Intracardiac Mapping of Clinical Markers for Prediction of Ventricular Tachyarrhythmia

Computer Integrated Surgery II
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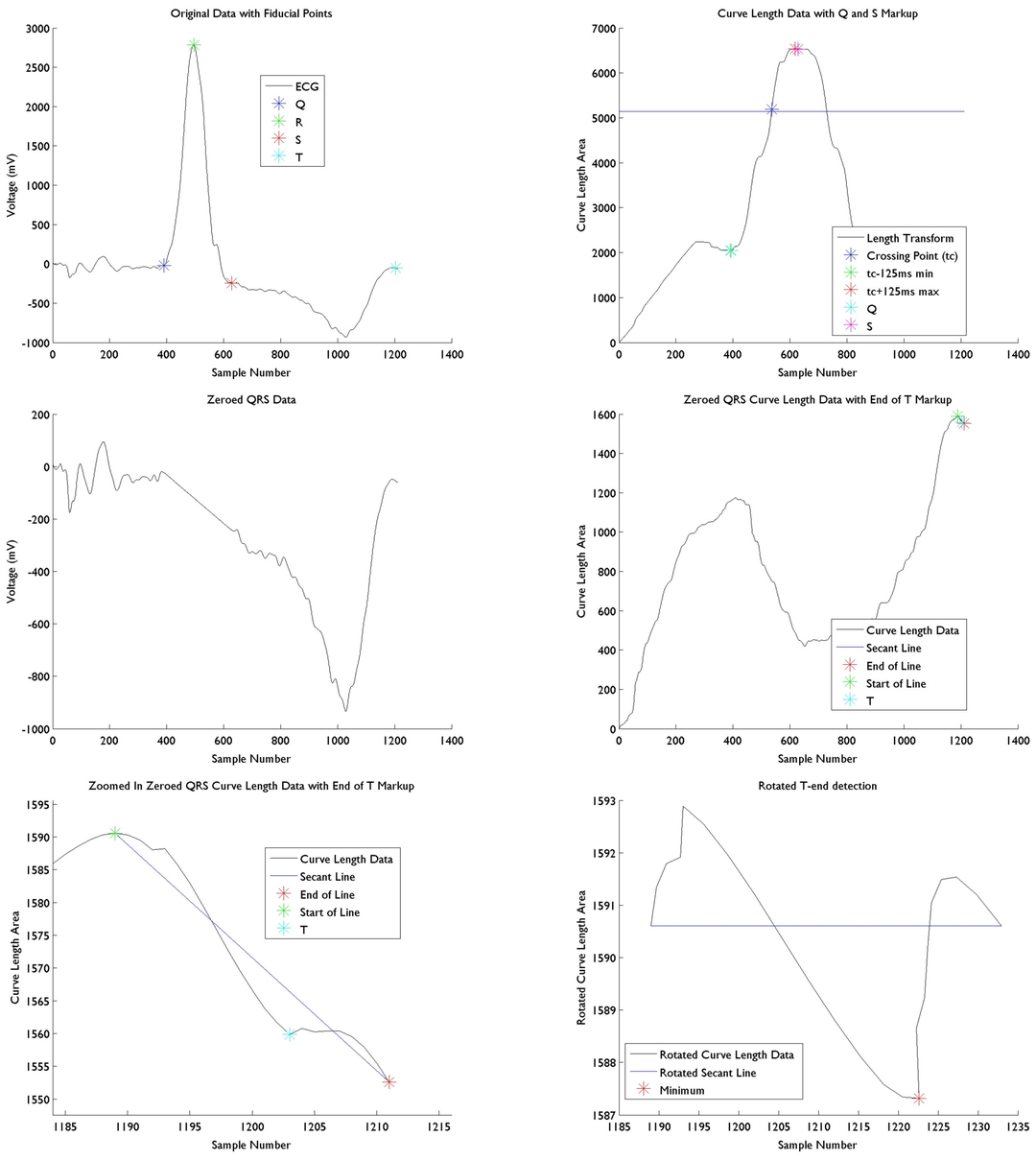
Introduction

