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Rheumatic Mitral Valve Repair versus Replacement in a Threshold Country

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ABSTRACT

Introduction: The most prevalent cause of valvular diseases in developing countries is rheumatic heart disease. The mitral valve is the most significantly impacted in up to 50% of such cases. Valve replacement with metallic prosthesis has been associated with many complications. Whereas Mitral repair has been the gold standard in degenerative mitral regurgitation, it is still a topic of controversy in rheumatic mitral valve disease due to its inferior durability.

Objective*:* To assess the mitral valve repair durability in comparison to a replacement within a rheumatic heart population under guidelines.

Methods*:* The study included 174 patients with rheumatic heart disease who underwent mitral valve surgery (repair or replacement) in different centers throughout Egypt from January 2012 to October 2015. Patients were classified into two main groups: A (repair group) and B (replacement group). The patients were retrospectively reviewed and followed up for 5 years post-surgery. The clinical and follow-up data were then analyzed, and statistical analysis was carried out.

Results*:* Mitral repair was implemented in 40% of cases (N=70), while replacement was implemented in 60% of cases (N=104). Replacement was performed using only mechanical prosthesis, no bio-prosthesis was included in the study. Patients who were undergoing concomitant heart surgery and/or redo cases were precluded from the study. Regurgitation was observed in 24% of cases, mitral stenosis alone in 31% of cases, and a double lesion in 45% of cases. Patients who underwent repair were significantly more likely to be female and younger than those who underwent replacement (P=0.001). A total of 23 patients underwent reoperation within 5 years of surgery with no operative deaths, 31.4% of which were from the repair group and 12.5% from the group of replacement (P=0.002). It was noticed that the re-operated cases from the repair group had in common a heavily diseased subvalvular apparatus as per Wilkin's echo score and intraoperative findings.

Conclusion*:* Mitral valve replacement has been demonstrated to be more durable than repair in rheumatic heart patients, particularly in patients with severely diseased subvalvular apparatus, in terms of 5-year freedom from reoperation.

Keywords: mitral valve repair; rheumatic heart disease; durability of valve repair

INTRODUCTION

Rheumatic heart disease (RHD) is a national concern in Egypt. The Egyptian Ministry of Health has prioritized it under the guidance of all relevant national experts and leaders [1]. The high prevalence of rheumatic fever (RF) and RHD was exacerbated by a combination of low socio-economic circumstances, overcrowding, and inadequate sanitary and nutritional conditions [2]. Although the prevalence of RHD has significantly decreased in Western countries over the past five decades, it continues to constitute 22% of valvular heart diseases [3].

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The manifestation of mitral affection varies among various populations. Patients in developing countries are susceptible to recurrent episodes of mitral valve disease due to the fact that they develop the condition at an earlier age. Unlike degenerative mitral valve disease repair has been debated in rheumatic lesions due to its technical difficulty and questionable long-term stability [4].

This study aimed to assess the mitral valve repair durability in comparison to a replacement within a rheumatic heart population under guidelines.

PATIENTS AND METHODS

Study groups*:* This was a retrospective study that included 174 patients with confirmed RHD on which isolated MV (repair/replacement) surgery has been done.

Inclusion criteria: We have selected patients with predominantly regurgitant lesions and valve areas more than 1.5 cm^2 and Wilkin's score of 9 or less.

Exclusion criteria: Patients undergoing concomitant cardiac surgery (aortic, tricuspid, CABG surgery) as well as redo patients and those with infective endocarditis were all excluded.

These criteria were chosen to decrease the bias in comparing the two groups. The two-year follow-up was carried out for all patients included in the study. Follow-ups were held in an outpatient clinic every six months.

Patients were divided into two groups based on the type of surgery that was performed. Group A "repair group" included 70 patients. Group B "replacement group" included 104 patients. All patients were operated on through standard median sternotomy and in the case of mitral valve replacement, it was carried out using only mechanical prosthesis.

