

Redo mitral valve surgery

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Article Info

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Abstract

This study is based on the findings of a single surgeon's practice of mitral valve replacement of 167 patients from April 2005 to June 2017 who developed symptomatic mitral restenosis after closed or open mitral commissurotomy. Both clinical and color doppler echocardiographic data of peri-operative and six months follow-up period were evaluated and compared to assess the early outcome of the redo mitral valve surgery. With male-female ratio of 1: 2.2 and after a duration of 6 to 22 years symptom free interval between the redo procedures, the selected patients with mitral valve restenosis undergone valve replacement with either mechanical valve in 62% cases and also tissue valve in 38% cases. Particular emphasis was given to separate the adhered pericardium from the heart completely to ameliorate base to apex and global contraction of the heart. Besides favorable post-operative clinical outcome, the echocardiographic findings were also encouraging as there was statistically significant increase in the mitral valve area and ejection fraction with significant decrease in the left atrial diameter, pressure gradient across the mitral valve and pulmonary artery systolic pressure. Therefore, in case of inevitable mitral restenosis after closed or open commissurotomy, mitral valve replacement is a promising treatment modality.

Introduction

Bangladesh being a developing country, the crowded population here, is more vulnerable to streptococcal infection by rheumatic strain and resultant mitral stenosis compared to Western countries. The sinister nature of mitral restenosis is predominantly due to the morphological changes of the valvular apparatus secondary to chronic inflammation which complicates the opening of the valve during diastole. Restenosis of the mitral valve is almost always rheumatic in origin which is still an important public health problem among the crowded, economically depressed population in the developing countries.¹

Being simple, less invasive, low cost procedure with good early outcome enables closed mitral commissurotomy a likely choice for those with poor economic background who has pliable valve with absence of calcification and thrombus in left atrium. Closed mitral commissurotomy also offers symptom palliation, short duration of procedure, quick recovery and short hospital stay with the advantages of preservation of native valve, exemption from use of cardiopulmonary bypass and avoids the hazards of anticoagulation.^{2,3} However, sooner or later patients develop recurrence of symptoms as it is obvious and supported by other

studies that, after mitral commissurotomy, restenosis is inevitable as chronic inflammatory process of rheumatic carditis continues and only the time of its occurrence is variable.⁴

In such situations mitral valve replacement may remain the treatment of choice for patient's survival as the valve morphology in mitral restenosis may not be amenable for repair in most cases.^{4,5} For restenosis cases mitral valve replacement may become optimal for survival of the patients because of the progressive nature of the disease with unfavorable valve morphology.^{5,6} This study is the appraisal of the role of mitral valve replacement as revision surgery for mitral restenosis cases which showed promising early outcome in a single surgeon's practice.

Materials and Methods

This retrospective study included 167 patients from April 2005 to June 2017 who underwent mitral valve replacement for symptomatic mitral restenosis who had mitral valve area ≤ 1.5 cm² with the history of open mitral commissurotomy (n=35) or closed mitral commissurotomy (n=132) for mitral stenosis. Patients were excluded if they underwent for other concomitant surgery like aortic valve replacement,



Table I

Pre-operative and per-operative variables of the study population		
Data		n=167
<i>Pre-operative variable</i>		
Age (year)		39.4 ± 11.5
Sex	Male	52
	Female	115
History of rheumatic fever	Present	97
	Absent	70
History of closed mitral commisurotomy		132
History of open mitral commisurotomy		35
Symptoms free interval (years)	Symptoms free interval (years)	6-22
Time interval for redo surgery (years)	Time interval for redo surgery (years)	7.8 ± 2.7
Pathological changes on echocardiography	Mitral stenosis	37%
	Mitral regurgitation	21%
	Combination	62%
	Leaflet retraction	13.2%
	Commissural fusion	96.5%
	Calcification	57%
	Fusion of chordae	62%
	Retraction of chordae	51%
<i>Operative variable</i>		
Types of prosthesis	Bioprosthesis	38%
	Mechanical valve	62%
Prosthesis size range (mm)		26-33
Cardiopulmonary bypass time (min)		88.8 ± 26.1
Aortic cross clamp time (min)		48.8 ± 22.4
<i>Post-operative variable</i>		
Ventilation time (hours)		9.0 ± 0.5
Blood loss range (mL)		340 ± 80
Bleeding complication		2.5%
Superficial wound infection		3%
Neuro-cognitive deficit		1.2%
ICU stay range (days)		2.5 ± 0.5
Hospital stay range (days)		10.0 ± 0.5
In hospital mortality		0%
Regular follow-up attended		98.8%

tricuspid valve surgery, coronary artery bypass etc. Patients were evaluated clinically and also by color doppler echocardiography peri-operatively as well as during follow-up for a period of six months.

