# Catheter Configuration for Mapping Micro-Anatomic Reentries sustaining Atrial Fibrillation

María Termenón-Rivas, Giada S. Romitti, Miguel Rodrigo

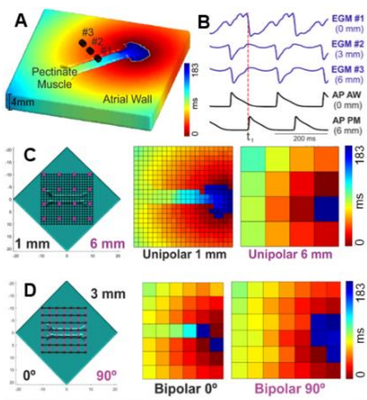
CoMMLab, Universitat de València, València, Spain

Persistent atrial fibrillation (perAF) ablation treatment may benefit from multi-electrode mapping (MEM) of extra-pulmonary vein arrhythmogenic sources including intramural microanatomic reentries. This works aims to define optimal MEM configurations to identify common microanatomic reentries.

Human microanatomic reentrant driver was reproduced in anisotropic 3D model (150µm3 resolution) of atrial tissue of 30x30x4mm with sub-endocardial laterally-insulated myobundle of 15x2.5x1.5mm with perAF cellular model (Kuivumaki). Unipolar and bipolar electrograms at endocardial electrodes (1mm diameter and length) were simulated and local activation time (LAT) maps were calculated by -dV/dt_max and V_max, respectively. 876 MEM configurations with variable inter-electrode distances (1-10 mm), polarities (unipolar-bipolar), orientations (parallel-perpendicular), surface distances (0.25-1 mm) and locations (1mm steps) to the reentrant track were used to evaluate the reentry visualization (>75% of cycle) by LAT mapping.

Action potential simulation of microanatomic reentry (A) showed that the conduction through common reentrant path could be only identifiable by EGMs located < 3 mm from the track (B). The reentrant track was identifiable in LAT maps from dense unipolar MEM (C, 1 vs 6mm) with close surface contact (0.25mm) and for bipolar catheter configurations only when bipoles were aligned with the reentrant path (D). On multiple positions (E), the reentry was observable >33% on unipolar LAT maps for inter-electrode distances ≤ 6mm. Bipolar LAT maps only showed the reentry was identifiable with the parallel catheter orientation and ≤ 3mm spacing.

The 3D human AF driver simulation suggested ≤ 3mm inter-electrode and <1mm surface distance requirements for contact would be required to map microanatomic reentrant drivers.




| E | Unipolar | | Bipolar | | | |
|---|---|---|---|---|---|---|
| | 0.25mm | 1mm | 0.25mm | | 1mm | |
| Spacing | | | 0º | 90º | 0º | 90º |
| 1 mm | 100% | 100% | 100% | 0% | 100% | 0% |
| 3 mm | 100% | 89% | 100% | 0% | 44% | 0% |
| 6 mm | 47% | 25% | 11% | 0% | 31% | 0% |
| 10 mm | 6% | 10% | 0% | 0% | 0% | 0% |