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A Retrospective Study to Compare Mitral Valve Repair and Replacement for Rheumatic Heart Disease

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Abstract

Background: Mitral valve repair has been proven to be superior to replacement in non rheumatic mitral valve disease. Mitral valve repair is more challenging rheumatic mitral valve disease due to complexity of lesions. This retrospective study was done to review our experience of mitral valve repair in predominant rheumatic population.

Methods: 693 parients who underwent various mitral valve procedures were compared to determine survival, functional status, residual lesions, freedom from reoperation, thromboembolic & bleeding complications, infective endocarditis and need for valve related redo surgery.

Results: Various demographic parameters were comparable in different subgroup. Survival for mitral valve repair patients was more than mechanical mitral valve replacement but lesser as compared to bioprosthetic valve at a follow up period of five year. Freedom from thromboembolic events was significantly higher in repair group with a resultant lower readmission rate. Freedom from re-operation was lower in the repair group, while in subgroup of mitral valve repair where complete mitral valve repair techniques were used it is better as compared to mechanical but lesser as compared to bioprosthetic valve.

Conclusion: Mitral valve repair has excellent durability comparable to mechanical or bioprosthetic

valve replacement in rheumatic disease, therefore, repair appears to be more beneficial as this avoids the need for lifelong anticoagulation therapy and the associated risks of bleeding and thromboembolism.

Keywords: Rheumatic Heart Disease, Mitral Valve Repair, Mitral Valve Replacement.

Introduction

According to a recent study undertaken by AIIMS, rheumatic heart disease (RHD) is still prevalent in India. The disease is particularly common among adolescents[1]. The mitral valve (MV) is the most often affected by RHD. In the developing world, it is the leading cause of valvular heart surgery[2].

Mitral valve restoration is considered to be equivalent to mitral valve replacement in non-rheumatic pathological processes such as degenerative mitral valve disease.[3] And where valve repair seems to be scientifically possible, the appropriateness of valve repair for patients with rheumatic heart disease is debatable.

Since 2007, it has been our practice at our institution to repair rather than replacing rheumatic mitral valves. We reviewed our 16-year single-institution history with rheumatic mitral valve repair and replacement to ascertain survival, functional status, residual lesions, freedom from reoperation, thromboembolism and bleeding, and other anticoagulation-related complications, cerebrovascular disorders, infective endocarditis, prosthesis failure, paravalvular bursts, and the need for valve-related redo surgery.

Methods

The present study was carried out on patients operated in Department of Cardiothoracic and Vascular Surgery, Pt. B.D. Sharma PGIMS, Rohtak. All cases of rheumatic heart disease where mitral valve repair or replacement was performed were reviewed. Mitral valve disease secondary to other pathological processes than rheumatic heart disease were excluded. The study population consisted of 693 patients who underwent mitral valve surgery from September 1997 to December 2013. Out of 693 patients, 350 are male and 343 female.

All patients were allocated into three groups:

- Group I Mitral valve repair n=238
- Group II Mitral valve replacement (Mechanical) n=343
- Group III Mitral valve replacement (Bioprosthetic) n=112

The medical and surgical records of all the patients were retrospectively reviewed. A standardized data collection sheet was used as per guidelines[4] for reporting the results in valve intervention to retrieve relevant information.

Demographics & Procedure: The 693 patients had mean age of 31±11 years; about half were female, 32% were in NYHA Class IV, about a third had associated AF, and 36% had concurrent procedures. 51.7% had mitral stenosis, 20% had regurgitation, and 28.3% had both. Valve repair was performed in 34.5%, 16% had a bioprosthesis, and 49.5% had a mechanical valve(Table 1).

Transthoracic echocardiography was done on each follow up visit. Anticoagulant therapy was continued for lifetime in patients receiving mechanical valve but it was stopped after three months in patient receiving bioprosthetic valve or mitral valve repair. Post-operatively, patients were reviewed at the outpatient clinic.

