

P3764

Morphological mechanisms of atrial functional mitral regurgitation in patients with atrial fibrillation

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Background: Atrial functional mitral regurgitation (AFMR) occurs in patients with atrial fibrillation. However, morphological mechanisms of AFMR are poorly understood.

Purpose: The purpose of this study was to examine the morphological characteristics in patients with AFMR.

Methods: Among consecutive 795 patients undergoing initial radiofrequency catheter ablation (RFCA) at our hospital, twenty-five patients with persistent AF accompanied by AFMR (\geq moderate) before RFCA (AFMR group) were studied. Age-matched 25 patients with persistent AF without MR were defined as a control group.

Results: Left ventricular ejection fraction (LVEF) was lower and left atrium

volume index was larger in the AFMR group (Table). Mitral valve annulus diameter and length of anterior mitral leaflet (AML) were similar between groups, whereas length of posterior mitral leaflet (PML) was significantly shorter in the AFMR group. Smaller tethering angle of AML (γ in the figure) and shorter tethering height were significantly associated with the occurrence of AFMR, which were different from morphology of functional mitral regurgitation in patients with dilated LV. Multiple regression analysis revealed that less tenting height ($p < 0.05$) and LA dilatation toward the posterior ($p < 0.01$) were significantly related to AFMR.

Conclusions: AFMR occurs in patients with unique morphological features, such as less tethering height and LA dilatation toward the posterior.

Echocardiographic parameters

| | AFMR (n=25) | Control (n=25) | P value |
|-------------------------|-------------|----------------|----------|
| Age, y | 69±8 | 66±10 | NS |
| Male, n (%) | 9 (36) | 20 (80) | P=0.001 |
| LVEF, % | 60±9 | 67±6 | P=0.004 |
| LAD, mm | 44±5 | 41±7 | NS |
| LAVI, ml/m ² | 56±17 | 41±13 | P<0.001 |
| MV diameter, mm | 3.9±0.4 | 3.8±0.5 | NS |
| α angle, ° | 34±9 | 35±7 | NS |
| β angle, ° | 48±9 | 50±8 | NS |
| γ angle, ° | 32±5 | 37±5 | P=0.0005 |
| AML length, mm | 3.0±0.5 | 3.0±0.5 | NS |
| PML length, mm | 2.1±0.1 | 2.4±0.1 | P=0.03 |
| Tenting height, mm | 1.5±0.1 | 1.8±0.1 | P=0.02 |
| D, mm | 0.8±0.3 | 0.5±0.3 | P=0.001 |

LVEF: left ventricular ejection fraction; LAD: left atrial diameter; LAVI: left atrial volume index; AML: anterior mitral leaflet; PML: posterior mitral leaflet.

Figure: Transthoracic echocardiography at a parasternal long axis view in mid-systole.



α angle: posterior leaflet tethering angle

β angle: posterior leaflet atrio-genic tethering angle

γ angle: anterior leaflet tethering angle

D: Length between the posterior mitral annulus and the left atrial posterior wall