Pulmonary Vein Isolation Induces Changes in Vectorcardiogram P-wave Loops

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Aims: Pulmonary vein isolation (PVI) is considered a standard treatment of paroxysmal atrial fibrillation aiming to restore and maintain sinus rhythm. The purpose of this study is to analyse how the PVI treatment affects the electrical conduction pattern in the atria. We have compared the morphology of P wave loops extracted from the vectorcardiogram before and after PVI.

Methods: 10 patients suffering from paroxysmal atrial fibrillation who underwent PVI were included in the study. All patients were in sinus rhythm before as well as after the procedure. Complete isolation of the pulmonary veins was verified by observing intracavitary electrocardiogram recordings. Vectorcardiogram (VCG) was obtained by Kors matrix. P-waves were automatically delineated, and the marks were afterwards reviewed by an expert electrophysiologist. Using these marks, P-wave loops were constructed from the three orthogonal leads of the VCG. First and second eigenvalues of P-wave loops were obtained and used to quantify the size and roundness of each P-wave loop.

Results: First and second eigenvalues increased after the PVI procedure was completed (5800 ± 3000 to 7600 ± 3200, and 1700 ± 500 to 1900 ± 700, respectively), corresponding to an increment of both diagonals of the P-wave loops. The ratio of the second to the first eigenvalue, quantifying the roundness of the P-wave loop, decreased significantly after catheter ablation (0.35 ± 0.19 to 0.30 ± 0.20).

Conclusion: Analysis of the first and second eigenvalues as well as the roundness parameter show that PVI induces morphological changes of the P-wave loops. These results indicate that the PVI procedure alters the electrical propagation pattern in the atria.