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ATRIAL FIBRILLATION CYCLE LENGTH SLOWING PREDICTS RHYTHM OUTCOMES IN PERSISTENT AF PATIENTS AFTER PULSED FIELD ABLATION WITH A PENTASPLINE CATHETER

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Background: Pulmonary vein isolation (PVI) alone is less effective for catheter ablation (CA) of persistent atrial fibrillation (PerAF) compared to paroxysmal atrial fibrillation. Empirical adjunctive left atrial posterior wall (LAPW) ablation (LAPWA), to increase rhythm outcome in this wide population, has yielded conflicting results.

Objective: We aimed to determine whether the analysis of signals recorded from a pentaspline pulsed field ablation (PFA) catheter could identify fast-LAPW PerAF patients who might benefit most from adjunctive LAPWA. Additionally, we investigated whether CA-induced AF cycle length (CL) slowing, recorded from a decapolar coronary sinus (CS) catheter, predicts rhythm outcomes.

Methods: consecutive PerAF patients treated with a pentaspline PFA catheter at three centers were enrolled. PVI and LAPWA were performed in all cases. AF-CL was measured using the FARS-10 method. Local AF-CL was measured as follow: from the four pulmonary veins (PV-CL), before CA, with the pentaspline catheter in basket configuration; from LAPW after the completion of PVI with the pentaspline catheter in flower configuration, placed at various LAPW locations to cover its whole area, recording the fastest value (LAPW-CL); from the distal CS-catheter at three steps: before CA (baseline CS-CL), after PVI (post-PVI CS-CL) and after LAPWA (post-LAPWA CS-CL). Patients converting to atrial flutter or sinus rhythm during CA were excluded. Arrhythmic recurrences were defined as any atrial tachyarrhythmia (ATA) beyond the 2-month blanking period.

Results: A total of 288 PerAF patients were enrolled, with 18 excluded for not meeting criteria. Of the remaining, 29.6% were female, mean age was 67.1 ± 11.0 years, and median PerAF duration was 12 [9–20] months. Rapid-LAPW activity was defined as less than the mean of fastest LAPW cycle lengths (190 ms); 56.1% of patients showed rapid-LAPW activity. PVI plus LAPWA was achieved in 100% of patients, with a mean procedural time of 71.5 ± 29.4 mins. After a median follow-up of 14 [12–16] months, 74 patients (26.5%) had an ATA recurrence. No difference was found in PV-CL between patients with and without recurrence. Ablating rapid-LAPW activity was not associated with ATA recurrences (OR 0.524, CI 0.154–1.797, $p=0.302$), but LAPW-CL/post-PVI CS-CL ratio was significantly lower in patients without ATA recurrence. In all patients CA was associated with AF slowing on signals from distal CS catheter: obtaining a higher ratio post-LAPWA CS CL/baseline CS-CL was linked to lower ATA recurrence rate (OR 0.210, CI 0.065–0.677, $p=0.009$). An empirical optimal cut-off point was identified as 23.5%, with a sensitivity of 0.65 and specificity of 0.72.

Conclusion: PFA of PV and LAPW induced a progressive slowing of AF-CL, measured on signals from distal CS-catheter. The magnitude of this slowing was predictive of rhythm outcome, with a cut-off of at least 23.5% of cycle length prolongation to predict freedom from ATA. The presence of an higher frequency gradient between the LAPW and the left atrium, rather than the LAPW-CL as an absolute value, was predictive of rhythm outcome and could suggest a role of LAPW as AF-driver in this PerAF population.