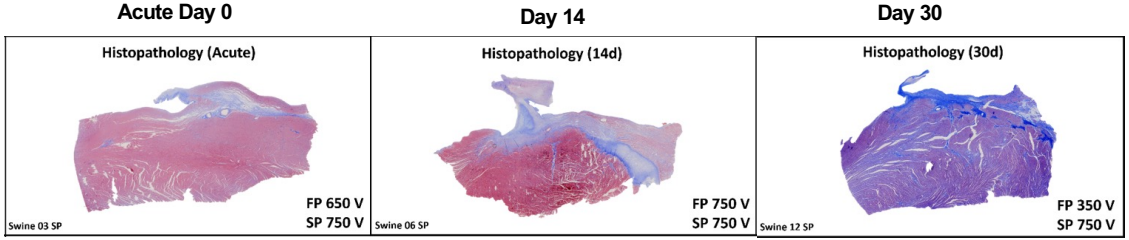
- Twelve swine were studied. PFA was applied at both the fast pathways (FP) and slow pathways (SP) in the right atrium's anteroseptal and posterior-septal regions.
- PFA was delivered starting at 250V and incremented by 100V until 750V or until a complete AV block was observed.



- The PR, AH, and HV intervals were measured before and after each PFA application. After 14d and 30d survival, cardiac specimens were sectioned for histologic analysis.

Results

- AV conduction recovered following PFA application. PFA demonstrated an acute dose-dependent functional effect on the AV node, with pulse voltage amplitude associated with transient PR prolongation or complete AV block.
- AV block was observed in 10/12 (83.3%) animals when FP was targeted and in 4/12 (33.3%) when SP was targeted (P=0.012). In the 4 animals with AV block achieved in both areas, the AV node was always disturbed by a lower level of voltage when PFA was applied at FP.
- The average maximum voltage required at SPs was significantly higher than that at FPs (741±29 vs. 599±148 V, P=0.001).
- Histologic examination confirmed acute peri-AV node targeting, with chronic studies showing minimal subendocardial myocardial fibrosis.



Conclusion

- PFA applications at the peri-AV node can cause functional PR prolongation and AV block.
- Fast pathways were more vulnerable than SPs using the same voltage.
- Further studies are required to optimize the safety and efficacy for lesion generation with PFA.

Disclosures/Reference

1. Bradley CJ, et al. Pulsed-field ablation for pulmonary vein isolation in the treatment of atrial fibrillation J Cardiovasc Electrophysiology. 2020
2. Zheng et al. The Safety and Feasibility of Pulsed-Field Ablation in Atrioventricular Nodal Re-Entrant Tachycardia: First-in-Human Pilot Trial JACC EP 2024