

Forward-Solution Computational ECG Mapping for Ventricular Arrhythmias in Patients with Adult Congenital Heart Disease

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Objective: Forward solution ECG mapping has demonstrated effective source localization in patients with ischemic and non-ischemic cardiomyopathy. Accuracy in patients with adult congenital heart disease (ACHD) is unknown. We hypothesized that forward solution mapping for PVC and VT ablation in patients with ACHD is feasible with good spatial and anatomical resolution.

Materials and Methods: We enrolled consecutive ACHD patients undergoing PVC and VT ablation between 2020-2022. Successful VT and PVC ablation locations were marked on a 3-dimensional cardiac model. ECGs of clinical arrhythmias were analyzed using the forward solution algorithm to generate heatmaps of probable source locations. Regional (free wall versus septal), segmental, center-to-center spatial, and right versus left ventricular accuracy were assessed compared to the site of successful ablation.

Results: Six patients (38 years [35 – 48], EF 61% [56 – 64], female=4) were enrolled. Patients had prior surgical intervention in the RV (67%) and LV (17%). Ten ablation sites were analyzed; the most common were RV apex (30%), moderator band (20%) and LV outflow tract (20%). Regional and segmental mapping outputs were accurate for all arrhythmias (10/10, 100%). Spatial accuracy was 13.5mm ([7.5–15.75]; Wilcoxon P <0.05). Right versus left ventricular accuracy was suboptimal in 2 subjects with double-outlet right ventricle and Williams Syndrome.

Conclusion: Forward solution ECG mapping demonstrated accurate source localization in ACHD. Suboptimal right versus left chamber accuracy may reflect abnormal electrical activation in ACHD. Additional studies are required to determine whether arrhythmia simulation libraries specific to ACHD may improve mapping results.

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