Guidelines of the Society of Thoracic Surgeons for reporting mortality and morbidity after cardiac valve interventions was used for the analysis and reporting of postoperative complications[4].

Statistical analysis: All continuous numerical data were expressed as means ± standard deviation and all actuarial estimates as percentage ± standard error. Univariate analysis of categorical data was carried out with $\chi 2$ or Fisher exact tests. Univariate analysis of continuous variables was carried out with analysis of variance or the Student t test. A p-value of <0.05 was considered to be statistically significant.

Results

The mean Aortic cross clamp and cardiopulmonary bypass time was slightly higher in group I and III as compared to group II and this is also statistically significant. This may be due to the reason that in group I and III additional procedures like AF ablation surgery, Tricuspid valve repair and left atrial appendage closure was done more frequently(Table 2).

Hospital mortality Overall operative mortality was 4.62%. There were a total of 32 deaths during hospital stay after surgery including one month duration post surgery: 11 (4.62%)in repair group, 14(4.08%) in mechanical valve group and 7(6.25%) in bioprosthetic valve group patients. This difference is not statistically significant.

Table 1 Patient Characteristics

	Repair	Mechanical	Bioprosthesis	P value
Demographics				
No. of patients	238	343	112	
Age(yrs)	30+/-11	30+/-11	36+/-12	0.51
Sex(%female)	56.72	42.86	54.46	0.52
NYHA IV	77	95	51	0.20
Preop AF	91	77	58	0.0001
Pathology				
Stenosis	101	199	58	0.56
Regurgitation	54	68	17	0.26
Mixed	83	76	37	0.10
Intraoperative				
Aortic valve surgery	24	61	8	0.002
Tricuspid valve surgery	22	29	15	0.30
AF surgery	47	3	43	0.0001
CPB time (min)	131+/-70	105+/-49	143+/-72	0.001
XCL time (min)	110+/-66	79+/-41	115+/-64	0.001

Re-operation 27 patients out of 206(11.89%) in repair subgroup I, seven patients out of 160(4.12%) in repair subgroup II, 17 patients out of 280(5.17%) in mechanical group and two patients out of 94(2.06%) in bio prosthetic group underwent a redo procedure which is not statistically significant. Among all redo in repair group, initialy closed mitral valvotomy has been done in 20 patients. In the mechanical group, the indications

for redo was valve thrombosis in 13(76.47%) and infective endocarditis in four(23.53%). There were two (1.79%) case of redo in bioprosthetic group, both due to structural valve degeneration. In all redo

Table 2 Post-Operative Outcomes

	Repair N=238		Mech N=343	Biop N=112	Statistical significance
Mortality	I* n=238	II** n=178			
	11(4.62%)	10(5.62%)			$\chi 2 = 4.97$; df=2; p=0.01 Significant
Early			14(4.08%)	7(6.25%)	
Late	6(2.91%)	5(3.13%)	31(11.07%)	1(1.06%)	
Readmission for any cause	20(9.71%)	15(9.37%)	57(20.36%)	13(13.83%)	$\chi 2 = 8.61$; df=2; p 0.01 Significant
Thromboembolic & Bleeding complications	4(1.94%)	4(2.5%)	39(13.93%)	2(2.13%)	$\chi 2 = 31.50$; df=2; p 0.000 Highly Significant
Endocarditis	4(1.94%)	4(2.5%)	7(2.5%)	5(5.32%)	$\chi 2 = 2.05$; df=2; p 0.357 Not Significant
NYHA Class					$\chi 2 = 1.55$; df=2; p 0.458 Not Significant
I/II	191	152	269	91	
III/IV	15	8	11	3	
Follow up Percentage	90.75%	95.24%	94.22%	96.91%	$\chi^2 = 1.55$ not significant
Redo Procedure	27 (11.89%)	7(4.12%)	17(5.17%)	2(2.06%)	$\chi 2 = 0.497$; df=2; p 0.779 Not Significant
Follow Up(mths) Mean+/-SD	81+/-43	61+/-23	109+/-34	65+/-23	
Residual pathology					
Significant MS & MR	28(13.6%)	10(6.25%)	-	-	

