

Tracking of Stepwise Ablation of Persistent Atrial Fibrillation using Synchronization of nearby Electrograms

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Purpose: The timing of bipolar intracardiac electrograms (EGMs) during atrial fibrillation (AF) reflects the dynamics of AF wavelets. The extent of synchronization between EGMs is an indirect measure of AF spatial organization. Our study intends to determine whether the synchronization of nearby electrodes can track the gradual organization produced by stepwise catheter ablation (step-CA) “en route” to AF termination (AF-term, i.e. restoration of sinus rhythm (SR)/conversion to atrial tachycardia).

Methods: 5 patients (mean age 60 ± 4) with long-standing persistent AF (per-AF) (mean duration 16 ± 10 months) successfully underwent AF step-CA consisting of pulmonary veins isolation, ablation of fragmented potentials and left atrial lines until AF-term. Bipolar EGMs from a quadripolar catheter placed into the right atrial appendage were continuously recorded and split into 10-sec epochs. Windows (whose size corresponded to the mean AF cycle length – AFCL) centered on each maximum positive activation potential of the source (distal electrode) were computed on the target (proximal electrode). These windows were summed to form a vector, the sparseness (SPAR) of which quantified the synchronization between proximal and distal dipoles. Differences in SPAR and AFCL values (in %) were compared during the last two steps preceding AF-term.

Results: Before AF-term, SPAR and AFCL both increased. However, SPAR increased by 31% while AFCL by 3%. SPAR performed considerably better than AFCL.

Conclusion: Our preliminary results suggest that our index based on the synchronization of nearby electrodes was able to track the evolution of organization before AF-term. SPAR is a promising parameter that might help to titrate the amount of ablation required to restore long term SR.