Dynamic Changes of Pulmonary Veins Ostia in Controls and Atrial Fibrillation Patients

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Introduction. The quantitative evaluation of pulmonary veins (PVs) contraction has not yet been clearly defined. The purpose of this study was to investigate the variation of PVs ostium size using ECG-gated cardiac CT.
Methods. Analysis was performed in 23 subjects divided into 3 groups: 9 controls, 8 paroxysmal (PAR) and 6 persistent (PER) atrial fibrillation (AF) patients. 3D patient-specific anatomical models were derived from CT scans through a threshold segmentation algorithm. First, the anatomical ostium of the PVs was identified and an orthogonal cut plane was then applied to the 3D model, following a non-rigid registration of the latter throughout the cardiac cycle. Subsequently, the area of the PVs ostium was evaluated for each model according to the number of acquired CT volumes. For each subject, PVs area-time curves were built. The area percentage variation was also computed as: (max_area – min_area)/max_area x 100.
Results. In our population, the right superior PV was the biggest while the left inferior was the smallest. The right superior also had the biggest area variation, with a mean value of 43% in controls, 31% in PAR and 16% in PER. On the other hand, the PV with the smallest area variation was the right inferior, with a mean value of 24% in controls, 13% in PAR and 10% in PER. In AF patients, inferior PVs ostia had flatter area-time curves compared to superior PVs. In addition, the latter showed different shapes between controls and AF but further data are required to draw any conclusions.
Conclusions. Morphological and functional differences were found in the two groups. AF patients had lower mean area percentage variation compared to controls, highlighting a reduction in effectiveness in terms of passive filling and active contraction within the left atrium that makes the PVs ostium contracting less than in healthy subjects.