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Original Article

Keeping the mitral smile: is it durable? A comparative study of mid-term outcomes of mitral valve repair and mechanical mitral valve replacement in rheumatic heart patients

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Abstract

Background: Rheumatic heart disease is a significant cause of morbidity and mortality in endemic countries. Traditionally, mechanical valve replacement has been the preferred surgical approach for treating rheumatic mitral valve disease due to its favorable short-term outcomes and low incidence of postoperative complications. However, its midterm results are suboptimal due to increased risks of thrombosis and bleeding. This study compared the midterm outcomes of mitral valve surgeries, repair versus replacement, in rheumatic patients.

Methods: A comparative retrospective clinical study was conducted from January 2016 to December 2018. The study included 203 patients who underwent mitral valve surgery for rheumatic heart disease. The patients were divided into two groups: Group A (n=107) had mitral valve repair, and Group B (n=96) had mitral valve replacement.

Results: In Group A, the mean age was 45.5 ± 5.2 years, and 49% of the patients were male. While in Group B, the mean age was 46.2 ± 5.35 years, and 54.75% of the patients were males. The two groups had no significant difference regarding cardiac dimensions or function preoperatively. In Group A, the mean cardiopulmonary bypass time was 89 ± 9 minutes, and the mean cross-clamp time was 81 ± 7 minutes; in Group B, the mean cardiopulmonary bypass time was 77±12 min, and the mean cross-clamp time was 81 ± 7 min. The two groups had highly significant differences concerning cardiopulmonary bypass and cross-clamp times ($p<0.001$). Survival at 5 years was 98.5% for Group A vs. 93.15% for Group B (0.09). The reoperation rate was 9.0% in Group A vs. 4% in Group B ($p= 0.261$). The thromboembolism incidence was 0.47% in Group A vs. 7.3% in Group B ($p= 0.03$), and the bleeding-related complications were 0.94% in Group A vs. 7.3% in Group B ($p= 0.03$).

Conclusion: The outcomes of mitral valve repair could be comparable to replacement in patients with rheumatic heart disease. Mitral valve replacement was associated with higher bleeding and thromboembolic complications compared to mitral valve repair.

KEYWORDS

Mitral valve repair; Outcomes of mitral valve repair; Rheumatic heart disease

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Introduction

Rheumatic heart disease continues to be a prominent cause of mitral valve pathology in developing nations, even though mitral valve repair is the preferred procedure for treating this disease. The benefits of mitral valve repair in rheumatic mitral valve disease have not been fully elucidated [1]. Rheumatic heart disease affects more than 1% of the population in endemic countries, causing more than 300000 deaths annually [2].

Mechanical valve replacement has been regarded as the traditional surgical approach for treating rheumatic mitral disease [3]. In the short term, mechanical valve replacement has demonstrated dependable outcomes characterized by low mortality rates and infrequent postoperative stenosis or regurgitation occurrences. However, its effectiveness in the medium term is less than ideal due to a heightened risk of thromboembolism and bleeding [4]. Several recent publications have focused on surgical interventions for rheumatic mitral valve disease. Fu and colleagues from China have shared their own experiences [5], along with a meta-analysis conducted by Fu et al. [6], which compared the outcomes of mitral valve repair and replacement. Their findings indicated that the repair group had lower early mortality rates and a reduced incidence of valve-related events, while the reoperation rates were similar between the two groups. Similarly, Kim and colleagues from Korea reported on the outcomes of 1171 patients. They found no significant difference in long-term mortality or reoperation rates between the repair and replacement groups, although the repair group experienced fewer complications related to the valve [7].

Taking a different perspective, Chen and colleagues from Taiwan conducted a propensity score matching analysis for 5086 patients who underwent surgery for rheumatic mitral valve disease. Their study, which had a mean follow-up duration of 6 years, revealed no superiority of mitral valve repair compared to replacement in mortality and reoperation rates [8].

