# Literature Reviews

## Dynamic quantitative echocardiographic evaluation of mitral regurgitation in the operating department.

Alijandro G MD, Vicky Souliere MD, Andre Y Denault MD et al. *J Am Soc Echocardiogr* 2006; 19 140:146

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**Introduction**: The intraoperative assessment of mitral regurgitation (MR) is complicated by the altered loading conditions and is often underestimated. Generally the assessment of MR in the operating room (OR) is performed by semi-quantitative methods such as Doppler color jet area (CJA), which is affected by instrument settings as well as the morphology of the regurgitant jet. This study was done to compare the preoperative and intraoperative transesophageal echo (TEE) findings using more objective quantitative methods such as Proximal Isovelocity Surface Area (PISA) method of MR assessment.

**Methods**: Patients who were 18 years or older and presenting for coronary revascularization or mitral valve surgery due to isolated MR without any other pathology were enrolled in the study. Patients with mitral stenosis, prior mitral surgery, aortic valve disease of more than mild severity and ruptured papillary muscles were excluded.

Baseline TEE examination was performed under conscious sedation and studies were recorded for off line analysis. A baseline intraoperative TEE examination was performed after induction of general anesthesia (GA) and placement of invasive monitoring lines prior to incision and MR severity was graded. Then the systolic blood pressure was gradually elevated to preoperative levels and MR assessment done again. The MR assessment was done by a single experienced echocardiographer using similar TEE machine as the preoperative TEE exam and instrument settings. The mechanism of MR was diagnosed on the basis of Carpentier's classification.

Semiquantitative methods used for MR assessment were CJA measurement, pulmonary venous flow assessment (PW), vena contracta measurement and the PISA method for quantitative assessment (Table I).

**Results**: A total of 25 patients were enrolled. Sixteen patients were in sinus rhythm and nine were in atrial fibrillation (AF). Ten patients were classified as having organic MR, 13 were classified as having functional MR (10 with ischemic MR and three with annular dilatation). Mean baseline ejection fraction (EF) 40+/- 12% for functional MR and 53+/- 9% for organic MR. The mean time delay between the preoperative intraoperative TEE assessment was 3.8 days.

Blood pressure varied significantly amongst the three time periods ($p < .001$). Maximal regurgitant jet velocity decreased with GA and returned to baseline with phenylephrine boluses. Heart rate was significantly lower under GA as compared with preoperative level and did not increase with phenylephrine infusion.

The assessment of MR during those three time periods is as shown in table II.

The severity of MR decreased with induction of GA regardless of the method of assessment. There was no difference in severity of MR during different time points when measured with the PISA method alone suggesting that it is least susceptible to be altered by loading conditions. However the variations in other hemodynamic parameters such as heart rate and filling pressures were not associated with change in the severity of MR.

**Discussion**: Intraoperative assessment of mitral regurgitation is a complicated subject. Preoperative transthoracic echo (TTE) and intraoperative TEE have shown only modest correlation.[1] Similarly pre-cardiopulmonary bypass TEE examination leads to a change in the management plan regarding mitral valve surgery in a significant number of patients.[2] The severity of MR is known to decrease under GA.[3-5] The exact cause of the reduction in severity is not known. Reduction on severity of MR is especially more pronounced in patients in which the regurgitation is due to inadequate leaflet coaptation (annular dilatation/ventricular dilatation), and does not seem to decrease in severity if the regurgitation is due to a flail leaflet.[4] However, gradual increase in afterload with phenylephrine infusion has been demonstrated in the past to increase MR severity.[5]

In the present study, both semiquantitative and quantitative methods were used for assessment of MR,[6] yet there were significant limitations in the study. Nine out of 25 patients were in atrial fibrillation, in whom the assessment of mitral regurgitation is even more complicated due to variability of the heart rate, contractility and the pulmonary venous inflow patterns are unreliable. Similarly, as reported by the authors, there was a significant reduction in the heart rate in all the patients. This could have accounted for reduction of MR in those patients who were being operated for ischemia. The authors did not report the preoperative/intraoperative dimensions of the left ventricle that could also account for a more optimal geometric alignment of the papillary muscles and thus leading to a better coaptation of the leaflets.[4] The time delay between the preoperative and intraoperative TEE was approximately three days, and no information is available on the preoperative filling pressures at the time of baseline TEE examination.

But this study does stress the importance of assessment of mitral valve as part of a "mitral valve apparatus" and assessment of regurgitation severity with multiple quantitative and semiquantitative means. Also, the impact of altered loading conditions must always be considered when making a diagnosis regarding mitral valve surgery. Similarly, increased preload/afterload and rate rhythm and contractility to provoke mitral regurgitation should be considered when there is discordant data.

*References and tables are on www.scahq.org*