

ORIGINAL ARTICLE

Early outcome of mitral valve repair in rheumatic mitral regurgitation.

Shahbaz Ahmad Khilji¹, Waqas Khalid², Shuja Tahir³

ABSTRACT... Objectives: To evaluate and record the early outcomes of mitral valve repair in patients with rheumatic mitral valve regurgitation in advanced functional classes (NYHA III/IV). **Study Design:** Prospective Observational study. **Setting:** Department of Cardiac Surgery, Faisalabad Institute of Cardiology, Faisalabad. **Period:** March, 2023 to March, 2025. **Methods:** One hundred and thirty patients having rheumatic mitral valve regurgitation in functional class (NYHA) III/IV were studied. Baseline demographical informations, perioperative, and initial postoperative outcomes were documented. Early (less than 30 days) mortality was taken as primary outcome measures, and secondary outcome measures were postoperative complications, ICU and hospital stay, and early echocardiographic valve function. **Results:** A successful repair was done on the patients having rheumatic mitral valve regurgitation having satisfactory post-operative morbidity and mortality rates. Majority of the patients exhibited satisfactory initial valve competency and none or mild residual mitral regurgitation on pre-discharge echocardiography. The initial results were similar to those of modern repair-based cohort and pool reports, indicating the safety of repair in the selected rheumatic patients. **Conclusion:** In rheumatic mitral regurgitation, mitral valve repair is linked to good short-term results in case of an appropriate patient selection.

Key words: Cardiac Surgery, Early Outcomes, Mitral Regurgitation, Mitral Valve Repair, Rheumatic Heart Disease.

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INTRODUCTION

Rheumatic heart disease (RHD) is a leading cause of cardiovascular morbidity and mortality in developing nations, with the most commonly affected cardiac valve being the mitral valve. This is due to the frequent recurrent patterns of rheumatic fever in early years of life and with complex progressive pathological changes of the mitral valve apparatus that leads to mixed mitral valve disease instead of isolated stenosis or regurgitation.¹ To deal such a complex pathology, many surgical approaches have been developed over the past many decades as the surgical intervention techniques to deal such patients and are supported by the evidence based benefits of mitral valve repair over replacement. Reduced operative mortality rate, enhanced left ventricular function, no need to take long-time anticoagulants and better survival rate in the long-term have been confirmed by numerous studies and is given in the literature as to be greater in mitral valve repair than mitral valve replacement (particularly in younger patients with rheumatic disease where anticoagulant and prosthesis-related complications may severely impact quality of life).²⁻³

Irrespective of these benefits, mitral valve repair in rheumatic pathology is still a challenging practice. Leaflet fibrosis, annular calcification, and sub-valvular involvement may jeopardize the durability of repair and restrict the viability of repair in some patient cohorts, especially in less experienced hands. However, the development of surgical procedures, better perioperative evaluation, and patient screening have sparked the new interest towards mitral valve repair of rheumatic mitral regurgitation.⁴

Despite the fact that trans-catheter mitral valve interventions offer an alternative approach to the treatment of degenerative mitral valve disease with minimal invasiveness, its application in the rheumatic pathology is not well defined and the cost-effectivity and accessibility in developing eras of the world is still a challenge where the disease burden is also more evident.⁵⁻⁶ Consequently, surgical repair of the mitral valve has remained the most effective and long lasting form of treatment to be administered to appropriate patients with rheumatic mitral regurgitation in such circumstances.

1. FCPS, Head Cardiac Surgery, FIC, Faisalabad.

2. FCPS, Assistant Prof Cardiac Surgery, FIC, Faisalabad.

3. MBBS, SHO General Surgery, University Hospital Waterford Ireland.

Correspondence Address:

Dr. Shahbaz Ahmad Khilji
Department of Cardiac Surgery, FIC, Faisalabad.
drshahbazkhilji@gmail.com

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However, there is limited data on early postoperative outcomes, especially in prospective studies done in resource-limited environments, with acceptable perioperative mortality and satisfactory early echocardiographic outcomes.⁷ Since there is a debate about the possibility of repair, durability, and perioperative risk in rheumatic disease, additional evidence is needed to clarify more about early outcomes and predictive factors of surgical success.⁸

The current study was thus planned to prospectively compare clinical and echocardiographic outcomes in the early (30-day) clinical period of mitral valve repair surgery in patients with rheumatic mitral regurgitation with special reference to perioperative mortality, postoperative complications, and pre-discharge valve performance.

