

A New Approach for Mapping Slow Electrical Conduction Areas in Atypical Atrial Flutter

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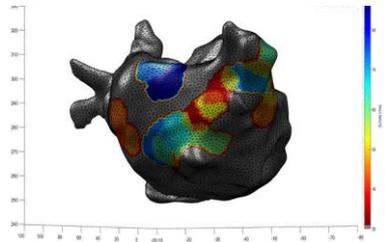
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Introduction. To properly recognize slow electrical conduction areas in atypical atrial flutter, local atrial activations must be accurately identified. To date, mapping systems identify the precocity or lateness of a local activation with respect to a fixed reference considering its first deflection while neglecting its duration, which can provide additional relevant information on slow conduction areas. In this study we developed an automatic approach to compute local activation durations from EGMs acquired using two AdvisorTM mapping catheters (Abbott), the FL circular (FL) and the HD Grid (HD), from which patient-specific 3D maps showing slow electrical conduction areas were reconstructed.

Methods. First, EGMs were pass-band filtered (30 to 300 Hz). Then the histogram of each EGM was computed, and three different pairs of thresholds (6°-94°, 5°-95° and 3°-97° percentiles) were used to identify the duration of the local activations. An additional step based on the shape similarity of the detected activations was applied to optimize the detection. Then, for each detected activation, its duration was computed. The developed approach was validated against 1392 activations (in 2 patients) for the FL and 2483 activations for the HD (in 2 patients) manually annotated by an expert electrophysiologist (gold standard, GS). **Results.** For FL/HD, the thresholds which resulted in the best performance were the pairs 6°-94°/5°-95° percentiles, respectively (sensitivity 99%/94.5%, specificity 99%/99.4% and accuracy 99%/96.8%). The mean errors in the computed activation durations are reported in the table.

Conclusions. The developed algorithm is accurate, and the 3D maps (figure) showing slow electrical conduction areas may represent a useful tool to be integrated with activation and voltage maps to plan and assist therapeutic interventions.



		GS activation duration (ms)	Mean error (ms)	Mean percentage absolute error (%)
Advisor TM FL circular	Pt 1	49.5±8.6	0.05±1.3	6.4±4.0
	Pt 2	45.9±10.1	-0.37±1.87	4.1±3.2
Advisor TM HD Grid	Pt 1	65.8±7.5	-5.3±0.8	5.3±0.8
	Pt 2	55.8±11.0	-0.1±9.7	7.5±6.0