

Predictors of clinical outcome after mitral valve replacement

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Abstract

Background: To identify and study predictors of morbidity, mortality, and survival after mitral valve replacement. **Methods:** We have examined 186 patients undergoing isolated mitral valve surgery between January 2013 to January 2015, with respect to preoperative clinical features, echocardiographic findings, hemodynamics and surgical approaches. Coronary angiography was done as a routine in all patients above 40 yrs of age & coronary artery bypass grafting with mitral valve replacement was done in 7 patients. The operative mortality was 5.37%. Postoperatively patients were followed up at 3 months interval for first 1 year & at 6 months interval thereafter. **Results:** Multivariate statistical analysis demonstrated that patients age > 60 years, patients with symptoms NYHA Class-IV, ventricular arrhythmias, associated disease (Coronary artery disease, Infective endocarditis), end diastolic diameter measuring $\geq 60 \pm 10$ mm, left atrial Dimension ≥ 65 mm, chordal preservation (Partial / Total) independently influenced the morbidity and Mortality. **Conclusion:** Strategies to diminish operative mortality should include careful assessment of the risks factors in elderly patients, early operative intervention before deterioration that necessitates urgent surgery, and use of improved techniques of myocardial protection in high-risk patients.

Key words: Mitral stenosis, Mitral regurgitation, Mitral valve replacement, Atrial fibrillation, morbidity

Introduction

Mitral valve replacement (MVR) is an accepted therapeutic modality for treatment of functional disability due to mitral valve disease. The management of mitral valve disease, including the indications for and timing of surgery and the type of surgical procedure, has changed during the last decade [1-3]. Previously, clinicians tend to observe patients with significant mitral valve diseases until severe symptoms developed or until there was evidence of left ventricular dysfunction This silent progression may result in delayed surgical intervention, thereby worsening the long-term surgical outcome [4-7].

Several studies have shown that both the short-term and long-term results are improved if surgery is undertaken in an earlier stage of the disease process [8-11]. Operative risk has declined over the years due to substantial advances in myocardial protection, surgical technique and hydraulic design of various mechanical /

bioprosthetic substitutes. The aim is to study the impact of clinical parameters, etiologies, echocardiographic parameters and intra operative techniques predicting the morbidity and mortality after mitral valve replacement.

Materials & Methods

In the department of Cardiovascular and thoracic surgery at B. Y. L. Nair Hospital, 186 Patients who underwent mitral valve replacement during period January 2013- January 2015, were retrospectively evaluated. Out 186 patients 7 patients had associated coronary artery disease and underwent coronary artery bypass grafting along with mitral valve replacement.

Exclusion criteria: Patients with redo mitral valve replacement, associated aortic or tricuspid valve replacement (tricuspid valve repair was not excluded), and patients with mitral regurgitation of ischemic or functional cause were excluded from the study. Operative technique of mitral valve replacement- All patients underwent mitral valve replacement using standard techniques of cardio pulmonary bypass under

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moderate hypothermia (32 degrees Celsius). Heart was arrested using cold sanguineous antegrade cardioplegia solution (4⁰ C). Mitral valve replacement was done with either mechanical valve prosthesis or bioprosthetic valve.

Total chordal preservation is done except in patients with severe calcified valve. Mechanical valve prosthesis was bileaflet (St. Jude / ATS / Sorin Biocarbon). Typically, a mechanical valve is used because of concerns about longevity of tissue valves in the mitral position and because many patients require long term

anticoagulation for chronic atrial fibrillation. Tricuspid valve annuloplasty was done by Modified De Vega's technique.

After collecting all necessary data of 186 patients who underwent mitral valve replacement, which include preoperative status like patient age associated comorbidities, severity of symptoms, etiological factor, 2D ECHO findings and operative methods used, all patients were evaluated and summarized to conclude the probable risk factors and predict the clinical outcome of patients after mitral valve replacement surgery.

Results

Patients data collected in study is summarized below in following table.

Table 1: Demographic distribution of patients.

