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Comparing multiple mapping methods at sites where persistent AF terminates: the COMPARE-AF registry

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Introduction: Sites where ablation terminates persistent AF may have mechanistic relevance, with high rates of acute termination during ablation suggesting an hierarchical role in sustaining AF.

Purpose: To date there has been no systematic comparison of mapping methods using the same patient data at sites where the fibrillatory process has been disrupted by localised ablation. We therefore compiled an international 5-center retrospective clinical registry of 103 patients all with the previously rare occurrence of termination of persistent AF by ablation. We systematically compared 3 methods of AF mapping in identifying driver sites (COMPARE-AF COMparison of Algorithms for Rotational Evaluation in Atrial Fibrillation, NCT02997254).

Methods: Ablation terminated persistent AF in each patient, at a location marked on electroanatomic shells. Three methods were retrospectively applied to 64-unipole basket to generate AF maps: (1) Activation (maximum -dv/dt, method of Waldo & Allessie); (2) Phase (Hilbert transform, method of Kuklik & Schotten); (3) Combined activation/phase (FIRM, method of Narayan & Rappel). All maps were read blinded to termination site by 3 readers. Random non-terminating sites acted as controls.

Results: Patients (63±10 years, 35% female, LA diameter 47+/− 9mm) had AF termination to sinus rhythm (55%) or atrial tachycardia (45%), either pre-PVI (46%), during PVI (17%) or post-PVI (37%). AF maps showed disorder, with organized zones that varied per method (p<0.05 using ANOVA). In pre-specified subgroup analysis, ablation termination of AF pre-PVI, revealed rotational/focal activity in 20.8% by method 1, 83.3% (method 2) and 73.8% (method 3; p<0.01 using ANOVA) (inset graph B).

Figure shows ablation pre-PVI (A) terminates persistent AF (C); at a LA site where method 1 showed partial rotations (D), methods 2-3 showed sustained rotations (E, F). At control sites , rotations/foci were less prevalent by methods 1-3 (0.0%, 2.4%, 4.8%, each p<0.01 vs termination sites). Organized activity was more common by methods 2,3 vs 1 (p<0.01).

Conclusions: In this multicenter international registry, sites where ablation terminated persistent AF could be more accurately identified by phase or phase/activation mapping than activation isochrones alone. Activation mapping of AF using current traditional criteria is not suitable for driver detection.
Future Directions: Multicenter comparative mapping studies may help reconcile AF mechanisms and approaches to substrate ablation. Long term ablation outcome data based on mapping method are pending. High resolution studies of the areas of agreement identified by differing mapping systems may help delineate the substrate basis for AF maintenance, and mechanisms for its termination.