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Title: ASSOCIATION OF LEFT ATRIAL STRAIN CHANGES TO FUNCTIONAL CAPACITY CHANGES IN MITRAL STENOSIS PATIENTS AFTER BALLOON MITRAL VALVULOPLASTY

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Background & Aims: Mitral stenosis (MS) leads to left atrial remodeling, dilation, and a gradual rise in left atrial pressure. Consequently, left atrial compliance decreases, resulting in morphological and functional alterations. The assessment of left atrial function can be done by measuring left atrial strain using speckle-tracking echocardiography examination. Previous studies have shown significant enhancement in left atrial strain following balloon mitral valvuloplasty (BMV). However, no research has investigated the correlation between changes in left atrial strain and improvements in functional capacity among MS patients who have undergone the BMV procedure.

Methods: A total of 132 MS patients were referred to our center from March 2019 to April 2020. Echocardiography examination and treadmill test were done before and within 1-2 weeks after the BMV procedure to evaluate the patient's condition. Left Atrial Reservoir Strain (LARS) was used to describe the left atrial reservoir function through speckle-tracking echocardiography. Functional capacity was measured using a modified Bruce treadmill protocol and described as the duration of the treadmill exercise (seconds). Improvement in functional capacity was defined as more than 180 seconds reduction of treadmill test duration after BMV compared to before BMV, as this was equivalent to the distance of one stage of the Bruce protocol. Statistical analysis used univariate, bivariate, and multivariate analyses to assess any association between left atrial strain and functional capacity changes with other clinical variables.

Results: Analysis was conducted on a total of 72 patients with moderate to severe MS (mitral valve area (MVA) < 1.5 cm²) who fulfilled the inclusion criteria. Post-BMV procedure, there were notable enhancements in functional capacity, with a significant increase in the median duration of exercise (from 241 (18 - 1080) seconds to 606 (80 - 1900) seconds, $p < 0.0001$) and a rise in the median estimated VO₂max value (from 18.8 (10.2 - 51.4) mlO₂/kg/min to 33 (12.6 - 83.2) mlO₂/kg/min, $p < 0.0001$). The LARS value also increased from a median of 8% (2 - 23%) to 11% (4 - 27%), $p < 0.0001$, pre- and post-BMV, respectively. Correlation tests revealed that pre-mitral valve gradient (pre-MVG) (correlation coefficient $r = 0.23$, adjusted R² = 4.9%) was associated with changes in functional capacity. However, multivariate analyses indicated that changes in left atrial strain were not correlated with changes in functional capacity (odds ratio (OR) 1.05, 95% confidence interval (CI) 0.90 - 1.23; $p = 0.505$). On the other hand, pre-BMV values of MVA > 1 cm² (OR 7.37, 95% CI 1.0 - 54.35; $p = 0.05$), pre-MVG > 10 mmHg (OR 6.6, 95% CI 1.71 - 25.5; $p = 0.006$), and pre-BMV mean pulmonary artery pressure (pre-mPAP) < 25 mmHg (OR 5.96, 95% CI 1.37 - 25.9; $p = 0.017$) were found to be associated with improvements in exercise duration following the BMV procedure.

Conclusions: We found that the LARS increased post-BMV compared to baseline in all subjects. There was no correlation between LARS changes and functional capacity improvement following the BMV procedure. However, improved functional capacity after BMV was associated with pre-BMV mitral valve area (MVA) greater than 1 cm², a pre-BMV mean mitral valve gradient (MVG) greater than 10 mmHg, and a pre-BMV mPAP lower than 25 mmHg.