METHODS

The present study was a prospective observational study that undertaken in the department of cardiac surgery, Faisalabad Institute of Cardiology, Faisalabad. Consecutive patients were recruited to the study between the March, 2023 through March, 2025 (ERC No.23-2023/DME/FIC/FSD dated 20.01.2023). The inclusion criteria of our cases include: Children aged up to 14 years of either gender, diagnosed cases of spastic diplegic cerebral palsy, presence of knee flexion deformity, defined by a supine popliteal angle greater than 25 degrees, undergoing hamstring lengthening surgery for correction of knee flexion deformity, classified as Gross Motor Function Classification System (GMFCS) levels I to IV, ability to walk barefoot without walking aids, at least for short distances (e.g., within the outpatient clinic) whereas all those American Society of Anesthesiologists (ASA) grade IV or V, non-spastic cerebral palsy, non-diplegic cerebral palsy (e.g., hemiplegic or quadriplegic CP) were excluded from the study.

These consecutive patients were determined with the diagnosis of rheumatic mitral regurgitation and are scheduled to undergo mitral valve repair. Clinical history, examination and echocardiographic characteristics that can indicate a potential rheumatic valve pathology, such as thickening of the leaflets, fusion of commissures, and sub-valvular lesions,

were used to determine rheumatic etiology. The following baseline demographic data was noted; age, gender, body mass index, functional status based on New York Heart Association (NYHA) classification, rhythm status, and comorbidities. The extent of mitral regurgitation, the size of the left atrium, the size of the left ventricle, the ejection fraction of the left ventricle, pulmonary artery systolic pressure, and the existence of other valvular lesions were recorded by the use of pre-operative transthoracic echocardiography.

Mitral valve repair was performed on all Mitral Regurgitation (NYHA III/IV) patients of the standard cardiopulmonary bypass techniques. Perioperative TOE is made mandatory for every patient. The decision to use annuloplasty ring or band implantation, commissurotomy, chordal shortening or transfer, leaflet thinning or augmentation and cleft repair was left at the will and the experience of the operating surgeon. Other surgeries that were recorded include tricuspid valve repair, aortic valve repair, coronary artery bypass grafting etc. There was also the recording of the operative variables such as cardiopulmonary bypass time and aortic cross-clamp time.

On the basis of already published data the sample size was estimated by one population proportion formula where early (30-day) mortality after mitral valve repair in rheumatic heart disease is the primary outcome. An early mortality rate of about 8.4% was reported in a cohort study by a population with rheumatic heart disease-dominant and underwent mitral valve repair. Based on such magnitude ($p = 0.084$), the 95 percent confidence level ($Z = 1.96$) and the absolute precision ($= 5$), the minimum required sample size was obtained as 118 patients ($= 130$ patients, after the addition of 10 percent).⁹

The main outcome was early mortality, which is the death during the index hospital admission or within 30 days after surgery. Early postoperative outcomes were the re-exploration due to bleeding, stroke, acute kidney failure that needs dialysis, sepsis, arrhythmias, extended mechanical ventilation, intensive care unit stay, and the length of stay in the hospital. All patients had pre-discharge transthoracic echocardiography to determine the residual mitral

regurgitation severity and valve hemodynamics.

The analysis was performed with the use of SPSS version 22. Continuous variables were reported in the form of mean plus standard deviation or median with interquartile range and frequency and percentages were reported in the categorical variables. Early outcome measures were reported with respective confidence intervals of 95. Where necessary, chi-square or Fisher exact test of categorical variables and independent t-test or MannWhitney U test of continuous variables were used to conduct subgroup analysis. The p-value that was regarded as statistically significant is 0.05 or less.

RESULTS

In this study, the majority of patients represented a younger age group. 74.6 percent were aged between 18 and 50 years, and 25.4 percent were aged between 51 and 75 years. The average age of study population is 42.67 years with the standard deviation of 13.22 years. Males were (58.5%) and females were also almost equally representing by (41.5%). The average body mass index (BMI) was 25.02±2.98 kg/m². Almost 50 percent of the patients were found to be between 18-25 kg/m² (49.2%) and close behind were those with a BMI between 26-30 kg/m² (47.7%), and a negligible percentage with BMI above 30 kg/m² (3.1%). Regarding New York Heart Association (NYHA) 65.4% of patients were in class III-IV. There was atrial fibrillation in 47.7%. The prevalence of diabetes mellitus and hypertension was 26.9% and 34.6% in the patients respectively.