Preoperative data included history, clinical and laboratory data, ECG, radiological examination, TTE or TEE to evaluate the MV pathology and associated hemodynamic severity.

Intraoperative repair/replacement was decided after mitral valve assessment, intraoperative recordings included the type of surgery, total bypass and cross-clamp time, weaning from bypass, need for DC, pacing, chemical or mechanical support, and on-table TEE findings after regaining the patient's own heart rhythm.

Postoperative data included morbidities in the ICU like de novo arrhythmias, need for intra-aortic balloon pump (IABP), blood transfusion, time for ventilatory support, total ICU, and hospital stay. Follow-up using TTE before discharge and need for readmission for any reason was also recorded.

The clinical outcomes were defined as mortality from any cause, MV reoperation, and valve-related complications, which included thromboembolic events, bleeding events, and infective endocarditis. As per the Society of Thoracic Surgeon Guidelines, early mortality was defined as all-cause mortality within 30 days of surgery [5].

The study was conducted in Benisuef University Hospital where all data were permissible for research purposes and patient consent was waived.

Statistical analysis:

SPSS version 23.0 was used for the analysis of recorded data. In the case of parametric (normal) distribution, the quantitative data were displayed as mean± SD and ranges. Additionally, qualitative

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characteristics were shown as percentages and numbers. Using qualitative data, the X^2-test was used to compare groups. The p-value was deemed significant if it was 0.05 or less.

RESULTS

Table (1): The preoperative data of both groups.

	Group A (repair) N= 70 (40.2%)	**Group B (Replacement) N= 104 (59.8%)**	**P value**
	N(%) or (mean ±SD)	N (%) or (mean ±SD)	
Age (mean ±SD)	32.3 ± 12.4 years	48 ± 9.5 years	0.001
Sex (male/female)	12/58 (17/83 %)	44/60(42.3/57.7 %)	0.001
NYHA classes III and IV	55(78.6%)	87(83.7%)	0.08
Atrial fibrillation	23(32.9%)	73(70.2%)	0.001
LVEF (mean ±SD)	58.3 ± 7.4 %	56.8 ± 5.2 %	0.26
Associated mitral stenosis	27(38.6%)	62(59.6%)	0.001
Left atrial diameter, mm (mean ±SD)	52 ± 11.2	56.1 ± 7.6	0.07
Severe pulmonary hypertension	12(17.1 %)	27(26%)	0.04

In Table 1, a significant statistical difference was observed regarding the patient's age and gender. The NYHA classes and left ventricular functions were not markedly different. The percentage of patients having associated mitral stenosis was higher in the replacement group. Furthermore, the left atrial diameter, incidence of atrial fibrillation, and the severity of pulmonary hypertension were higher in the second group.

Table (2): Intraoperative data of both groups.

	Group A (repair) N= 70 (40.2%)	**Group B (Replacement) N= 104 (59.8%)**	**P value**
Total bypass time, min	111.2 ± 21.66	118.3 ± 18.28	0.068
Cross-clamp time, min	88.27 ± 16.41	93.55 ± 13.54	0.366

In Table 2, the cross-clamp and total bypass times were not significantly different among both groups.

Table (3): Postoperative morbidity and mortality of both groups.

	Group A (repair) N= 70 (40.2%)	**Group B (Replacement) N= 104 (59.8%)**	**P value**
High Inotropes or vasopressors*	22 (31.4%)	36 (34.6%)	0.66
Ventilation (hours)	9.6 ± 3.2	11.3 ± 3.6	0.0017
ICU stay (hours)	42.8 ± 7.3	47.1 ± 9.2	0.0013
Post-op congestive heart failure	6 (8.6%)	13 (12.5%)	0.418
Hospital stay (days)	6.8 ± 2.3	11 ± 3.7	0.017
Mortality	3 (4.3%)	10 (9.6%)	0.192
Reoperation for severe valve dysfunction within the first years	11(15.7%)	4(3.8%)	0.006
All reoperations for severe valve	22 (11 early + 11	13 (4 early + 9 late)	0.002