Table 1: Comparison of demographic and baseline data between patients with mitral valve repair (Group A) vs. replacement (Group B)

	Group A (n= 107)	Group B (n=96)	P value
Age, years			0.88
Mean ± SD	45.5 ± 5.2	46.2 ± 5.35	
Median (Minimum-Maximum)	43 (27-57)	47 (32-65)	
Gender			0.56
Male	52 (49.0%)	53 (54.75%)	
Female	55 (51.0%)	43 (45.25%)	
LAD (cm)			0.72
Mean ± SD	4.67 ± 0.29	4.69 ± 0.27	
Median (Minimum-Maximum)	4.8 (4.15-5.1)	4.8 (4.25-5.1)	
LVEDD (cm)			0.5
Mean ± SD	5.9 ± 0.65	6.1 ± 0.67	
Median (Minimum-Maximum)	6.1 (5.33-7.1)	6.4 (5.24-7.2)	
LVESD (cm)			0.79
Mean ± SD	4.2 ± 0.42	4.15 ± 0.47	
Median (Minimum-Maximum)	4.1 (3.9 -4.9)	4.45 (3.85-4.9)	
Ejection fraction (%)			0.31
Mean ± SD	52.78 ± 3.94	53.9 ± 3.94	
Median (Minimum-Maximum)	61 (52-68)	61 (53-69)	

LAD: left atrial diameter; LVEDD: left ventricular end-diastolic diameter; LVESD: left ventricular end-systolic diameter

In another article, Luo and colleagues discussed standardizing repair techniques for rheumatic mitral repair. They proposed a grading system to identify features that make repair feasible. Additionally, they compared their midterm results with those of 921 patients and observed a greater incidence of heart failure and valve-related complications in the replacement group [9].

Notably, rheumatic valve disease has received relatively less attention than degenerative valve disease, primarily due to its rarity in high-income countries. A study on the global burden of disease showed that rheumatic heart disease received the least funding relative to its significance among the evaluated diseases [10]. Hence, additional efforts are needed to improve the understanding of rheumatic heart disease and build regional centers of excellence in treating this disease. This work aimed to compare the midterm outcomes of surgeries performed on the mitral valve in patients with rheumatic mitral valve disease.

Methods

Design and patients

This study was a comparative retrospective cohort study and was conducted at two cardiac centers. The study included patients who underwent mitral valve surgery for rheumatic heart disease, either via mitral valve replacement with a mechanical prosthesis or via mitral valve repair, from January 2016 to December 2018.

The study included patients with elective isolated mitral valve surgery with or without tricuspid valve surgery, with an ejection fraction > 40%. Patients with degenerative or congenital valve disease were excluded. Additionally, patients who underwent concomitant aortic valve surgery, concomitant Cox-maze surgery, concomitant coronary artery bypass grafting, emergency cases, redo cases, chronic kidney disease, had an ejection fraction < 40%, missing information, and whose medical records were unavailable were also excluded.

Sampling

A convenience sampling method was used. All patients who underwent mitral valve surgery for rheumatic heart disease, mitral valve replacement with a mechanical prosthesis, or mitral valve repair at two cardiac centers were included in the study. The total sample size was 203 patients.

The patients were divided into two groups: Group A (n=107) had mitral valve repair, and Group B (n=96) had mitral valve replacement.

Study variables

Study variables were age, gender, preoperative echocardiographic data, cardiopulmonary bypass and ischemic times, mitral valve replacement by prosthetic valve with preservation of both mitral leaflets and mitral valve repair by different techniques (peeling of cusps, commissurotomy, chordal transfer, artificial chords, the release of secondary chords, papillary muscle splitting, thinning or wedge resection of thickened chords, leaflet extension with autologous pericardium and flexible posterior annuloplasty band).

Follow-up

All patients had active follow-up by phone calls and all patients completed 60 months follow-up.

Ethical consideration

The Ethical Committee approved the study, and the patients consented to include their data in research projects at the time of surgical consent.