Clinical Parameters	Total No. Patients	Category of patients	No of Patients	Percentage (%)
Age	186	< 60 Years	172	92.47
		> 60 Years	14	7.53
Sex	186	Male	84	45.16
		Female	102	54.84
Predominant Lesion	186	Mitral Stenosis	52	27.95
		Mitral Regurgitation	57	30.64
		Mixed Lesions	77	41.41
NYHA Class	186	II, III	174	93.54
		IV	12	6.46
Rhythm	186	Sinus	52	27.95
		AF	117	62.9
		Others	7	9.15
Others	186	Coronary Artery Disease	7	3.76
		Infective Endocarditis	11	5.91

Out of 186 patients representing our study population 84 were male patients (45.16%) and 102 were female patients (54.84%) with 172 patients (92.47%) below 60 years and 14 patients (7.53%) above 60 years of age. Predominant lesion of mitral valve was stenotic in 52 patients (27.95%), regurgitation in 57 patients (30.64%) and mixed in 77 patients (41.41%). 117 patients were in atrial fibrillation (62.9%). The cause of mitral valve pathology was rheumatic in 157 patients (84.4%), endocarditis in 11 patients (5.93%), myxomatous in 18 patients (9.67%). Summarized in table 2. Patients with symptoms of New York Heart Association class II and class III were 174 patients (93.54%) and class IV were 12 (6.46%). Early Death means death occurring within 30 days of the operative procedure. Total number of early deaths were 4 (2.1 %) and late death means death occurring after 30 days up to 3 years after operative procedure. Total number of late deaths are 6 (3.22 %).

Table-2: Etiology of Disease.

Etiology	Total No. of Patients	No. of Patients	Percentage (%)
Rheumatic	186	157	84.4
Myxomatous	186	18	9.67
Infective	186	11	5.93

Table-3: Echocardiographic assessment of patients.

Echo Parameters	Total No. of Patients	Category of Patients	No. of Patients	Percentage
LVESD	186	$\geq 30 \pm 10$ mm	132	70.96
		$< 30 \pm 10$ mm	54	29.04
LVEDD	186	$\geq 60 \pm 10$ mm	22	11.8
		$< 60 \pm 10$ mm	164	88.2
LA	186	≥ 65 mm	49	26.34
		< 65 mm	137	73.66
MVA	186	≥ 0.7	64	34.4
		< 0.7	122	65.6
FS	186	≥ 0.4	99	53.2
		< 0.4	87	46.8

2D Echocardiography is the key examination. It is of crucial importance to confirm the diagnosis, assess the severity using a quantitative assessment [12,13,14], and evaluate left ventricular function. The left ventricular diameters, ejection fraction, and wall thicknesses were measured, and the ratio of diameter to wall thickness was calculated at end diastole and end systole. Left atrial diameter was measured in systole in mm. Left ventricle end diastolic dimensions (LVEDD) and left ventricle end systolic dimensions (LVESD) in mm were measured along with FS that is left ventricle shortening . 2D Echocardiography findings are summarizing in table number3.

Table-4: Operative Methods

Intraoperative Parameters	Total No. of Patients	Category of Patients	No of Patients	Percentage (%)
Chordal preservation	186	Done	178	95.7
		Not Done	8	4.3
TV annuloplasty	186	Done	92	49.46
		Not done	94	50.54
Cross clamping time	186	> 60 min	22	11.82
		< 60 min	164	88.18
Valve Size	186	> 25	16	8.6
		< 25	170	91.4
Valve Type	186	Mechanical	164	88.17
		Bioprosthetic	22	11.83

Operative methods- We try to do chordal preservation in all patients of mitral valve replacement except in some patients of severe sub valvular crowding or severely calcified posterior mitral leaflet where chordal preservation is not possible. Chordal preservation techniques were used in 178 patients. 42 patients had total chordal preservation and 136 had partial chordal preservation.

Tricuspid annuloplasty using Modified De Vegas technique was done in 92 patients (49.46%) patients. Cross clamp time was < 60 minutes in 88.18% of patients. We usually put mechanical valve in patients less than 60 years of age and bioprosthetic if patient age is more than 60 years and in sinus rhythm. Operative methods are summarized in table 4

About 70% of deaths are in age group more than 60 years of age. 70% of deaths are in patients presenting with NYHA IV symptoms and patient with failure. Patient with ventricular tachycardia are more prone for early deaths. Associated disease like coronary artery disease are associated with 30% mortality as compared to patients without coronary artery disease and patient with infective endocarditis are associated with 20% mortality. LVEDD > 60 mm is associated with 70% early and late mortality as well size of left atrium > 65 mm is associated with 60% mortality. 80% mortality mainly late mortality in those patients were chordal preservation is not done.

