

## Original Article

# Short Term Outcome of Double Valve Replacement vs. Aortic Valve Replacement with Mitral Valve Repair in Bangladesh: A Comparison

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**Abstract:**

**Key words:**  
Mechanical valve,  
Mitral valve  
repair, Aortic  
valve  
replacement,  
Rheumatic heart  
disease,  
Bangladesh.

**Background:** Although all mitral valves are not repairable, most non rheumatic valves and a substantial proportion of rheumatic valves are amenable to repair. Repair preserves the normal valvular tissue, so the left ventricular function is well maintained post-operatively. Combined aortic and mitral valve surgery is associated with increased mortality and morbidity. Several studies have shown the superiority of DVR (Double valve replacement) in this entity to prevent re-operation. Some other data suggested superiority of aortic valve replacement combined with mitral valve repair in double valve disease. No study had been done over Bangladeshi population. Our aim was to compare the short-term outcome of mitral valve repair and aortic valve replacement with double valve replacement.

**Methods:** It was a prospective non-randomized observational study took place in the Department of Cardiac Surgery of National Institute of Cardiovascular Disease. In this study post-operative result of double valve replacement was compared with aortic valve replacement and mitral valve repair. Total 60 patients under went aortic valve replacement with either mitral valve replacement (n=30) marked as group A or (n=30) repair marked as Group B.

**Results:** Aortic cross clamp time and cardiopulmonary bypass time was higher in group B than group A but it was well tolerated without any short-term measurable consequences. Required inotrope support was  $49.8 \pm 2.3$  hours in group B and  $87.2 \pm 3.5$  hours in group A ( $p < 0.05$ ). Duration of ICU stay were  $91.1 \pm 3.2$  hours in group A and  $60.3 \pm 2.9$  hours in group B ( $p < 0.05$ ). Development of post-operative low output syndrome was significantly higher (23.33%) in group A versus 3.33% in group B. Patients of group A suffered more from CHF in the follow up period than the group B. But the result was statistically insignificant. There was an early post-operative fall of ejection fraction in both groups but it was recovered after 3 months. Post-operative thromboembolism was 13.79% in group A and 3.33% in group B. There was no early death in repair group though total three (10%) cases died after DVR. There was no valve failure, re-stenosis or regurgitation in any group in this limited follow up period. Higher dose of warfarin was required in group A to maintain INR. Consequently, post-operative major bleeding occurred in 24.14% patients of group A. On the contrary, no patient of repair group suffered from this catastrophe.

**Conclusion:** This study reveals that the result of mitral valve repair with aortic valve replacement is equally comparable or in some cases superior to that of double valve replacement. Therefore, in feasible cases, mitral valve repair should be attempted who need concomitant aortic valve replacement.

(*Cardiovasc j* 2021; 13(2): 164-171)

**Introduction:**

Rheumatic heart disease had been reported as 26 % of total cardiac diseases in Bangladesh.<sup>1</sup> Mitral valve is most commonly affected followed by aortic

valve in a percentage of 56.7% and 6% respectively in Bangladesh.<sup>2</sup> 10% of patients with valvular heart disease present with involvement of both mitral and aortic valve.<sup>3-6</sup> Though the benefits of isolated

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mitral valve repair over replacement are well documented,<sup>7-11</sup> controversy remains whether the mitral valve should be repaired or replaced in patients who need concomitant aortic valve replacement but some have advocated DVR (Double valve replacement) in this entity to prevent re-operation.<sup>12-14</sup> The aim of valve surgery is to provide a competent non obstructive valve without compromising left ventricular function. To a large extent these aims are met with valve conservation and repair rather than valve replacement.<sup>15-17</sup> Stated more explicitly, mitral valve replacement is associated with decreased long-term survival in all patients with double valve disease.<sup>18</sup> Concomitant replacement of the aortic and mitral valves is associated to an increased morbidity and mortality compared to aortic valve replacement with mitral valve repair.<sup>19</sup> There are several studies regarding the result of double valve surgery in the form of DVR and AVR and mitral valve repair.<sup>12,13,18,20-23</sup> Majority of them demonstrated that, mitral valve repair with AVR offers excellent short- and long-term results and is the ideal choice where anticoagulation is contra indicated and difficult to maintain. In our country no study yet performed to compare the effects of these two procedures.

