

Optimizing Atrial Electrogram Classification Based on Local Ablation Outcome in Human Atrial Fibrillation

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Aims: Changes in atrial fibrillation cycle length (AF-CL) are broadly used as a ‘ground truth’ to assess the effect of substrate modification during AF ablation. Increase in AF-CL following ablation has been reported before persistent AF (persAF) termination. There is, however, no consensus on how much of a change in AF-CL should be considered to characterise significant substrate modification. In this work, we sought to optimize thresholds for changes in coronary sinus CL (CS-CL) after local ablation using different atrial electrogram (AEG)-derived markers.

Methods: 834 AEGs were collected from 11 patients undergoing persAF ablation. Pulmonary vein isolation was performed followed by AEG-guided ablation. All patients achieved AF termination as a result of ablation. CS-CL was measured before and after each ablation point. AEGs collected at regions in which ablation resulted in CS-CL increase above a certain threshold were labelled ‘target’, and those below this threshold were labelled ‘non-target’. Thresholds from 0 to 100 ms were investigated. Five AEG-derived markers were tested as classifiers for CS-CL changes: ICL (Biosense Webster), CFE-Mean (St. Jude Medical), Wave Similarity, Shannon Entropy and AEG-CL. The area under the receiver operating characteristic (AUROC) curve was used to assess the quality of classification for each.

Results: Maximum AUROC was found at threshold values between 9 and 14 ms in all markers, with the exception of Shannon Entropy (Table 1). The average AUROC among the five markers reached a maximum of 0.60 at threshold 10 ms, which is one of the points of smallest variance (Figure 1).

Conclusion: Our results show good agreement between the markers, despite their different optimal thresholds. The 10 ms threshold is suggested as a starting setpoint for future studies seeking to identify AF ablation targets based on objective CL-based ‘ground truth’.

Marker	Maximum AUROC	Optimized Threshold (ms)
ICL	0.60	14
CFE-Mean	0.62	14
Wave Similarity	0.62	9
Shannon Entropy	0.67	66
AEG-CL	0.62	10

Table 1: Max AUROC and threshold for each marker

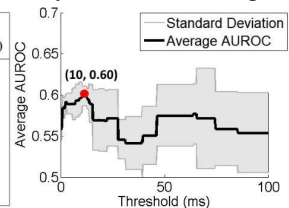


Figure 1: Average AUROC vs Threshold