https://doi.org/10.29309/TPMJ/2026.33.07.10234 www.theprofesional.com

ORIGINAL ARTICLE

Comparison of interrupted and semi-continuous suture techniques in rheumatic valvular disease by analysis of paravalvular regurgitation following mitral valve replacement: A retrospective cohort study.

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ABSTRACT… Objective: To compare o fboth interrupted and continuous technique following mitral valve replacement in terms of paravalvular regurgitation in patients with rheumatic heart diseases. **Study Design:** Retrospective Cohort study. **Setting:** Peshawar Institute of Cardiology, Peshawar. **Period:** 01/01/2022 to 31/12/2024. **Methods:** Analyzed 110 patients (46 males, 41.8%; 64 females, 58.2%) with a mean age of 39.8 ± 11.5 years and mean BMI of 23.3 ± 4.2, all of whom underwent isolated MVR for rheumatic pathology. Patients were grouped based on the suture technique used: semi-continuous or interrupted. Outcomes assessed included operative mortality, New York Heart Association (NYHA) functional class, PVR severity, and cross-clamp time. **Results:** Operative mortality was identical in both groups, with 1 patient each (0.9%), accounting for a total mortality of 1.8% (p = 1.0). Most patients were categorized as NYHA Class I or II postoperatively, representing 44.0% and 50.5% of the overall cohort, respectively. NYHA Class III occurred in 1.8% of the semi-continuous group and 3.7% of the interrupted group. PVR rates were comparable between techniques, with any-degree PVR observed in 44.5% of the semi-continuous group and 41.8% of the interrupted group. Moderate-to-severe PVR was slightly more prevalent in the semi-continuous group (1.8%) compared with the interrupted group (0.9%); however, this difference was not statistically significant (p = 0.5). Mean aortic cross-clamp time was significantly shorter for the semi-continuous technique (68.75 ± 22.2 minutes) than the interrupted technique (91.7 ± 27.3 minutes). **Conclusion:** Semi-continuous and interrupted suture techniques demonstrate comparable efficacy in preventing paravalvular regurgitation following rheumatic MVR, with no significant differences in operative mortality or postoperative functional class. The semi-continuous technique, however, offers the advantage of reduced cross-clamp time. Further prospective studies are warranted to validate these findings and explore long-term outcomes.

Key words: Mitral Valve Replacement, Para-valvular Leak, Semi-continuous Technique.

Article Citation: Khan YB, Gohar MA, Rani P, Abdullah A, Iqbal A, Afzal Z. Comparison of interrupted and semi-continuous suture techniques in rheumatic valvular disease by analysis of paravalvular regurgitation following mitral valve replacement: A retrospective cohort study. Professional Med J 2026; 33(07):1252-1255. https://doi.org/10.29309/TPMJ/2026.33.07.10234

INTRODUCTION

Rheumatic heart diseases are the major cause of valve dysfunction, especially in developing countries, which ultimately leads to surgical intervention.[1,2] In low-income countries, in patients with acute rheumatic fever without treatment, 72% patients will develop chronic rheumatic heart disease.[3] In 65-70% of rheumatic heart disease cases, the mitral valve is involved, leading to mitral stenosis or mitral regurgitation.[4,5] In severe disease where repair is not possible mitral valve replacement is done which is well established low risk procedure with low morbidity and mortality.[6] But one of the important complication associated with mitral valve replacement is paravalvular regurgitation (PVR) which is characterized by regurgitation of blood between native annulus and prosthetic valve.[7]

Paravalvular regurgitation can be classified from mild to severe. In severe cases, it can lead to hemolysis and congestive cardiac failure, which often needs surgical intervention.[8] There are many factors responsible for PVR; among those, suture technique is also considered to be an important factor, whether it should be semi-continuous or interrupted. The interrupted technique is considered to be superior because it offers equal distribution of mechanical stress and decreases the risk of annular tearing and enhances prosthetic seating.[9] In comparison semi-continuous technique is faster and decreases cross-clamp time and pump time, but some studies claim it is more likely to get