### **Study Methods:**

It was a prospective non- randomized observational study took place in the department of Cardiac surgery of National Institute of Cardiovascular Diseases over the period of January 2006 to December 2007. We did the study to compare the short-term effects of mitral valve repair and aortic valve replacement with double valve replacement. The study protocol was approved by the institutional review board. Total 60 patients under went aortic valve replacement with either mitral valve replacement (n=30) marked as group A or (n=30) repair marked as Group B. Inclusion criteria were patients having both mitral and aortic valvular diseases requiring surgical management. Exclusion criteria's were previous intervention on the aortic or mitral valves, concomitant coronary artery diseases, concomitant congenital heart diseases, ejection fraction less than 40%, age more than 60 years, severe and uncontrolled COPD, LVIDd: >85 mm, LVIDS: >55mm. Variables recorded were age, sex, preoperative NYHA, LVEF,

per operative Extracorporeal circulation time in minutes, Aortic cross-clamp time in minutes (CCAB), Procedure used-Repair or replacement, postoperative ICU stay in hours, Inotrope support required, development of LOS, early postoperative death, other complications like major bleeding, thromboembolism, LVEF (%) at discharge, LVEF (%) at 3 months.

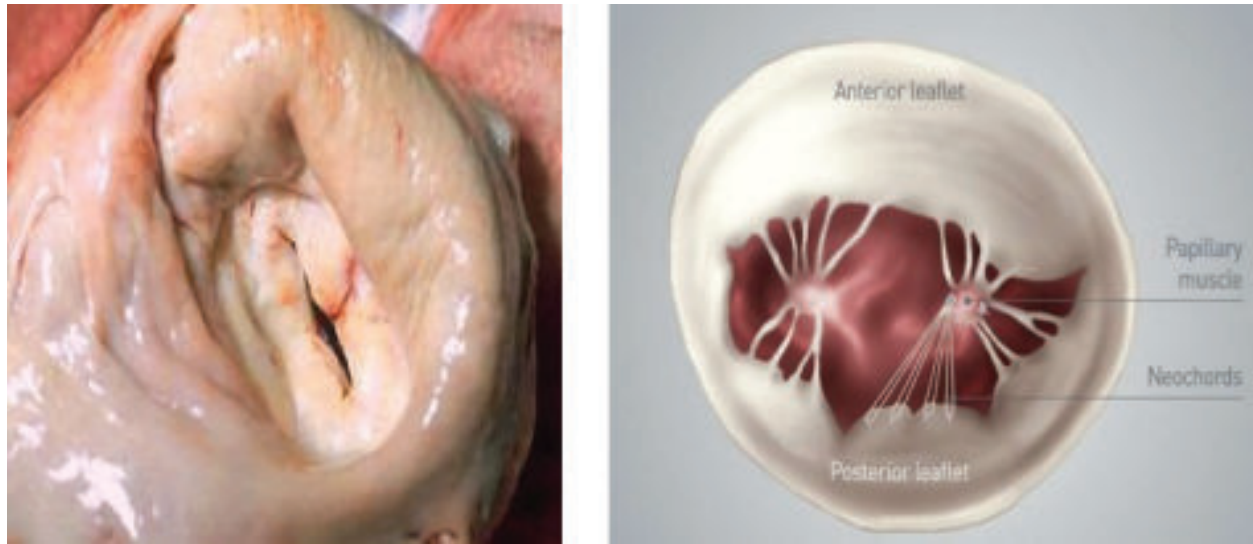
### **Surgical technique:**

Surgery was performed using median sternotomy. Standard moderate hypothermic (30°C- 32°C) cardiopulmonary bypass established by aorto bicaval cannulation. After arrest of the heart aortic valve was removed and replaced. Mitral valve was exposed by an incision through the Sondergaard's groove and horizontal biatrial trans septal incision in case of small left atrium. In case of group B, site of the commissures was located; if necessary, by traction on the free edge of the anterior leaflet of mitral valve toward the center of the mitral orifice. Commissurotomy performed along the groove leaving a 3 mm tissue ridge from the annulus and directed toward the center of the orifice. In case of absolute stenosis of mitral valve, thinning of the leaflets was done after OMC. In some cases, incision was extended up to the papillary muscle to increase its mobility. Quadrangular resection of posterior leaflet, sliding annuloplasty or ring annuloplasty was performed in mitral regurgitation cases.

