

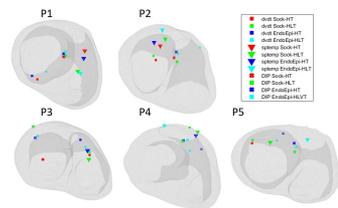
# Variability of Premature Ventricular Contraction Localization With Respect to Source and Forward Model Variation in Clinical Data

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**Objective:** Electrocardiographic imaging can provide a preliminary location of premature ventricular contraction (PVC) origins, which can help shorten the invasive radio-frequency ablation (RFA) procedure. However, PVC localization results vary significantly with respect to the equivalent cardiac source model and the level of complexity assumed in the forward model. This study aims to evaluate PVC localization based on various source and forward model assumptions. **Methods:** We use body surface potential (BSP) measurements from 5 patients with PVCs, indicated for RFA. We assume two equivalent source models: dipole-based and heart surface potential-based. We obtain forward matrices using the boundary element method for epicardial only/ endo-epicardial surfaces of the heart, and for homogeneous/ inhomogeneous torso models. PVC origin for the dipole-based solution is the location of the single dipole yielding the lowest relative error between the measured and computed BSPs. Tikhonov regularization is used for the potential-based solution, and activation times (AT) are computed using the minimum derivative method (dVdT) and a spatio-temporal (sptemp) approach. PVC origin is assigned as the node with the minimum AT. We evaluate the variability in the PVC origin estimates based on these various source and forward models. **Results:** Dipole-based PVC locations are in general more clustered compared to potential-based PVC locations. Min(dVdT)-ATs had artifacts, resulting in PVC locations spread around the heart and usually with conflicting results. Spatio-temporal AT estimates smooth the ATs, therefore, result in more clustered PVC locations. The localization of PVC origin using the potential-based solution was more sensitive to changes in the forward model than the dipole-based method.

**Conclusion:** Despite variation in the PVC origin estimates, the AT and RRE maps provided similar information consistent with patient descriptions. Rather than specifying a single point PVC origin, these maps could guide the physicians for more accurate localization.



PVC origins for 5 patients.