Statistical analysis

The data were analyzed using SPSS version 23 software (IBM Corp, Chicago, IL, USA). The statistical analysis of the study's results involved employing the following methods. The data were expressed as numbers and percentages for qualitative variables and mean ± standard deviation (SD) for quantitative variables. The student's t-test was used to compare the continuous data and chi-squared or Fisher exact test for categorical data.

Results

Baseline data

In Group A, the mean age was 45.5 ± 5.2 years, and 49% of the patients were male. While in

Table 2: Comparison of operative data between patients with mitral valve repair (Group A) vs. replacement (Group B)

	Group A (n=107)	Group B (n=96)	P value
Cardiopulmonary bypass time, minutes			<0.001
Mean ± SD	89 ± 9	77±12	
Median (Minimum-Maximum)	92 (76-120)	77 (63-91)	
Cross-clamp time, minutes			<0.001
Mean ± SD	81 ± 7	57±12	
Median (Minimum-Maximum)	72 (66-87)	55 (46-87)	

Group B, the mean age was 46.2 ± 5.35 years, and 54.75% of the patients were males. There was no significant difference between the groups concerning age or gender. In Group A, the mean left atrial diameter was 4.67 cm, the mean end-systolic diameter was 4.2 cm, and the mean ejection fraction was 52%. However, in Group B, the mean left atrial diameter was 4.69 cm, the mean end-systolic diameter was 4.15 cm, and the mean ejection fraction was 54%. The two groups had no significant difference regarding dimensions or function preoperatively. (Table 1)

Operative data

In Group A, the mean cardiopulmonary bypass time was 89 ± 9 minutes, and the mean cross-clamp time was 81 ± 7 minutes; in Group B, the mean cardiopulmonary bypass time was 77±12 min, and the mean cross-clamp time was 81 ± 7 min. The two groups had highly significant differences concerning cardiopulmonary bypass and cross-clamp times. (Table 2)

Follow-up

Survival at 5 years was 98.5% for Group A vs. 93.15% for Group B (0.09). The reoperation rate at 5 years was 9.0% in Group A vs. 4% in Group B (p= 0.261). The thromboembolism incidence was 0.47% in Group A vs. 7.3% in Group B (p= 0.03), and the bleeding-related complications were 0.94% in Group A vs. 7.3% in Group B (p= 0.03) (Table 3).

Discussion

Our study demonstrated that in Group A, the mean age was 45.5 ± 5.2 years, and 49% were male. Group B's mean age was 46.2 ± 5.35 years, and 54.75% were males. There was no significant difference between the groups about age or gender. Waikittipong et al. [11] conducted a retrospective study to assess the midterm outcomes of mitral valve repair for rheumatic mitral regurgitation. Between January 2003 and January 2014, 97 patients aged 8 to 74 (mean 24.1 ± 1.4 years) underwent mitral valve repair. Seventy-four percent of the patients were female. The follow-up period varied from 6 to 137 months, with a mean of 58.8 ± 4.2 months. The study focused on survival rates and late valve failure. Our study revealed that in Group A, the mean cardiopulmonary bypass time was 105.22 ± 9.42 minutes, and the mean cross-clamp time was 80.48 ± 7.1 minutes. In Group B, the mean cardiopulmonary bypass time was 102.40 ± 6.9 minutes, and the mean cross-clamp time was 70.74 ± 5.32 minutes. There was a highly significant difference between the two groups regarding cardiopulmonary bypass and cross-clamp times.

Table 3: Follow-up events after 5 years survival in patients with mitral valve repair (Group A) vs. replacement (Group B)

	Group A (n=107)	Group B (n=96)	P value
Mortality	2 (1.5%)	7 (6.85%)	**0.09**
Reoperation	9 (8.4%)	4 (4.2%)	**0.261**
Thromboembolism incidence	1 (0.47%)	7 (7.3%)	**0.03**
Bleeding-related complications	1 (0.47%)	7 (7.3%)	**0.03**

Compared with replacement procedures, Fu and associates demonstrated that repair procedures had longer mean cardiopulmonary bypass and aortic cross-clamp durations. In contrast, the repair group exhibited significantly shorter mechanical ventilation times and shorter ICU and hospital stays post-surgery compared with the replacement group.