Surgical procedure

Chest cavity was accessed with standard median sternotomy in all cases. Careful and meticulous dissection done to separate the pericardium com-

pletely from the epicardium. Cardiopulmonary bypass was established with aortic and bicaval cannulation. Myocardial protection was provided by antegrade blood cardioplegia and moderate hypothermia (32°C). The left atrium was opened and the mitral valvular apparatus was assessed, findings of which are mentioned in Table I. Mitral valve was excised completely in 40 cases and posterior mitral leaflet was preserved in 127 patients. Mitral valve was replaced with appropriate size prosthetic mechanical mitral valve in 103 cases or with tissue valve (bioprosthesis) in 64 cases with continuous non-absorbable prolene suturing technique. After deairation left atriotomy was closed in layers and subsequently patient was weaned from bypass. However, in five cases beating heart mitral valve replacement was done. Postoperative anticoagulation therapy was maintaining with parenteral heparin bridging to oral warfarin therapy and International Normalized Ratio (INR) was maintain between 2.5 to 3.5.

Results

Of 167 study patients, most of the patients were female, and mean age was 39.4 ± 11.5 years. Total 74% of the patients were in New York Heart Association (NYHA) functional class III. The mean duration of disease free interval was 7.8 ± 2.7 years. Pre-operative color doppler echocardiography demonstrated mitral valve restenosis, mitral regurgitation and combined stenosis and regurgitation in 37, 21 and 62% cases respectively. Most common intra-operative findings (Table I) were leaflet retraction, calcification, commissural fusion, commissural calcification, chordae fusion and retraction (Figure 1). The mean aortic cross clamp time was 48.8 ± 22.4 min and the mean cardiopulmonary bypass time was 88.8 ± 26.1 min. Other pre-operative and intra-operative characteristics are given in Table I.

Post-operative ventilation time, bleeding, ICU stay and hospital stay were within the normal limit. No re-intervention was required, and there was no wound infection, renal impairment, transient ischemic attack or cerebrovascular accident and also no mortality occurred during the period of ICU and hospital stay as well as within six months after the valve replacement surgery. However, only 1% patients had cognitive neurological deficit post-operatively but it was improved before the discharge of the patient. Other post-operative variables are shown in Table I.

At follow-up following mitral valve replacement surgery, echocardiography demonstrates excellent prognosis in the cardiac function measuring variables were mitral valve area, pressure gradient across the valve, left atrial and left ventricular end systolic diameter, mean systolic pulmonary artery

Table II**Comparison between pre-operative and post-operative echocardiogram findings and NYHA class of study population**

Data	Pre-operative (n=167)	Post-operative (n=167)
Echocardiography (Doppler)		
Mitral valve area (cm ²)	1.28 ± 0.4	2.9 ± 0.6
Trans mitral valve gradient (mmHg)	15.3 ± 5.1	2.3 ± 1.1
Left atrial diameter (mm)	48.2 ± 11.4	44.7 ± 10.4
Left ventricular end systolic diameter (mm)	32.2 ± 6.5	32.2 ± 6.5
Ejection fraction (%)	49 ± 13	51 ± 12
Pulmonary artery systolic pressure (mmHg)	58.4 ± 9.6	38.7 ± 12.4
NYHA functional class		
I	0	66
II	14	86
III	123	15
IV	30	0
NYHA- New York Heart Association functional class		

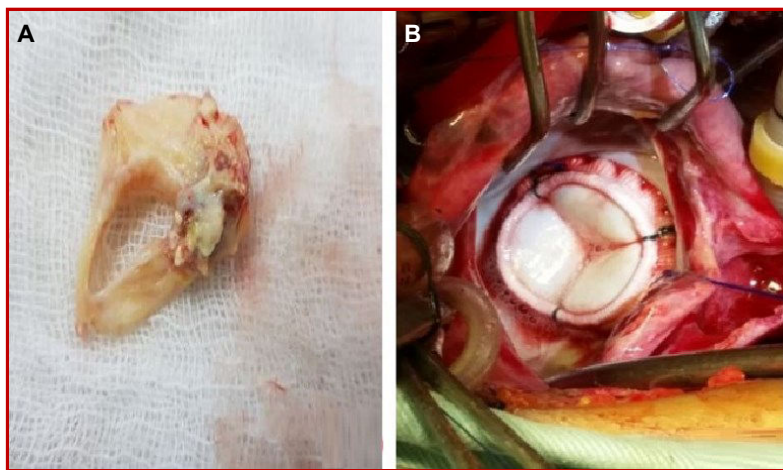


Figure I: Photograph illustrate native and prosthetic mitral valve. (A) Calcified mitral valve with features of commissural fusion and thickened leaflet; (B) Bio-prosthesis (tissue valve)

pressure and also left ventricular ejection fraction. New York Heart Association (NYHA) functional class was improved in 94% patients. Only 1% patients did not attend the follow-up regularly, and only 2.5% patients had bleeding complication related to anti-coagulation therapy (warfarin), and 3% patient had superficial wound infection (Table II).