Table-II presents the outcomes of early postoperative period. The average cardiopulmonary bypass (CPB) took 88.86 minutes, which was accompanied by a standard deviation of 6.80. After surgery, the average days under intensive care unit stay was 3.18 and the average stay in hospital was 6.86 with standard deviation of 0.97 and 1.88 respectively. One patient was witnessed to mortality earlier i.e. within 30 days of the procedure which translated to a 0.8% rate.

Table-III describes pre-discharge echocardiographic results. Fullness of residual mitral regurgitation was reported in 35.4% of the patients. Residual mitral

regurgitation was mildest in its manifestation, as it was witnessed in 40.0% of cases, but moderate residual mitral regurgitation was found in 24.6% of patients.

Table-IV summarizes the early postoperative complications. In 13.8 percent of patients, it took extended ventilation. Arrhythmias in the postoperative period were present in 16.9% whereas 4.6 percent of the patients required re-exploration due to bleeding.

Table-V demonstrates the correlation between pre-discharge residual mitral regurgitation and baseline factors (demographic and clinical). There was no statistically significant relation between age group and residual mitral regurgitation ($p = 0.445$). On the same note, there was no significant relationship between gender and residual mitral regurgitation ($p = 0.483$). Small expected cell counts also meant that BMI category was not significantly correlated with residual mitral regurgitation; Fisher exact test was used ($p = 0.461$). Residual mitral regurgitation had no significant correlation with functional status measured by NYHA class III -IV ($p = 0.905$). Similarly, pre-discharge residual mitral regurgitation had no significant association with the presence of diabetes mellitus ($p = 0.758$) and hypertension ($p = 0.748$). In general, all of the assessed baseline aspects did not have considerable links with residual mitral regurgitation at the pre-discharge period.

TABLE-I

Baseline demographic and clinical characteristics of patients (n = 130)

Variable	Value	n (%) / Mean ± SD
Age group (years)	18–50	97 (74.6)
	51–75	33 (25.4)
Age (years)	Mean ± SD	42.67 ± 13.22
Gender	Male	76 (58.5)
	Female	54 (41.5)
BMI (kg/m ²)	Mean ± SD	25.02 ± 2.98
BMI category	18–25	64 (49.2)
	26–30	62 (47.7)
	>30	4 (3.1)
NYHA class III–IV	Yes	85 (65.4)
Atrial fibrillation	Yes	62 (47.7)
Diabetes mellitus	Yes	35 (26.9)
Hypertension	Yes	45 (34.6)

TABLE-II

Operative and early postoperative outcomes (n = 130)

Variable	Value
CPB time (minutes)	88.86 ± 6.80
ICU stay (days)	3.18 ± 0.97
Hospital stay (days)	6.86 ± 1.88
Early mortality (≤30 days)	1 (0.8%)

TABLE-III

Pre-discharge echocardiographic outcomes (n = 130)

Residual Mitral Regurgitation	n (%)
None (Trivial)	46 (35.4)
Mild (MR+1)	52 (40.0)
Moderate (MR+2)	32 (24.6)

TABLE-IV

Early postoperative complications (n = 130)

Complication	n (%)
Prolonged ventilation	18 (13.8)
Arrhythmias	22 (16.9)
Re-exploration for bleeding	6 (4.6)

TABLE-V

Association of baseline factors with pre-discharge residual mitral regurgitation (n = 130)

Variable	Group	None (n=46)	Mild (n=52)	Moderate (n=32)	P-Value
Age group	18–50	37 (80.4%)	36 (69.2%)	24 (75.0%)	0.445†
	51–75	9 (19.6%)	16 (30.8%)	8 (25.0%)	
Gender	Male	24 (52.2%)	31 (59.6%)	21 (65.6%)	0.483†
	Female	22 (47.8%)	21 (40.4%)	11 (34.4%)	
BMI category	18–25	22 (47.8%)	24 (46.2%)	18 (56.3%)	0.461†
	26–30	24 (52.2%)	25 (48.1%)	13 (40.6%)	
	>30	0 (0.0%)	3 (5.8%)	1 (3.1%)	
NYHA III–IV	Yes	31 (67.4%)	34 (65.4%)	20 (62.5%)	0.905†
	No	15 (32.6%)	18 (34.6%)	12 (37.5%)	
Diabetes	Yes	13 (28.3%)	15 (28.8%)	7 (21.9%)	0.758†
	No	33 (71.7%)	37 (71.2%)	25 (78.1%)	
Hypertension	Yes	15 (32.6%)	20 (38.5%)	10 (31.3%)	0.748†
	No	31 (67.4%)	32 (61.5%)	22 (68.8%)	