*Complete mitral valve repair

**MV repair excluding CMV

^ Significant regurgitation was defined as jet area >4cm^2 on colour Doppler mode. Significant stenosis was defined as mean gradient across MV >5mmHg. surgeries, approximately 50% of patients died in the mechanical group while 14.82% of patients had mortality in the repair group. In the bio prosthetic group, no patient died as a result of the redo surgery. At an average follow-up of 81 months, 88% of patients were free of reoperation for mitral valve repair. Freedom from reoperation was 95% in subgroup II of mitral valve repair after a mean follow-up of 61 months, and 95% in subgroup II of mechanical valve replacement after a mean follow-up of 101 months. At a 65-month follow-up, the freedom from reoperation for bio prosthetic valve repair was 98%.

Survival: Survival for mitral valve repair at mean follow-up of 61months was 96.9%. Survival for mechanical valve replacement at mean follow up of 101months was 89%. Mean Survival for bioprosthetic valve at 65months was 99%. A subgroup of patient where mitral valve repair including closed mitral valvotomy were included, had a survival of 97.1% after mean follow-up of 81months.

Thrombo-embolic & Bleeding complications: A total of 45 thrombo-embolic complications were registered. Four patients out of 206 (1.94%) in the repair group, 39 patients out of 280 (13.93%) in the mechanical group, and two patients out of 94 (2.13%) in the bioprosthetic group had thromboembolic cases (Table3). The mechanical group has the highest rate of thromboembolic incidents, which is statistically significant at p=0.0001 level.

Readmission: Readmission rate in mechanical group was 20.36% as compared to 9.71% in repair subgroup I & 9.37% in repair subgroup II, whereas it is 13.83% in bioprosthetic group which is also statistically significant (p=0.01).

Table 3: Various Thromboembolic & Bleeding complications

	Repair	Mechanical	Bioprosthetic
IC Bleed	1	5	-
Stroke/TIA	2	12	2
Prosthetic valve thrombosis	-	16	-
Peripheral Embolism	1	1	-
Bleeding complications	-	11	-

Discussion

Epidemiologically the average age of the patients in our study was 31 years. Silwa et al at the same hospital where Antune's study was conducted in 1986 verified this pattern with rheumatic patients being symptomatic for surgery later in life. In 2010, the mean age of patients requiring surgery was 43 years compared to 21 years (44% of which were under 15 years) in the original study 25 years prior[2,5].

In all three groups, the gender distribution is almost identical. The majority of patients who presented to our institute have stenotic or mixed lesions emphasizing the importance of late presentation in burnt out phase of disease. Artrial fibrillation affects about a third of patients.

Hospital mortality: In this study, overall operative mortality was 4.62%. There were a total of 32 deaths during hospital stay after surgery including one month duration post-surgery: 11 (4.62%)in repair group, 14(4.08%) in mechanical valve group and seven(6.25%) in bioprosthetic valve group patients. This difference is not statistically significant. Out of seven early death in bioprosthetic group, four patients had a conversion from mitral valve repair to bioprosthetic valve. This was in early phase of learning curve of mitral valve repair. These data are consistent with previously published results[6,7].

Survival: After implantation of a mechanical mitral prosthesis, we observed an 89% survival rate after 100 months, which is consistent with most published series[8-10]. When compared to bioprosthetic valve and mitral valve repair, the late mortality is primarily due to thromboembolic events and bleeding complications of long-term anticoagulation. Because of the strict INR

monitoring in our study, mechanical valve patients have a higher survival rate than in other studies. At 61 months, we observed that patients who had valve repair had a 97% survival rate. The survival of repair patients was higher than in other studies, and this was due to Carpentier's comprehensive complete mitral valve repair techniques[11]. After a mean follow-up of 65 months, we had a survival rate of 99% in the Bioprosthetic group. The bioprosthetic group had a higher survival rate than other studies due to chordal preservation and the use of IIIrd generation tissue valves. In a meta-analysis published in 2007, Shuhaiber[12] et al found similar findings in terms of long-term survival.

