Finite Computed Tomographic Analysis of the Morphometrics and Dynamics of the Right Atrio-ventricular Junction in Secondary Functional Tricuspid Regurgitation

Objective
Secondary functional tricuspid regurgitation (FTR) management remains controversial mainly due to the lack of knowledge in its pathogenesis and the difficulties to measure the actual dimensions of tricuspid annulus (TA) with current imaging methods. Using a new developed method based on cardiac CT-scan acquisition to finely analyze the right atrioventricular junction (RAVJ), we sought to explore modifications of TA morphometry and dynamics in secondary FTR.

Methods
In addition to echocardiographic data, cardiac CT-scans were obtained from 21 patients with severe myxoid mitral regurgitation (MR group) and 21 patients with ischemic or idiopathic dilated cardiomypathy (DCMP group), all in sinus rhythm. Using an in-house software, 3D semi-automated delineation of 18 points around TA perimeter were defined. Modifications of diameters, 2D/3D areas and perimeters were analyzed through time. Right ventricle (RV) and right atrium (RA) were also delineated to analyze the entire RAVJ dynamics and determine their dimensions. These 2 groups were compared to 30 healthy subjects, considering the presence of a significant FTR in each group of patients.

Results
Maximum TA 3D area was 7.0±1.2cm²/m² in healthy subjects at mid-to-late diastole and was smaller than in patients of the MR group (9.8±2.1cm²/m², p<0.001) or of the DCMP group (9.2±3.0 cm²/m², p<0.001) (Figure). Moreover, in the MR group, but not in the DCMP group, subjects with FTR<2+, had greater TA diameters than healthy patients (maximum septo-lateral diameter, 23.6±3.6mm/m² versus 21.4±2.7mm/m², p=0.035). Conversely, TA shape was more circular and more planar only in the DCMP group with FTR≥2+ compared to all others. In multivariate analysis, both RA area (p<0.001) and RV volume (p=0.002) were independently related to TA dilatation (r=0.845). RV ejection fraction was strongly associated with both RV concentric strain (r=0.66, p<0.001) and with TA apical longitudinal excursion (r=0.64, p<0.001).

Conclusion
Based on multi-phase CT image analyses, TA area was directly related to RV and RA dimensions and these could be used for assessing TA dilatation. Patients with severe mitral myxomatous disease and non-dysfunctional tricuspid valve had yet increased TA diameters which questioned the current cut-off recommendation for concomitant tricuspid annuloplasty in this specific population.

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TA 3D areas / BSA according to groups subgroups during phases of the cardiac cycle

TA, tricuspid annulus. BSA, body surface area. ES, end-systole.