Clinical and Echocardiographic Correlates of Postoperative LV Function after Mitral Valve Surgery in Patients with Severe Mitral Incompetence

A Thesis Submitted for Partial Fulfillment of Master Degree of Cardiology

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Abstract

Background: Severe mitral regurgitation (MR) is associated with reduced afterload and overestimated ejection fraction (EF). Correction of MR may result in significant decline of EF in some patients**.**

Aim: Determine the predictors of postoperative decline of EF in patients with severe MR after mitral valve surgery.

Methods: From April 2011 to April 2012, we prospectively recruited 30 consecutive patients with isolated primary severe MR who had successful mitral valve surgery (repair in 19 patients including 10 patients with rheumatic etiology and replacement with mechanical prosthesis with chordal preservation in the remaining patients). Clinical data were collected including the presence of atrial fibrillation (AF) and functional capacity using 6-minute walk test (6MWT). Echocardiography was done to study the left ventricular (LV) volume, EF, and left atrial volume. We performed pulsed wave tissue Doppler imaging (TDI) to measure lateral mitral annulus peak S wave velocity and myocardial performance index (MPI). Follow up echocardiogram was done two months after surgery to asses postoperative EF. Patients with post-operative EF<50% (Group I) were compared with patients with post-operative EF ≥50% (Group II) using independent sample T test for continuous variables and Chi square test for categorical variables.

Results: The mean age of patients was 33±12.7 years and 63.3% were females. The cause of MR was rheumatic in 20 patients, myxomatous in 10 patients. The effective regurgitant orifice area was 0.46±0.17 cm^2. The pre-operative biplane EF was 63±6.7%. Compared to Group II, patients in Group I (n=9) had significantly more AF (p=0.008), shorter 6MWT distance (p=0.009), larger LV end-systolic volume (p=0.047), larger LA volume index (p=0.008) and lower pre-operative EF (p=0.004). However, the TDI peak S wave velocity and MPI were not different between the two groups (p=0.06 & p=0.27 respectively). Multiple linear regression analysis using stepwise technique showed that the preoperative biplane EF and the 6-minute walk distance are independent predictors of postoperative EF<50% with p value 0.007& 0.013 respectively. The receiver operating characteristic (ROC) curve analysis showed that a pre-operative biplane EF< 61% has 76.2 sensitivity & 78% specificity and a 6-minutes walk distance <245meters has 87.5% sensitivity & 75% specificity to predict a post-operative LV EF<50%.

Conclusion: Pre-operative LV biplane EF <61% and 6-minute walk distance <245meters are independent predictors of postoperative LV systolic dysfunction (EF<50%) after mitral valve surgery for severe mitral regurgitatation.

Key word;

-Sever Mitral incompetence

- Left Ventricular ejecfion Fraction

- 6. Minulue Walk test – Mitral Valve Surgery

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List of Abreviations

ACC: American College of Cardiology

ACE: Angiotensin Converting Enzyme

AF: Atrial Fibrillation

AHA: American Heart Association

CW: Continuous Wave

CR: Contractile Reserve

EF: Ejection Fraction

EROA: Effective Regurgitant Orifice Area

ESWS: End Systolic Wall Stress

FAC: Fractional Area Change

FS: Fractional Shortening

IVCT: Isovolumic Contraction Time

IVRT: Isovolumic Relaxation Time

LA: Left Atrium

LV: Left Ventricle

LVEDA: Left Ventricular End Diastolic Area

LVESA: Left Ventricular End Systolic Area

LVEDD: Left Ventricular End Diastolic Diameter

LVESD: Left Ventricular End Systolic Diameter

LVEDV: Left Ventricular End Diastolic Volume

LVESV: Left Ventricular End Systolic Volume

LVOT: Left Ventricular Out flow Tract

LVPV: Left Ventricular Pressure Volume

LVSI: Left Ventricular Sphericity Index

MR: Mitral Regurgitation

MPI: Myocardial Performance Index

NYHA: New York Heart Association

PASP: Pulmonary Artery Systolic Pressure

PCWP: Pulmonary Capillary Wedge Pressure

PH: Pulmonary Hypertension

PW: Pulsed Wave

ROC: Reciever Operating Characteristic Curve

RV: Regurgitant Volume

Sm: Myocardial Systolic Wave Velocity

TDI: Tissue Doppler Imaging

VC: Vena Contracta

2D: Two Dimensions

3D: Three Dimensions

6-MWT: Six Minute Walk Test

Introduction

Before the 1990s, most clinicians viewed mitral regurgitation (MR) as a relatively benign condition, and surgery was reserved for patients who were severely symptomatic or failed medical management.Reluctance to proceed with operation was related to the likelihood of prosthetic valve replacement and to the notion that asymptomatic patients with severe MR were a stable compensated group with negligible risk of serious complications, including sudden death.[1&2]

Nowadays it becomes well known that MR is a progressive disease, with an average increase of 7.5ml per year for regurgitant volume and 5.9 mm^2 per year for the effective regurgitant orifice area,[3] as well as progressive left ventricular (LV)remodeling, leading eventually to the development of LV dysfunction, which may be irreversible.

Evaluation of LV systolic function in chronic severe MR is challenging due to increased preload and reduced afterload as left ventricle empties into low impedance left atrium, consequently the ejection fraction (EF) remains higher than normal during compensated phase of chronic MR. Thus, ejection indices such as ejection fraction (EF) in patients with severe MR cannot be considered reliable measures of left ventricular contractile function, as it remains within the normal range despite contractility is already becoming impaired. Also Symptoms often occur late in chronic MR, most likely as a result of the compliance properties of the left atrium that allow it to accommodate large volumes of blood without a significant rise in pressure.Another major concern for patients with asymptomatic severe MR is the risk of sudden cardiac death, with an absolute risk of 1–2.5% over 6years.

The major determinants of sudden cardiac death in degenerative MRare LV dysfunction, redundant leaflets and severe MR.[4]

For the above reasons and due to significant improvements in surgical technique with a lower perioperative mortality and better long-term outcome of valve repair, the current trend is early surgical correction in patients with severe mitral regurgetation.