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Prognostic Importance of Exercise Brain Natriuretic Peptide in Asymptomatic Degenerative Mitral Regurgitation

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Background: Exercise Doppler echocardiographic stress test can be of interest in the management of asymptomatic patients with primary MR. The resting BNP level is a good surrogate marker of MR consequences and is a powerful predictor of outcome. The incremental prognostic value of BNP response during exercise is unknown. We aimed to identify the determinants of exercise brain natriuretic peptide (BNP) level and to evaluate its prognostic value in asymptomatic patients with primary mitral regurgitation (MR).

Methods: Comprehensive resting and exercise transthoracic Doppler-echocardiography was performed in 113 consecutive asymptomatic patients with moderate to severe degenerative MR and preserved LV function. Blood samples were collected both at rest and exercise.

Results: The BNP level significantly increased from rest to exercise (p<0.0001). The independent determinants of exercise BNP were resting E/Ea ratio (p=0.043), indexed left atrial volume (p=0.022) and exercise LV global longitudinal strain (p=0.001). There was a significant graded relationship between increasing BNP level at exercise (according to tertiles) and increased incidence of cardiac events (death, heart failure, mitral valve surgery driven by symptoms or LV dilatation/dysfunction onset) (2-year: 21±7 vs. 40±8 vs. 67±59%; in tertiles 1, 2 and 3, respectively). On multivariable analysis, after adjustment for demographic and echocardiographic data and for resting BNP level, exercise BNP remained significantly associated with increased risk of cardiac events during the follow-up (hazard ratio=2.8 and 3.4, p=0.041 and 0.023, for tertiles 2 and 3, as compared to tertile 1).

Conclusions: In asymptomatic patients with primary regurgitation, exercise BNP level provides important incremental prognostic value beyond what is achieved by demographic and echocardiographic data and resting BNP level. Patients with elevated exercise BNP should be considered at high risk of reduced cardiac event-free survival.

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Quantification of mitral regurgitation by calculation of regurgitant volume: 3D left ventricular echocardiography versus PISA

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Quantification of mitral regurgitation (MR) by echocardiography is well established using several echo or Doppler parameters in which effective regurgitation office area (ERO) and regurgitant volume (RV) are the most commonly used. However, hemispheric assumptions allowing application of proximal isovelocity area (PIA) may be erroneous due to complex mitral valve morphology (i.e. mitral valve prolapse).

We hypothesized that 3D left ventricular echocardiography associated with pulse Doppler could obtain RV with high reliability for comparison of 2 methods (3D vs PISA) in presence of mitral regurgitation.

Methods: First, in 50 patients without MR, we compared LV ejection volumes (LVEj) from a full volume 3D echocardiographic acquisition and 2D Simpson method to the aortic stroke volume (ASV) obtained by Pulsed Doppler for validation of the 3D approach. Second, we analyzed 50 patients with different degree MR for comparison of the two approaches and verification of PISA RV values. Inter and intra observer variabilities were assessed for all techniques.

Results: Correlations and Bland&Altman methods gave high adequacy between 3D LVEj and ASV compared to 2D and ASV (respectively 3D, p=0.96, y=0.91x+4.8, mean error (ME) and 95% confidence interval of error (CIE) [-0.84±6 ml] and 2D, r=0.81, y=0.78±x+5.8, [-5.4±16 ml]. Variabilities average for 3D LVEj was 6±3% and 15+/-5% for 2D. In patients with mitral regurgitation, RV from PISA and 3D LVEj were 23±12 ml and 24.5±11 ml (p=0.37) and the fractional regurgitation 32±13% and 33±12% (p=0.63). However, mean error measurement was –1.37 ml and 95% confidence interval of error was 17.90 ml showing high discrepancy between the two methods. By selecting a cut-off of 5, 10, 15 ml, numbers of patients with uncorrected measurements was 48.5, 17 and 8.5%. When using ASE 4 grades classification, 25.7% of misclassified patients was obtained with PISA.

Conclusion: 3D LVEj method is robust and reliable for calculation of mitral regurgitant volumes with significant differences compared than those obtained with PISA which seems to be less adequate for all types of MR.

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Prevalence, determinants and prognosis value of right ventricular function impairment in organic mitral regurgitation

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Objectives: Prevalence, determinants and prognosis value of right ventricular (RV) ejection fraction (EF) in organic mitral regurgitation (MR).

Methods: Two-hundred eight pts (62±13 years, 138 males, AF 57 pts) with organic MR referred to surgery underwent an echocardiography and left ventricular (LV) and RV radionuclide angiography. LV and RV regional function was assessed.

Results: Mean RV EF was 40.7±10.1%, ranging from 10 to 65%. Sixty pts (29%) had a RV EF ≤55%. In multivariate analysis, LV septal function (LV EF ≤80 or ≥90 vs. 80-89, p=0.001; LV EF ≥90 vs. ≥85, p=0.004), LV EDD index (β=–0.27, p=0.001) and PISA (r=−0.19, P=0.008) were predictors of RVEF. In the subgroup with MR quantitation (n=85) predictor of RV EF was mitral ERO (β=–0.30, P=0.007). After surgery, RV EF increased strongly (27.5±4.3 to 37.9±7.3, P=0.001) in pts with preoperative RV EF ≤55% while it did not change in pts with RV EF>55% (46±6 vs. to 46.1±8.2, P=0.91). Independent predictors of postoperative RV EF were preoperative RV EF (β=0.32, P=0.013) and TR grade 2 (β=0.22, P=0.036) while LV septal function (LV EF ≥80 vs. ≤80, P=0.069) was marginally predictive. Fifty-seven pts died during post-operative follow-up of 7±4.3 years. Pts with RV EF ≤55% compared with RVEF>55% had a similar survival rate at 10 years (63.6±8.7% vs. 68.8±5.3%, P=0.68), but cardiovascular mortality was higher (25.3±8.0% versus 8.1±5.3, P=0.03; HR=2.67, 95% CI 1.06-6.76, P=0.037). RV EF was not a predictive factor of operative mortality. In a Cox model, NYHA class, CABG, and left atrial diameter, but not RV EF, were independent predictors of overall mortality.

Conclusion: In organic MR RV function depends not only on PASP but mainly on LV remodeling and septal function, and improves strongly after surgery. RV EF is a predictor of cardiovascular mortality in univariate but not in multivariate analysis. Hence, impaired RV EF before surgery is not a sufficient argument to deny surgery in patients with organic MR.

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Surgery of chronic functional mitral regurgitation: interest of mitral valve replacement in severe heart failure patients

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