- Ventricular tachyarrhythmias play a key role in sudden cardiac death which claims the lives of approximately 400,000 people per year in the United States.
- One of the current therapies for preventing tachyarrhythmias, an implantable cardioverter-defibrillator, is only effective in ~65% of patients
- Recently, Dr. Larisa Tereshchenko, showed that the sum absolute QRST integral is an accurate predictor for ventricular tachyarrhythmia
- Unfortunately, the current method for mapping the electrical activity in the heart involves a catheter-fed electrode and is unable to map individual heart beats
- Our project seeks to allow physicians to understand the electrical activity in the heart through noninvasive 120-lead ECGs

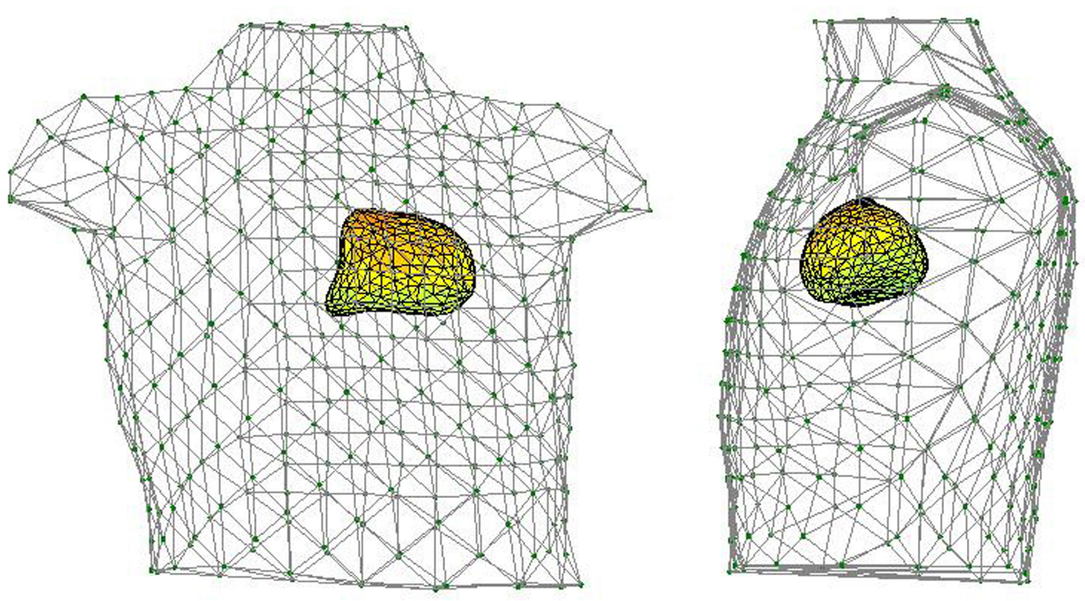
Methods

- ECG Fiducial Points were determined semi-automatically using a modified version of the algorithm detailed in "A QT Interval Detection Algorithm Based on ECG Curve Length Transform" (Zong et al. 2006)
- From these detected fiducial points, various clinical markers were mapped to their corresponding nodes in a 120/291 node heart-torso model. The remaining surface was calculated through interpolation.