OMC, valve thinning and other reparative procedures were applied in combination for mixed valvular lesions. The competence of the mitral valve was tested by injecting saline through the mitral valve into the left ventricle under pressure from a 250 ml bulb syringe. In case of group A, after resection of aortic valve, mitral valve was resected and replaced followed by replacement of aortic valve. In feasible cases of double valve replacement sub valvular apparatus was preserved. In all the cases ON-X bileaflet mechanical valve was used. Repair or replacement of the mitral valve was decided by the surgeon after examination of the lesion.

### **Post-operative anticoagulation:**

The systemic anticoagulant therapy with warfarin sodium was initiated in all patients after removal of chest tubes. In the later days, dose of warfarin



Stenotic Mitral Valve

Normal Mitral Valve

**Fig.-1:** Normal and stenotic mitral valve**Fig.-2:** Open mitral commissurotomy.

was adjusted to keep the INR at 2.5-3.5 for group A and 2-3 for group B.

#### **Postoperative evaluation by Echocardiogram:**

Two-dimensional, M-mode and Colour flow Doppler transthoracic echo cardiogram was performed in all patients before operation, during discharge and after 3 months of follow up. Echo cardiogram was interpreted by single observer in the Department

of Cardiology, NICVD. Left ventricular function was assessed by LVEF (left ventricular ejection fraction). Mean value for each measurement were derived from 3 consecutive beats in sinus rhythms and from 5 beats in those in atrial fibrillation. LVEF was calculated by standard way.

#### **Follow up:**

All the patients were followed up for three months after operation. Trans thoracic Echocardiogram

was done during discharge and 3 months post operatively and result was compared with preoperative data and those at discharge between two groups. Patients were followed up for mortality, cardiac failure, thromboembolism, bleeding from various sites, features of endocarditis and level of INR. The findings were compared between the two groups.

### Statistical analysis:

Data were collected in a preformed data collection sheet. Data were analyzed in statistical programmer for social science (SPSS). Data were verified by unpaired "t" test, paired "t" test, Chi-square test, Fishers exact test and other descriptive statistical methods. P value of less than 0.05 was considered significant.

### Results:

Maximum patients were in the age range of 20-29 years and least percentage of patients had age more than 49 years. The mean age was found  $34.9 \pm 8.7$  years in group A and  $34.8 \pm 10$  years in group B. In the group A, 18 (60%) patients were male and 12 (40%) patients were female. On the contrary 16 (53.33%) patients were male and 14 (46.67%) patients were female in group B. NYHA functional class II occupied 6.67% in group A and 20% in group B. Class III occupied 76.67% in group A and 73.33% in group B. NYHA class IV occupied 16.66% patients in group A and 6.67% patients in group B. There was no patient in class I (Table I).

Numbers of stenotic lesions were least in repair group than replacement group. Isolated mitral stenosis was 23.33% in repair group and 60% in replacement group. On the contrary, isolated aortic stenosis was 6.67% in repair group and 10% in replacement group. In the same time, incompetent valvular lesions were higher in repair group. Mitral regurgitation was 30% in repair group and 10% in replacement group. Aortic regurgitation was 43.33% in repair group and 33.33% in replacement group. Mixed mitral valve lesions were 30% in DVR group and 46.67% in repair group. Mixed aortic valve lesion was 56.67% in DVR group and 50% in repair group. As a whole, regurgitant lesions were more in aortic valve replacement with mitral valve repair group (Figure I).

Extra-corporeal circulation time was  $177.9 \pm 39.8$  minutes in group A and  $212.1 \pm 57.2$  minutes in

group B. Significantly higher time was required in group B than group A ( $p < 0.05$ ). Aortic cross clamp time was  $124 \pm 38.4$  minutes for group A and  $137 \pm 33.6$  minutes for group B. No significant difference of cross clamp time between group A and group B ( $P > 0.05$ ).

