

Body-Surface Atrial Signals Analysis Based on Spatial Frequency Distribution : Comparison Between Different Signal Transformations

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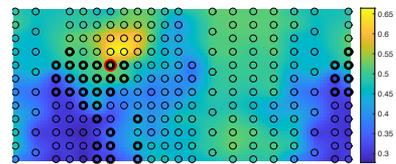
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The frequency of atrial fibrillation (AF) is known to vary over both time and space. In contrast to electrograms, Body-Surface Potential Mapping (BSPM) records the global atrial activity but at the cost of a lower spatial accuracy. In this study, a comparison between various spectral analysis approaches is performed. The aim is to investigate whether the BSPM discriminates persistent patients undergoing electrical cardioversion, based on the body-surface normalized AF spatial frequency distribution.

High-density body surface potential maps (120 anterior, 64 posterior electrodes) were recorded in 75 patients with persistent AF. For each patient and electrode recording, the frequency content of AF was analyzed on the raw signal, and also by means of the normalized correlation function, and Singular Spectrum Analysis (SSA). In order to compare the body-surface spatial distributions of AF frequency in all patients, these distributions were first normalized, before performing statistical analysis.

We found that the distribution of AF frequency on the body-surface, and its interpretation, are strongly dependent on the specific method employed. Moreover, the estimated body-surface frequencies values were larger over the central posterior and the right anterior BSPM locations. Finally, SSA-based decomposition followed by frequency analysis could discriminate AF patients recurring 4 to 6 weeks after electrical cardioversion from those who did not, based on the frequency content in the vicinity of V1.

SSA-based frequency analysis of BSPM recordings allows to distinguish patients showing AF recurrence (R) after electrical cardioversion from those who do not (NR), based on the frequency distribution over the torso. This result is consistent with clinical conclusions using electrograms.



Median normalized frequencies for all patients. Red circle: V1, bold circle: $p < 0.05$ when comparing R to NR.