Quantitative analysis of mitral annulus morphology in aortic stenosis using real time 3-dimentional transesophageal echocardiography

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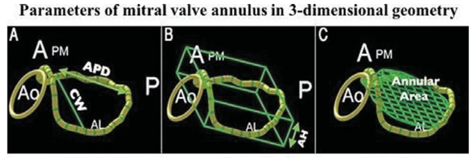
Background: Normal mitral annulus morphology is known to be saddle shape. There are a few reports regarding the relationship between flattening of the mitral annular saddle shape and mitral regurgitation. However, the relationship between aortic stenosis (AS) and mitral annulus morphology is unknown.
Purpose: To assess the impact of AS on mitral annular saddle shape using 3-dimentional transesophageal echocardiography.
Methods: A total of consecutive 83 subjects including 44 patients with severe AS (AS group) and 39 patients without AS (control group), who underwent real-time 3-dimentional transesophageal echocardiography of the mitral valve, were enrolled. The 3-dimentional geometry of the mitral annulus apparatus was evaluated by the parameters analyzed using dedicated quantification software such as anteroposterior diameter (APD), commissural width (CW), annular height (AH), mitral annulus (MA) area and annular height to commissural width ratio (AHCWR) as shown in Figure. We assessed the impact of severe AS on AHCWR, which is the key parameter showing flattening of the mitral annular saddle shape. These parameters were adjusted by body surface area (BSA). Exclusion criteria included left ventricular ejection fraction $<50\%$, the presence of aortic regurgitation, mitral valve disease, pericardial or congenital diseases, endocarditis, cardiomyopathy, prior myocardial infarction, and paroxysmal or persistent atrial fibrillation.
Results: Comparisons of mitral valve geometry between AS group and control group are summarized in Table. AH/BSA and AHCWR were significantly lower in AS group compared with control group. Multiple linear regression analysis revealed severe AS to be a significant and independent predictor of lowering AHCWR ($\beta=-0.39$, $t=-4.04$, $p<0.001$) (adjusted with MA area, selected by stepwise analysis).
Conclusions: Severe AS might contribute to flattening of the mitral annular saddle shape, lead to the mitral annular structural remodeling. Assessment of the mitral annulus morphology might help evaluating severe AS.

Parameters of mitral valve annulus in 3-dimensional geometry



APD and CW **AH** **MA area**

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- APD, anteroposterior diameter
- CW, commissural width
- AH, annular height
- MA area, mitral annulus area
- AHCWR, annular height to commissural width ratio = AH/CW × 100

Comparison of 3-dimensional mitral annulus geometry

	AS group (n = 43)	control group (n = 39)	p-value
BSA, m²	1.46 ± 0.2	1.60 ± 0.2	0.002
MA characteristics			
APD/BSA, mm/m²	19.8 ± 3.0	19.2 ± 2.8	0.464
CW/BSA, mm/m²	22.3 ± 3.1	21.7 ± 3.3	0.368
AH/BSA, mm/m²	4.15 ± 1.36	4.93 ± 1.25	< 0.001
MA area/BSA, mm²/m²	536 ± 111	544 ± 115	0.752
AHCWR, %	18.5 ± 5.0	22.6 ± 4.3	< 0.001

BSA, body surface area; MA, mitral annulus

Mitral annulus 3-dimensional geometry