Non-invasive Electrophysiological Mapping Entropy Predicts Atrial Fibrillation Ablation Efficacy Better than Clinical Characteristics

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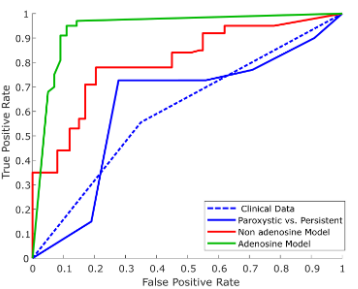
Introduction: Catheter Ablation procedure is assumed as one of the more effective treatments to terminate Atrial Fibrillation (AF). However, the efficacy of this expensive, invasive and complex procedure remains low.
Aims: This study evaluated the potential usefulness of Fuzzy Entropy of Non-invasive Electrophysiological mapping to identify AF patients in which ablation treatment was not effective. The accuracy of this novel methodology is compared with standard of care clinical characteristics.
Methods: A total of 29 patients were included in the study. All were referred for pulmonary vein isolation ablation procedure. During the ablation procedure a Body Surface Potential Mapping (BSPM) consisting of 54 electrodes homogeneously distributed over the torso. BSPM signals were recorded under AF basal conditions and after the administration of adenosine (12-18mg). The ability of 4 matching learning models to predict which patients would be in sinus rhythm and which would remain in AF six months after ablation was tested. Specifically, prediction models evaluated (1) differences in clinical characteristics, (2) classical paroxysmal vs. persistent classification, (3) a predictive model based on Fuzzy Entropy of Non-invasive Electrocardiographic mapping during basal AF recordings and (4) a predictive model based on Fuzzy Entropy of Non-invasive Electrocardiographic mapping during the administration of adenosine. The 4 predictive models were compared in terms of accuracy and area under the receiver operating characteristic curve (ROC curve).
Results: Figure 1 shows the ROC curve for the 4 prediction models. Predictions based on non-invasive electrocardiographic mappings during adenosine infusion (accuracy: 90%, AUC: 0.93) showed a clear improvement over standard-of-care clinical parameter models (accuracy: 62.1%, AUC: 0. 54). The best performance corresponds to the Fuzzy Entropy model obtained from non-invasive electrocardiographic signals during the infusion of adenosine.



Conclusions: Complexity of non-invasive electrocardiographic maps signals appear as a potential tool to predict the efficacy of AF ablation therapies.