Example Method



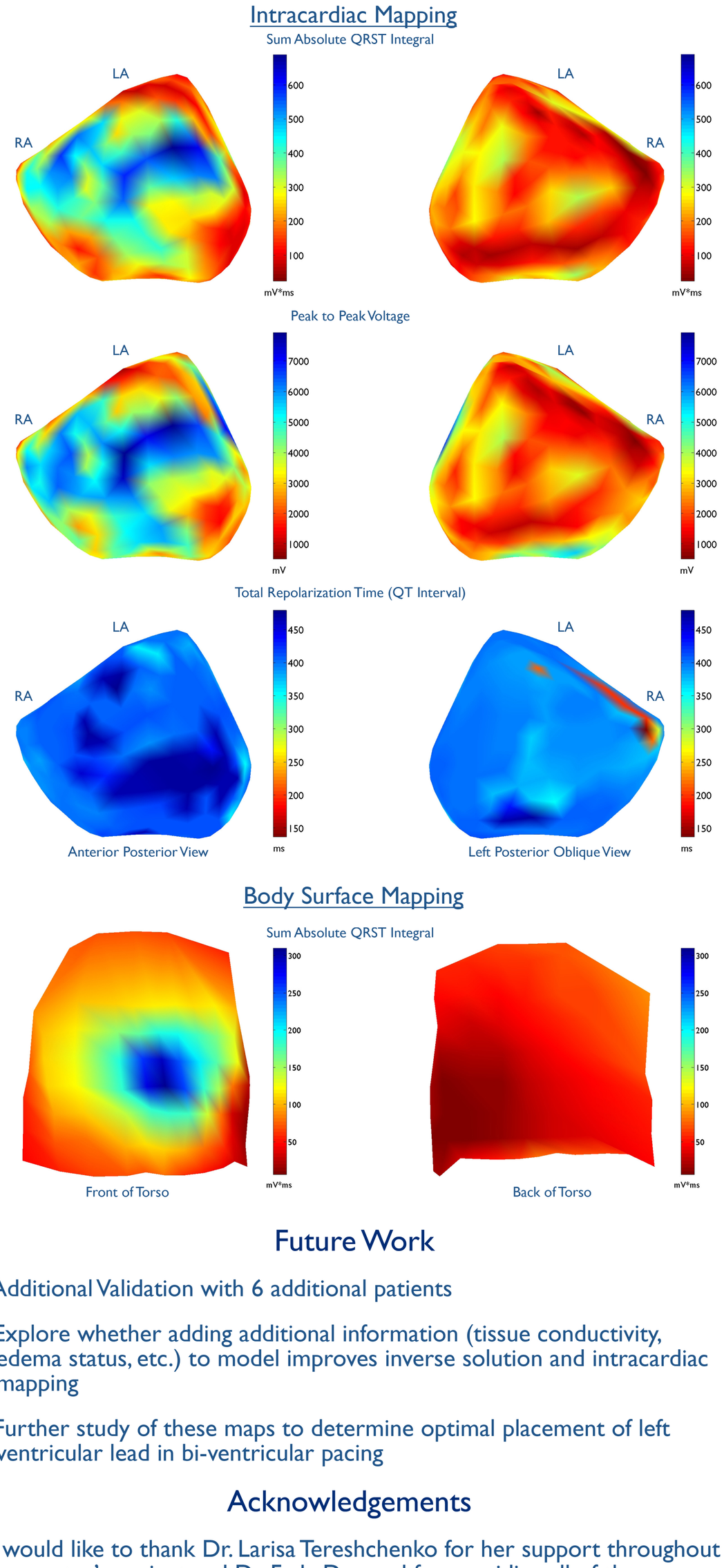
Heart-Torso Model



Results

- Areas with elevated SAI QRST and/or high peak-to-peak voltage matched closely with hypertrophied tissue as seen in MRI scan
- QT interval map shows dispersion of depolarization at the edge of arrhythmogenic scar tissue
- SAI QRST may be a surrogate for peak-to-peak voltage
- The placement of each orthogonal lead for traditional SAI QRST measurement is very important

Intracardiac Mapping



Body Surface Mapping

Future Work

- Additional Validation with 6 additional patients
- Explore whether adding additional information (tissue conductivity, edema status, etc.) to model improves inverse solution and intracardiac mapping
- Further study of these maps to determine optimal placement of left ventricular lead in bi-ventricular pacing

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