Discussion

In this study, total 167 patients were evaluated who developed mitral restenosis and regurgitation with female predominance. The mean age was around 40

years and symptom free interval was 7.8 ± 2.7 years. Most common pathology was combined valvular stenosis and regurgitation in 62% cases. Leaflet calcification, retraction, and commissural fusion, was most common intraoperative findings. Mean aortic cross clamp time was 48.8 ± 22.4 min and mean cardiopulmonary bypass time was 88.8 ± 26.1 min. Post-operative average ventilation time and bleeding was not significant. There was not unpleasant event like wound infection, renal impairment, transient ischemic attack or cerebrovascular accident and no re-intervention required. However, only 1% patients had cognitive neurological deficit postoperatively but it was improved before the discharge of the patient. Only 2.5% patients developed anticoagulation related bleeding complication. New York Heart Association (NYHA) functional class was improved in 94% patients. Color doppler echocardiography during follow-up period revealed increase in mean mitral valve area and reduce the mean pressure gradient in comparison to pre-operative value.

In a study, Adhikary et al. (2016) demonstrate that patients with restenosis mostly present with echocardiographic findings of reduced mitral valve area, LV ejection fraction, increased pressure gradient across the mitral valve and also pulmonary artery systolic pressure. Moreover, restenosis causes increased left atrial dimension also and most of the patients presents with NYHA functional class III-IV. These findings are similar with this current study and also the findings by several published articles.^{1, 4, 6-8}

Vohra et al. (2012) observed that the pericardium was extensively adhered with the surfaces of the heart as well as other findings like valve leaflet retraction, calcification, commissural fusion with calcification, chordae fusion and retraction; all of which are the consequence of chronic inflammatory process leading to fibrosis which is concordance to this review also.⁹ However, several published articles also observed the same findings and recommended that, the adhered pericardium should be separated completely from surface of the heart in order to achieve better base to apex and global contraction of heart.^{1, 6, 9-12}

Patients underwent for mitral valve replacement with preservation of posterior mitral leaflets, illustrate this technique is beneficial for postoperative left ventricular ejection performance observed in the study by Djukić et al. (2006) which is also supported our findings.¹³ Mean aortic cross clamp time and mean cardiopulmonary bypass time was 48.8 ± 22.4 min and 88.8 ± 26.1 min respectively, which is less time consuming compare to other studies.^{5, 6, 11-13} In this study, continuous suturing technique was used for valve replacement in most cases which is cost effective, time saving and equally beneficial than

interrupted suture technique supported by the study of Beddermann and Borst. (1978).¹⁴

Post-operative ventilation time, mediastinal bleeding, duration of ICU and hospital stay was within standard limit similar to other studies.^{9,11-14} There was no post-operative re-intervention, wound infection, renal failure, transient ischemic attack or cerebrovascular disease as well as no mortality during the period of hospital stay. The New York Heart Association (NYHA) functional class was seen improved in 94% patients within the six months after the valve replacement surgery as most of the patients upgraded to NYHA Grade I-II which favors an encouraging successful early outcome in this study like others also.^{1,6,13-15} In a study, Akay et al. (2008) observed that besides the clinical parameters, the post-operative echocardiographic findings were also promising as there is statistically significant increase in mitral valve area, and ejection fraction with significant decrease in pressure gradient across mitral valve.¹⁶ Moreover, all of these echo findings are also supportive of better postoperative outcome after redo mitral valve surgery.¹⁵⁻¹⁸

This study assessed the efficacy and early postoperative outcome after redo mitral valve surgery in a patient who have had prior open or closed mitral commissurotomy and has shown that, mitral valve replacement significantly improves patient's functional status and has favorable early outcome in patients with restenosis.

Conclusion

Mitral valve commissurotomy which provides symptom alleviation in patients with mitral stenosis could be an initial treatment modality provided that valve morphology is suitable. However, it's inevitable restenosis could be best managed by redo surgery with mitral valve replacement.

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