

An Automated Platform to Standardize Position in the Left Atrium and Map Electrophysiological Data

Marianna Meo, Josselin Duchâteau, Jason Bayer, Thomas Pambrun, Caroline H. Roney, Edward J. Vigmond, Nicolas Derval, Arnaud Denis, Pierre Jaïs, Méléze Hocini, Michel Haïssaguerre, Rémi Dubois

IHU Liryc, Electrophysiology and Heart Modeling Institute, Foundation Bordeaux University

Introduction: Left atrial (LA) electrophysiological assessment is essential to guide atrial fibrillation (AF) ablation. However, we still lack tools for intra-patient regional analysis and inter-patient comparisons. This study proposes an automated platform to describe position and display electrophysiological data in a standardized LA reference space.

Methods: High-density 10-s bipolar electrograms (EGMs) were acquired on LA in 36 persistent AF patients (28 male, 68 ± 11 years, AF duration 8 ± 10 months) before ablation (828 ± 326 points). Peak-to-peak voltage and fractionation as quantified by the shortest interval between consecutive complex fractionated EGMs (SCI) were measured and interpolated on patient's LA mesh. Each point on LA surface was identified by radial (ρ) and angular (θ) coordinates, which were calculated by solving Laplace's equation on LA mesh with appropriate Dirichlet boundary conditions. The same coordinate system was determined on a reference LA anatomy (Figure 1A), on which EGMs parameters were projected (Figure 1B). Average distributions of SCI and voltage were compared through the Kruskal-Wallis test in four regions: lateral, anterior, posterior, and septal.

Results: Bipolar voltage was significantly lower on the posterior wall (0.59 ± 0.14 mV vs lateral: 0.77 ± 0.14 mV, anterior: 0.63 ± 0.12 mV; septal: 0.58 ± 0.10 mV, $p < 0.0001$). Higher fragmentation was measured by lower SCI in the LA septum (34.4 ± 1.8 ms vs lateral: 35 ± 1.8 ms; anterior: 34.9 ± 2.2 ms; posterior: 34.1 ± 1.7 ms, $p < 0.0001$).

Conclusions: We developed a quantitative, automatic system to identify position on LA and visualize EGM data, which improves standard AF mapping and enables systematic comparisons between AF patients.

