Man vs. Machine: Comparison of manual vs. novel 12-lead ECG algorithm to predict the ventricular arrhythmia origin to guide ablation procedure

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Introduction: Catheter ablation of frequent idiopathic ventricular arrhythmias (VA) is increasingly performed. Preprocedural prediction of the arrhythmia origin from the 12-lead ECG is critical to reduce invasive mapping procedure time. Preprocedural prediction, however, is limited by inter-individual variation in electrode position and heart orientation. In this study, we prospectively assessed the performance of manual vs. automated 12-lead ECG analysis in the prediction of VA origin in the RV as opposed to the LV.

Methods: In a prospective observational cohort study, consecutive patients undergoing catheter ablation of idiopathic VA were enrolled. The VA origin was defined as the site where ablation caused arrhythmia suppression. A digital 12-lead ECG was recorded at admission for documentation of the VA. All baseline ECG's were analyzed manually by 3 Electrophysiologists and 3 EP Fellows guided by a previously published ECG algorithm. Similarly, the same 12-lead ECG's were analyzed using a recently developed fully automated ECG algorithm (Alvale), which assumed standard body build and lead placement.

Results: A total of 54 patients were enrolled. Median age was 48 years and 59% of the patients were female. The VA origin was found in the RV in 33 patients (61%) and in the LV in 21 patients (39%). The automated 12-lead ECG algorithm successfully identified the VA origin in 76% of the patients, which was similar compared to manual ECG analysis performed by the Electrophysiologists (median 76%, range 74-80%) and the EP-Fellows (median 76%, range 74-78%).

Conclusion: Alvale predicted the origin of idiopathic VA in the RV or LV with a similar accuracy as manual expert analysis. Inter-individual variation of precordial electrode positions and of the heart orientation, however, introduce a source of error that limits the accuracy. Integration of the patient-specific electrode positions obtained with 3D photography might further improve the performance of the automated analysis.

Figure: Example of a PVC origin correctly predicted in the RVOT based on the automated Alvale ECG algorithm