Patients of group A required inotropes for longer duration ( $87.2 \pm 3.5$  hours) than the patients of group B ( $49.8 \pm 2.3$  hours) and the difference is significant ( $p < 0.001$ ). Mean duration of ICU stay was  $91.1 \pm 3.2$  hours in group A and  $60.3 \pm 2.9$  hours in group B. The difference is also significant ( $p < 0.001$ ) between groups. 7 (23.33%) patients of group A and only 1 (3.33%) patient of group B developed LOS in the ICU. Significant difference was found in the development of LOS between groups ( $p < 0.05$ ). 3 (10%) patients of group A expired in the total study period in comparison to group B, where no patient died. Among the expired cases, one patient (3.33%) died in the ICU.

7 (24.14%) patients of group A had history of major bleeding in the follow up period. On the other hand, no patient of group B had this feature ( $p < 0.05$ ) which indicates significant difference between groups. 13.79% patients of group A and 3.3% patients of group B developed thromboembolic episodes in the three months follow up period. (24.14%) patients of group A had history of major bleeding in the follow up period. On the other hand, no patient of group B had this feature.

Change of left ventricular ejection fraction (LVEF) within the group pre operatively, post operatively at discharge, and 3 months after follow up were measured. In group A, LVEF was  $54.2 \pm 5.5\%$ ,  $50.5 \pm 5.1\%$  &  $52.2 \pm 7.2\%$  during pre-operative, post operatively during discharge and after 3 months follow up respectively. On the other hand, it was  $55.8 \pm 7.6\%$ ,  $50 \pm 6.8\%$  and  $53.5 \pm 7.4\%$  respectively in group B. P value was  $< 0.05$  during discharge in both groups compared to LVEF on admission. It indicates, there was significant reduction of ejection fraction post operatively during discharge. But this reduction was not sustained i.e., ejection fraction improved, as evidenced by the change of ejection fraction post operatively after 3 months. Ejection fraction increased in both the cases though the result was insignificant ( $p > 0.05$ ).

**Table I**  
*Demographic data, preoperative NYHA class and LVEF of the patients of study groups.*

	Group A (n=30)	Group B (n=30)	p value
Age in years (Mean±SD)	34.9±8.7	34.8±10.0	0.968
Sex			
Male	16(60%)	16(53.33%)	0.602
Female	12(40%)	14(46.66%)	
Preoperative variable			
NYHA Class			
Class II	2 (6.67%)	6 (20%)	0.127
Class III	23 (76.67%)	22 (73.33%)	0.765
Class IV	5 (16.67%)	2 (6.67%)	0.211
LVEF	54.2±5.5	55.8±7.6	0.376

**Table-II**  
*Comparison of ECCT and Aortic cross-clamp time (XCT) between the groups.*

Variable	Group A (n=30) (Mean±SD)	Group B (n=30) (Mean±SD)	p value
ECCT (minutes)	177.9±39.8	212.1±57.2	0.009
Aortic X-Clamp time (Minutes)	124±38.4	137±33.6	0.163*

**Table-III**  
*Post-operative data of the study population.*

	Group A (n=30)	Group B (n=30)	p value
Immediate post-operative data			
Inotrops needed (hours)	87.2±3.5	49.8±2.3	0.001
LOS developed	7(23.33%)	1(3.3%)	0.026
CHF developed	8(24.14%)	2(6.7%)	0.065
ICU stay (hours)	91.1±3.2	60.3±2.9	0.001
ICU death	1(3.33%)	0(0.0%)	0.492
3 months follow up data			
Thrombo-embolic manifestation	4(13.79%)	1(3.33%)	0.311
Major bleeding episode	7(24.14%)	0(0.0%)	0.004
CHF developed	8(24.14%)	2(6.7%)	0.065
Death within 3 months	2(6.9%)	0(0.0%)	0.237

**Table-IV**  
*Comparison of LVEF in different follow up time of Group A.*

Variable	Group A Mean±SD	Comparison	p value
LVEF on admission	54.2±5.5	Admission vs discharge	**0.009
LVEF at discharge	50.5±5.1	Admission vs 3 months	*0.236
LVEF after 3 months	52.2±7.2	Discharge vs 3 months	*0.301

**Table-V**  
*Comparison of LVEF in different follow up time of Group B.*

Variable	Group B Mean±SD	Comparison	<i>p</i> value
LVEF on admission	55.8±7.6	Admission vs discharge	0.001**
LVEF at discharge	50.0±6.8	Admission vs 3 months	0.197*
LVEF after 3 months	53.5±7.4	Discharge vs 3 months	0.079*