Thromboembolism: Mitral valve repair was also associated with a statistically significant lower incidence of thromboembolism (1.94%) as compared to mechanical group (13.93%). Incidence of thromboembolic episodes in bioprosthetic group was 2.13% due to uncorrected AF. In our study implantation of a mechanical valve was associated with maximum number of thromboembolic events. Other studies done in developing countries with perceived non-compliance to anticoagulation therapy had led to a strong advocacy of mitral valve repairs over replacements[2,13]. Yau and colleagues compared mitral valve repair with replacement in rheumatic mitral valve disease patients[6]. The authors found that valve replacement with a mechanical prosthesis resulted in a lower re-operation rate but poorer long-term survival and a higher incidence of thrombo-embolic complications. Consequently, the authors concluded that rheumatic mitral valves should be repaired when technically feasible, accepting the risk of re-operation, to maximize survival and reduce morbidity.

Reoperation: In repair subgroup I patients had 88% freedom from reoperation at mean follow-up of 81months, whereas freedom from reoperation in subgroup II was 95% at follow up of 61months suggesting better durability with complete mitral valve repair than valvotomy alone. Reoperation was required in 27 patients in repair group and was accomplished with a mortality of 14.82%. The observation that reoperation did not carry a demonstrably increased risk of death as compared to redo surgery for mechanical valve in this series favors a strategy of repair in all suitable patients. Mechanical mitral valve replacement gave freedom from reoperation of 95% at mean follow up of 101months. But almost half of the patient expired among the redo patients of mechanical group because these patients presented with prosthetic valve thrombosis in pulmonary edema and needed emergency surgery. For bioprosthetic group, at mean follow up of 65months freedom from reoperation was 98%.

Infective endocarditis: Incidence of infective endocarditis was statistically similar in all three groups. There were four(1.94%) cases of infective endocarditis in repair group, seven(2.5%) in mechanical and five(5.32%) in bioprosthetic group. Similar results were reported by a study done by Antunes in 1990[14].

Readmission Readmission rate in mechanical group was 20.36% almost double as compared to 9.7% in repair group, whereas it is 13.8% in bioprosthetic group which is also statistically significant (p=0.01). Similar results were obtained by Shuhaiber et al[12] in 2007 and Wang et al[15] in 2008 reporting significantly higher readmission rate for mechanical valve as compared to mitral valve repair.

Conclusion

Long-term outcome for mitral valve repair in a weak, rheumatic heart disease affected population in a

developing country in the current period are much higher than commonly assumed. By evaluating the progression of disease following mitral valve repair with the adverse events associated with mitral valve replacement(mechanical as well as bioprosthetic), we could demonstrate that:

- Survival for mitral valve repair patients was more than mechanical mitral valve replacement but lesser as compared to bioprosthetic valve at a follow up period of five year.
- Freedom from thromboembolic events was significantly higher in repair group with a resultant lower readmission rate.
- Freedom from re-operation was lower in the repair group, while in subgroup of mitral valve repair where complete mitral valve repair techniques were used it is better as compared to mechanical but lesser (not statistically significant) as compared to bioprosthetic valve.

This study concludes that Mitral valve repair has excellent durability comparable to mechanical or bioprosthetic valve replacement in rheumatic disease, therefore, repair appears to be more beneficial than replacement as this avoids the need for lifelong anticoagulation therapy and the associated risks of bleeding and thromboembolism.

Comprehensive Mitral valve repair strategy with annuloplasty gives better freedom from reoperation as compared to open mitral valvotomy alone, hence, should be employed in all mitral valve repair patient to provide improved long term survival.

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Disclosure All authors declare that there is no conflict of interest in this article. The authors declare that the patient has given approval and consent to the publication of this article.

Ethical approval: All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 helsinki declaration and its later amendments or comparable clinical standards.

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