New Iterative Pace Mapping Algorithm to Predict Ventricular Ectopy Origin

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March 12, 2021

Introduction   Catheter ablation can cure premature ventricular contractions (PVCs) but it can be time-consuming and difficult to find the exact site of origin.

We developed an iterative method to detect PVC origins based on multiple stimulations and the corresponding 12-lead electrocardiograms (ECGs) and tested it in silico on models of 7 patients.

Methods   The algorithm assumes a linear relation between PVC origin and QRS integrals of the 12-lead ECG. It learns the relation between origin and ECG from beats paced at known locations. This learning is performed using the partial least squares method. This method is particularly convenient when there is colinearity in the data, the case of the 12-lead ECG. The algorithm starts with 4 pacing sites and then computes a first prediction of the PVC origin. The cardiologist stimulates at this location, and the algorithm uses the new information to improve the accuracy of the prediction. These steps are iterated until there is no large movement between two consecutive predictions.

Results   For each of the 7 models, 300 target PVCs were chosen randomly: 50 subendocardial, 50 intramural, and 50 subepicardial, for each ventricle. Thus we tested 2100 target PVCs. The initial 4 pacing sites were chosen manually, in the same ventricle as the target.

As shown in Fig. 1, 95 % of the predictions were accurate enough for ablation after 8 paced beats. Accuracy was much better for targets located in the left ventricle. Accuracy was also better in the endocardium than in the epicardium.

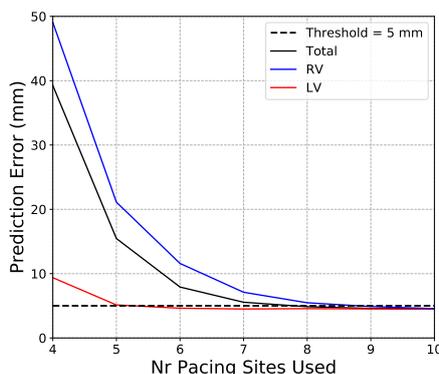**Discussion**   In 95 % of the cases, this method is accurate enough to hit the origin with a radiofrequency lesion.

Figure 1: 95th Percentile of Localization Error