### Discussion:

Mitral valve repair is widely accepted surgical procedure for non-rheumatic heart valve lesions.<sup>7</sup> Experience with rheumatic mitral valve disease is less and some study advocated not as a procedure of choice even when feasible.<sup>12</sup> Higher number of rheumatic valve diseases were managed by AVR and mitral valve repair and showed equally comparable result with DVR.<sup>21-23</sup> Mitral valve repair in rheumatic patients can effectively correct hemodynamic and functional abnormalities with satisfactory results.<sup>15</sup> Mitral valve repair is associated with lower early mortality, thromboembolic episodes and non-significant re operation rate in repair group even in rheumatic population.<sup>24</sup>

Major bleeding, thromboembolism, endocarditis, hemolysis, valve failure, re operation are the main determinants of the prognosis of valve surgery.<sup>25</sup> Anticoagulation plays the vital role in post-operative management. INR was maintained between 2.5-3.5 in double valve replacement group and 1.5-2.5 in AVR and mitral valve repair group.<sup>12</sup> In both cases, warfarin was used to maintain anticoagulation. When aspirin is added, it is associated with the avoidance of long-term use of high dose coumarin anticoagulants.<sup>12,23</sup> Valve repair requires no use of anticoagulation if the patient is in sinus rhythm; left atrium is free of thrombus and not dilated.<sup>25</sup> In case of AVR with mitral valve repair for double valve disease, anticoagulation could be maintained by aspirin only.<sup>23</sup> Avoidance of coumarin anticoagulants is very much significant in child bearing age group.

In this study 23.33% patients of group A and 3.33% patients of group B developed low output syndrome (LOS). There was significantly higher incidence of LOS in replacement group than repair group. The incidence of LOS was 18% in the study of Hamamoto et al.<sup>12</sup> and 17% in the study of Gillinov

et al.<sup>18</sup> The study of Yau et al.<sup>8</sup> also revealed the increased incidence of LOS in replacement group than repair group. Our result correlates with their studies. One patient of replacement group died from LOS in ICU, but none of repair group. ICU stay was higher in mitral valve replacement group compared to mitral valve repair group. This finding was comparable to the study of Wu and associates.<sup>26</sup> This might be due to the increased incidence of left ventricular dysfunction in group A in the early post-operative period.<sup>27</sup>

Congestive heart failure was significantly higher in group A (24.14%) than group B (6.7%). Tasdemir et al.<sup>28</sup> showed increased incidence of CHF where native valvular tissue was not preserved in comparison to cases where native valvular tissue preserved. Our result corresponds with their study.

The incidence of thrombo embolism was 7% in DVR group and 2.3% in AVR with mitral valve repair group in the study of Hamamoto et al.<sup>12</sup> and Talwar et al.<sup>20</sup> showed that thromboembolic episode was 21% in DVR group and 10.5% in Mitral valve repair group. In the study of Kaul et al.<sup>23</sup>, thromboembolic manifestation was 2.7% in AVR with OMC group.<sup>23</sup> Some other researchers also showed the lower rate thromboembolism in repair group than replacement group.<sup>8,25</sup> Though this feature was higher in DVR group, in all the studies it was statistically insignificant. Our result was very much similar to the above-mentioned studies.

Ho et al. found major bleeding in 20% of the patients of DVR group and 5% in the patients of AVR and mitral valve repair group and their result was statistically significant. 8% patients of DVR group and 1.33% patients of mitral valve repair with AVR group suffered from bleeding manifestation in the study of Hamamoto et al.<sup>12</sup> In the study of Talwar et al.<sup>20</sup> major bleeding episode was 38.2% for repair group and 50.3% for DVR group. Chauvaud et al.<sup>29</sup> and Yau et al.<sup>8</sup> also

showed the higher post-operative bleeding episodes in DVR group. The result of our study corresponds to their studies. This finding reflects the natural advantage of mitral valve repair over the replacement.

### Conclusion

With the improved myocardial protection and current technique of mitral valve repair in the hands of experienced surgeons, AVR with mitral valve repair is a more worthy operation. The outcome is equally comparable to the results of double valve replacement. In the AVR with mitral valve repair group, there was less incidence of early mortality, low output syndrome, CHF, thromboembolic episodes and major bleeding in comparison to the replacement group.

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### Conflict of Interest - None.

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