Table 5: Mortality profile

Parameters	Total No. of Death	Early Deaths (n = 4)	No of Deaths	Percentage (%)	Late Deaths (n = 6)	No of Deaths	Percentage (%)
Age	10	> 60	3	30	> 60	4	40
		< 60	1	10	< 60	2	20
NYHA Class	10	II, III	1	10	II, III	2	20
		IV	3	30	IV	4	40
Rhythm	10	Sinus, AF	1	10	Sinus, AF	2	20
		VT	3	30	VT	4	40
Associated Diseases	10	With CAD	1	10	With CAD	2	20
		With IE	1	10	With IE	2	20
Echo	10	LVEDD \geq 60 \pm 10mm	3	30	LVEDD \geq 65 \pm 10 mm	4	40
		LVEDD \leq 60 \pm 10mm	1	10	LVEDD \leq 60 \pm 10 mm	2	20
		LA > 65 mm	2	20	LA > 65 mm	4	40
		LA \leq 65 mm	2	20	LA \leq 65 mm	2	20
Operative Technique	10	Chordal Preservation done	1	10	Chordal Preservation done	1	10
		Chordal Preservation not done	3	30	Chordal Preservation not done	5	50

Discussion

Mitral valve replacement is one of the standard managements for patients with mitral valve disease. Older age is often considered to be associated with increased operative risk and to have a negative influence on the long term outcome. [15,16,17,18]. In a series by Tribouillily they found that operative mortality for patients in NYHA class I and II was 0% below 75 years of age as compared to 3.6% over this age [11]. In our study mortality rate is higher in patient above 60 years of age. Patients with NYHA class I and II showed a low operative mortality and excellent post operative long term survival, which appear significantly better than those in patient with NYHA class III and IV [11,19]. Patients with congestive heart failure and emergency mitral valve surgery have higher mortality.

Thus in patients younger than age 60 years, the current operative mortality is extremely low and allows consideration of operation in patients with no or minimal symptoms (class I or II). Preoperative atrial fibrillation is predictor of excess preoperative and postoperative morbidity [11,20,21]. Similarly in one study left atrial dilatation was predictive of post operative mortality but precise dimensions of left atrium which should not be exceeded have not clearly been identified [22].

In patients with an ejection fraction <50%, the late mortality is high, but operation should not be contraindicated and has been shown to improve survival. In patients with an ejection fraction of 50% to 60%, there is an increased risk of postoperative left ventricular dysfunction and excess mortality, and surgical treatment probably should not be delayed. In patients with ejection fraction >60%, the surgical outcome is usually excellent but better in those without severe symptoms [23, 24].

Patients with left ventricular end systolic diameter (LVESD) of more than 45 mm likely to have abnormal post operative left ventricular function and shown to be predictive of decreased survival. Coronary artery disease is of borderline significance as a predictor of operative mortality and an independent predictor of late mortality [25,26 27,28].

Total chordal preservation maintains annular–papillary muscle continuity which helps to maintain normal left ventricular geometry and systolic function, hence ejection fraction typically remains stable or improves after mitral surgery. In contrast to decline in ejection fraction by an average of 10% when this continuity is disrupted [29,30,31].

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For MVR with or without CABG operation, shock was again the most significant risk factor [32].

Conclusion

Independent variables significantly influencing the morbidity & mortality after Mitral valve replacement are age > 60 years, NYHA Class-IV, ventricular arrhythmias, associated diseases (Coronary Artery Disease, Infective Endocarditis), end diastolic diameter- $\geq 60 \pm 10$, left atrium dimension ≥ 65 mm, chordal preservation (partial / total).

In any case it is the physiologic consequences of chronic mitral regurgitation that provide the best predictors of clinical outcome. Left ventricular size and systolic function, left atrial size, pulmonary artery pressures, and atrial fibrillation-with the left ventricular response to chronic volume overload having the strongest predictive value.

Thus, even asymptomatic patients with severe mitral valve regurgitation but 2D ECHO findings suggesting above values should be consider for early mitral valve replacement surgery.

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