Our study illustrated that in Group A, the survival rate was 98.5%, the reoperation rate was 9.0%, the thromboembolism incidence was 0.47%, and the bleeding-related complications were 0.94%. In Group B, the survival rate was 93.15%, the reoperation rate was 4%, the thromboembolism rate was 7.3%, and the incidence of bleeding-related complications was 8%. There were significant differences between the two groups regarding survival rate, reoperation rate, and thromboembolism incidence.

Waikittipong et al. [11] indicated that out of all patients, a single individual (1%) died of low cardiac output in the early postoperative stage. Additionally, there were a total of six late deaths (6.1%) caused by endocarditis in one instance and sudden unexplained death in five cases. Notably, none of the patients who experienced sudden unexplained death had any remaining mitral regurgitation before being discharged. Furthermore, the actuarial survival rates were calculated to be 95.5% at five years and 89.2% after ten years.

Study limitations

One of its drawbacks is that this study was conducted using retrospective data. During the study, a number of different reconstructive approaches were utilized, the specifics of which were dependent, in part, on the surgeons' level of experience. It is possible that this aspect played a role in the results of the midterm outcome. Additionally, several other factors could have affected the outcomes and were not included in the analysis.

Conclusion

The outcomes of mitral valve repair could be comparable to replacement in patients with rheumatic heart disease. Mitral valve replacement was associated with higher bleeding and thromboembolic complications compared to mitral valve repair.

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References

1. Wang T, Liao Y, Wang M, Wheeler M. Rheumatic Mitral Valve Surgery: Meta-Analysis of Repair Versus Replacement. Heart, Lung and Circulation, 2017; 26: S335.
2. Watkins DA, Johnson CO, Colquhoun SM, et al. Global, regional, and national burden of rheumatic heart disease, 1990–2015. New England Journal of Medicine, 2017; 377(8): 713-722.
3. Choudhary SK, Talwar S, Airan B. Choice of prosthetic heart valve in a developing country. Heart Asia, 2016; 8(1): 65-72.
4. Yacoub M, Mayosi B, ElGuindy A, Carpentier A, Yusuf S. Eliminating acute rheumatic fever and rheumatic heart disease. Lancet (London, England), 2017; 390 (10091): 212-213.
5. Fu JT, Popal MS, Zhang HB, et al. A meta-analysis of late outcomes of mitral valve repair in patients with rheumatic heart disease. J Thorac Dis. 2017; 9 (11): 4366-4375.
6. Fu JT, Popal MS, Jiao YQ, et al. A predictor for mitral valve repair in patient with rheumatic heart disease: the bending angle of anterior mitral leaflet. Journal of Thoracic Disease, 2018; 10 (5): 2908.
7. Kim WK, Kim HJ, Kim JB, et al, Clinical outcomes in 1731 patients undergoing mitral valve surgery for rheumatic valve disease. Heart, 2018; 104 (10): 841-848.
8. Chen SW, Chen CY, Wu VCC, et al. Mitral valve repair versus replacement in patients with rheumatic heart disease. The Journal of thoracic and cardiovascular surgery. 2022; 164 (1): 57-67.
9. Luo T, Meng X. Rheumatic mitral valve repair: the Score procedure. Asian Cardiovascular and Thoracic Annals, 2020; 28 (7): 377-380.

10. Macleod CK, Bright P, Steer AC, Kim J, Mabey D, Parks T. Neglecting the neglected: the objective evidence of underfunding in rheumatic heart disease. Transactions of The Royal Society of Tropical Medicine and Hygiene, 2019; 113 (5): 287-290.
11. Waikittipong S. Mitral valve repair for rheumatic mitral regurgitation: mid- term results. Asian Cardiovascular and Thoracic Annals, 2015; 23(6): 658-664.