

A Comparison Methodology for Pulmonary Veins Elimination in High-Definition Voltage Maps of Patients with Atrial Fibrillation

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Abstract: Atrial fibrillation (AF) is one of the most common arrhythmias, associated with aging, and related to a high risk of morbidity and mortality. For treating AF, catheter ablation guided by an electro-anatomical mapping system is the standard procedure. For the statistical analysis of the acquired high-definition voltage maps (HDVm), one important step in the image segmentation is the elimination of the pulmonary veins (PVs) from those maps. The aim of the present study is to compare three different methodologies dealing with their elimination.

Method: During the ablation process, data are extracted with Rhythmia system (Boston Scientific). The integrated software has the ability to eliminate the PVs from the acquired maps. We have collected 122 HDVm from AF patients but not all were clean for the PVs. Therefore, we have developed other two methodologies to achieve the cleaning of PVs.

Method (1) is based on the direct elimination by the operator. The atrium image is shown in the screen and the user selects manually the PVs.

Method (2) uses a semi-automatic method based on geometric considerations, coupled with a threshold for voltage value. This combination allows eliminating the PVs.

Method (3) based on literature eliminates the PVs using the geometric curvature of the maps. We have compared the efficiency and the easiness of use of the three methods. In particular, the values of electrical biomarkers of the maps before and after the PV's elimination to classify them according to their sensitivity with respect to the cleaning of the PVs.

Conclusion: Elimination of the PVs is an important part of the pipeline associated with the atrium image treatment and we have compared three different methodologies for this process. To validate our methods, the developed models based in the literature ones are compared in terms of effectiveness and precision.