The Influence of the Most Powerful Signals on the Pacing Site Localization by Single Dipole

Jana Svehlikova, Beata Ondrusova, Jan Zelinka, Milan Tysler

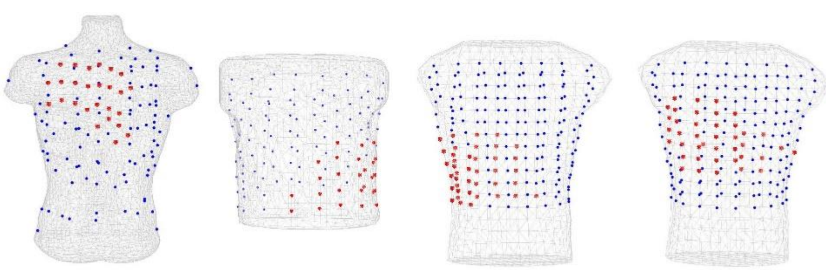
Institute of Measurement Science, SAS, Bratislava, Slovakia

In electrocardiographic imaging, the important role plays the quality of measured signals, the signals pre-processing, as well as the number of measuring leads. In real clinical conditions, the signals are often disturbed due to the bad connection between the skin and electrode, local myopotentials from the patient, and the noise from external devices/equipment in the measuring room. It was shown that the omission of the signals with the smallest amplitudes does not affect the inverse solution. In this study, the impact of the absence of the most powerful signals on the single dipole inverse method was inspected.

Data from four experiments with ventricular pacing (provided by the Consortium for ECGI) measured on three different models of heart-torso geometry were used: Bordeaux data from pig heart (IHU-LIRYC France) and human data (IMS Bratislava) recorded in 128 leads, and two data sets from dog heart (SCI Utah) recorded in 192 leads. Bordeaux and Utah data were recorded on the homogeneous tank-torso model. Averaged signals in each experiment were sorted according to their power value and then up to 20% of the largest ones were removed. The localization error (LE) between the true and computed pacing site was evaluated for various combinations of the removed leads.

For Bordeaux data, the LE increased from 7 to 24 mm, for human data LE increased from 16 to 68 mm and from 14 to 63 mm for homogeneous and inhomogeneous torso model respectively. The LE 13 and 7 mm remained unchanged for two data sets from Utah even if 40 leads were omitted.

The largest effect of electrodes omission using human data can be explained by the largest complexity of the measured torso. No effect for Utah data results probably from the fact that 50% more leads were measured in comparison to Bordeaux or human data.



Measuring electrodes (blue dots) in four experiments (Bordeaux, human, Utah1, Utah2) with 20% of the most powerful electrodes (red asterisks).