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dysfunction within five years	late) (31.4%)	(12.5%)	
Deep sternal wound infection	2(2.9%)	4(3.8%)	0.749
Anticoagulant complication (bleeding or embolization) in 5 y	2(2.9%)	17(16.3%)	0.005
Readmission for cardiac cause	11(15.7%)	26(25%)	0.141

*More than 150 nano/kg/h of Adrenaline or noradrenaline

In Table 3, the mechanical ventilation time and ICU stay time were significantly higher in the replacement group. However, early mortality was not significantly different. The reoperation rate was greater in the repair group either within the first or the 5-year follow-up. The anticoagulant complications were higher in the replacement group.

DISCUSSION

This cross-sectional study was carried out in RHD center in Egypt from 2006 to 2018, it included a total of 17050 individuals, John's criteria was applied to diagnose RF while ECG and color Doppler echocardiography were used for confirmation of RHD. 12.7% of total RF cases have shown to have RHD. The mitral valve was most commonly affected and represented 95.2% of valvular affections [1].

MV replacement with metallic prosthesis has been associated with thromboembolic complications, suboptimal ventricular preservation, and so reduced survival. Whereas rheumatic Mitral repair has below standard outcome in comparison to degenerative mitral regurge. Therefore, it remains controversial in rheumatic mitral valve disease due to inferior durability [6].

In extremes of age mitral repair is very challenging due to heavily destroyed MV with its underlying subvalvular apparatus with extensive scarring, calcifications, fibrosis, stenosis, and retraction [7].

In our study, patients subjected to mitral valve replacement were older with a higher incidence of associated mitral valve stenosis. Consequently, they have a higher rate of AF and more severe pulmonary hypertension. Therefore, this might contribute to higher early mortality with more ventilation and ICU stay times.

The outcome of mitral repair is influenced by a variety of factors, including the age of the patient, as advanced rheumatic inflammatory activity may increase the likelihood of initial repair failure in young patients. **Yakub *et al.* [8] and Yankah *et al.* [9]** demonstrated that The reoperation rate and valve failure of younger patients (under the age of 20) are inferior to those of elderly individuals.

The surgeon's experience and repair type also contribute to repair failure. This is because mitral repair requires special experience when compared with valve replacement. Furthermore, many authors reported that Repaired MV has a higher rate of potential valve failure and less durability in rheumatic patients than in patients with degenerative disease [10].

Yau and colleagues [6] conducted a comparison between MV correction and replacement in patients with rheumatic MV disease. Their findings indicated that the use of a mechanical prosthesis to replace the valve led to a reduced rate of reoperations, but also to a lower long-term survival rate and a higher incidence of thrombo-embolic complications. Therefore, the authors determined that rheumatic MVs should be repaired

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when technically feasible, despite the potential for re-operation, in order to improve survival and reduce morbidity. Nevertheless, the cited study contained data from surgeries conducted in the 1970s, and significant advancements have been made in the field of cardiac valve replacement surgery since then, including the introduction of bi-leaflet mechanical valves and the concept of subvalvular apparatus preservations. Also, operative outcomes have improved, and MV repair techniques have also undergone an evolution. Subsequently, it is imperative to reconsider the viability of repair versus replacement in the context of rheumatic mitral disease currently [6].

The prognosis may be significantly impacted by the progression of rheumatic disease. Consequently, penicillin prophylaxis is an effective prevention strategy and is essential even after successful rheumatic MV repair surgery. Most recent guidelines recommend lifelong use [11].

CONCLUSION

With recent advances, achieving late survival and decreasing the incidence of thromboembolic complications of the mechanical valves make it in favor of rheumatic valve repair which caries a significant reoperation rate especially when associated with stenotic pathology.

LIMITATIONS

One of the primary limitations of this study is that it was retrospective. Furthermore, the use of a variety of repair techniques by surgeons was contingent upon their level of experience. Consequently, additional research is required to provide a precise assessment of the repair of rheumatic MV.

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