† Chi square test. ‡ Fisher exact test

DISCUSSION

The current study has assessed the potential experiences of repairing the mitral valve among patients who had rheumatic mitral regurgitation and showed good short-term outcomes such as low mortality rates, satisfactory postoperative morbidity and good echocardiographic valve functions. These outcomes correspond to the increasing evidence of the fact that mitral valve repair, in the case when the anatomy allows, is a reasonable surgical option in rheumatic mitral valve disease.

Similar findings were made in other previous repair-oriented cohorts. Salem et al. have found highly appreciable early and mid-term results in patients with rheumatic mitral valve repair having no operative mortality and with significantly good results in terms of mitral valve gradients and severity of regurgitation, which is an important consideration for the patient as well.¹⁰ On the same note, Yang and Zhao found no perioperative mortality and significantly good functional outcome after rheumatic mitral valve repair, which supports the possibility of repair of rheumatic valves with complex structures.¹¹ Such observations are similar to the results of the present study, in which the early postoperative valve competence was obtained in most of the patients.

The safety of repair is further supported by the age specific information in rheumatic pathology. Ananthanarayan et al. reported excellent early results of rheumatic mitral valve repair in a pediatric cohort with low mortality at the time of surgery and long-term good functional outcome.¹² They were not similar in terms of population, but the continually low mortality rate in the early age indicates that the rheumatic etiology is not the reason to decline valve repair in case the valve morphology allows it.

The cohorts of adult surgical patients with the protracted history of surgeries have also assured positive early results. Dillon et al. presented a comparison of rheumatic and degenerative mitral valve repair and reported rights of early mortality about 1% with isolated rheumatic repair similar to degenerative disease, cardiopulmonary bypass, and cross-clamp time were found as predictors of early adverse outcomes.¹³ These results highlighted the importance of operative complexity and not necessarily rheumatic etiology per se in the predetermination of early surgical risk, which is also present in the current study.

This argument is also supported by evidence of pooled analyses. A meta-analysis of more than 2,700 patients who had undergone rheumatic mitral repair carried out by Fu et al. had reported a combined mortality of less than 2 in 30 days as well as a high percentage of non-valve-related complications.¹⁴ These benchmark numbers would be a valuable point of reference on which the initial results on the current cohort can be pegged and which reflects similar safety in the short term.

Comparison studies between repair and replacement provide further information on initial results. In a larger meta-analysis of mitral valve repair compared with mitral valve replacement in rheumatic heart disease, there was a significant tendency toward lower risk of early mortality and fewer valve-related adverse events in the repair group, even though the long-term risk of reoperation is higher.¹⁵ These results indicate the survival benefit of repair in early stages without disqualifying the importance of long-term close observation. Similarly, the incidences of regional data have demonstrated similarities in early

mortality of the two strategies of rheumatic mitral valve repair and replacement whereby repair has benefits in restoring left ventricular functionality and preventing the occurrence of complications related to prosthesis.¹⁶

Taken together, the mentioned studies support the assumption that mitral valve repair in rheumatic mitral regurgitation is associated with positive initial results in case of performing it in well-chosen patients. Advancements in surgical methods, improvement in intraoperative echocardiographic assessment and experience of the surgeon have all led to better early outcomes. The current results align with the existing literature and support the increasing relevance of mitral valve repair as the surgical choice of preference in the rheumatic mitral regurgitation, especially in those hospitals that have experience in complex valve repair.

CONCLUSION

Mitral valve repair in rheumatic mitral regurgitation (NHY III/IV) has been noted to give good early results, including low operative mortality, reasonable postoperative morbidity, and satisfactory early valve performance. The findings supported by the current repair-oriented cohorts and meta-analyses, suggest that a rheumatic etiology should not exclude, per se, the possibility of valve repair. Mitral valve repair gives the benefits of valve-saving in experienced centers when anatomical suitability is appropriate and the surgery is performed in centers where valve repair is done. These results support the growing importance of mitral valve repair as a powerful early surgical intervention to patients who have rheumatic mitral regurgitation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Shahbaz Ahmad Khilji: Data collection.
2	Waqas Khalid: Data analysis.
3	Shuja Tahir: Data entry.