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Degree **:** Ph.D.

Title of Thesis: Quantitative Measurements Comparing Body Surface Potentials During Pace Mapping and Spontaneous Ventricular Tachycardia

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Abstract :

Background: Catheter ablation of recurrent ventricular tachycardia (VT) in patients with structural heart disease is challenging, in the majority of these patients, a substrate-based approach using pacemapping and guided by body-surface electrocardiograms (ECGs) is used. Our aim was to develop a computational method for localizing the origin of ventricular activation from the 12-lead ECG and/or from the body surface potential mapping (BSPM) data. **Methods and Results:** For 18 consecutive consenting patients who underwent ablation of scar-related VT, BSPM data (120 ECG leads, including the standard 12 leads) were recorded during pacing at 266 left-ventricular endocardial sites identified on three-dimensional electroanatomic maps, and each site was associated with one of the 16 anatomical segments. BSPM data corresponding to these sites constituted a design set for generating characteristic ECG templates for each segment, consisting of time-integrals of the entire QRS (∫QRS) or of the trimmed QRS (e.g. initial 120 ms, denoted as ∫QRS120), for either 12 or 120 leads. ECG patterns were matched with pre-determined templates, using the correlation coefficient (CC) or mean absolute deviation (MAD) as metrics. Localization accuracy (percentage correct hits by the first-ranked segment and by those ranked as first/second and first/second/third. The ∫QRS120 templates correctly ranked the pacing segment as the first, first/second, and first second/third in 52%, 76%, and 87% of cases, respectively, for 12-lcad templates, while localization accuracy of the 120-lead ∫QRS120 was significantly better at 61%, 83%, and 92% (P = .007, .002, .0003), respectively.

Conclusions: Localization of the origin of ventricular activation to the vicinity of the endocardial segment of origin can be achieved with high accuracy by template-matching using the 12-lead ECG; significantly better accuracy can be achieved

with 120-lead body surface potential maps. Real time implementation of this method may facilitate pacemapping of VT.

Keywords:

Quantitative measurements; Ventricular tachycardia; Body surface potential mapping.