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Article received on:
10/12/2025
Accepted for publication:
19/02/2026

annular dehiscence and PVR.[10,11] But there is lack of data on comparison of two techniques in terms of paravalvular regurgitation in patients who undergone mitral valve replacement, especially in rheumatic heart disease pathology. Rheumatic pathology involves fibrotic calcified and thickened annulus, which may influence either suturing method.[12] Our study aims to do comparison of both interrupted and continuous technique following mitral valve replacement in terms of paravalvular regurgitation in patients with rheumatic heart diseases. The study intends to find out optimal suturing technique to decrease the risk of PVR in this specific population.

METHODS

This study is a retrospective cohort study which is conducted at Department of Cardiac Surgery, Peshawar Institute of Cardiology, Peshawar after approval from institutional review board (IRC/25/235/24-9-25). 110 rheumatic heart disease patients who underwent mitral valve replacement during the period of 01/01/2022 to 31/12/2024 was conducted. All patients in the study sample underwent mitral valve surgery using either interrupted or semi-continuous technique. The intervention group will consist of patients who underwent mitral valve replacement with the interrupted technique. comparator group will consist of patients who underwent mitral valve replacement with the continuous technique. Prolene and Ethibond are types of suture materials used during mitral valve replacement. Preoperative echocardiography Ejection fraction was classified into three groups (reduced <35%, mild reduced 35%-50% and Preserved > 50%). Severity of paravalvular regurgitation assessed by post-operative echocardiography. Patients' data were collected from the hospital's digital software to extract detailed patient data, which were subsequently verified with physical files kept in the hospital records room. Patients with incomplete medical records or lost to follow-up and other cardiac Procedures such as AVR, CABG were excluded from the study sample. the study was approved by the research ethics committee. Our study utilized SPSS (Statistical Program of Social Science) version 20 for analysis of our dataset, applying a variety of statistical tests to extract meaningful insights. Statistical analysis, including Chi Square tests, analysis of variance (ANOVA), and independent t-tests, was performed.

RESULTS

The number of patients in our study consists of 46 males (41.8%) and 64 females (58.2%). The average age of our patients was 39.8 years, with a deviation of 11.5, and the mean BMI was 23.3, with a deviation of 4.2. The overall population of 110 (100%) consisted of rheumatic patients undergoing isolated Mitral Valve Replacement. (Table-I) The semi-continuous mitral valve replacement technique group had (0.9%) operative mortality and a similar number was observed in the interrupted mitral valve replacement technique group. Total operative mortality was 1.8%. Among patients treated with the semi-continuous technique, 20.2% had symptoms of NYHA Class I, and 31 patients (28.4%) had NYHA II, showing slight limitations in physical activity. In the interrupted technique group, 26 patients (23.9%) and 24 patients (22.0%) were classified under NYHA Classes I and II, respectively. (Table-III) Regarding paravalvular regurgitation no difference were observed in both types of suture techniques. But slight difference was observed in the semi-continuous technique group, having slight increase in moderate to severe paravalvular regurgitation with incidence of (1.8%) compared to the interrupted technique group.

The p-value of 0.5 indicates a lack of statistically significant difference in paravalvular regurgitation between the semi and interrupted techniques. (Table-III) Regarding of cross clamp time of two groups, the average value for the semi-continuous technique was 68.75 with a standard deviation of 22.2, which was less than the average value of 91.7 compared to interrupted technique group. (Table-IV)

TABLE-I

Suture technique overall analysis

Parameters	Frequency (n)	Percentage
Total patients	110	100.0
Male	46	41.8
Female	64	58.2
Age (Mean)	39.8±11.5	--
BMI (Mean)	23.3±4.2	--
Rheumatic	110	100.0
Isolated MVR	110	100.0

TABLE-II

Operative mortality vs technique

Parame-ter	Semi n (%)	Interrupt-ed n (%)	Total n (%)	Sig (P)
Operative Mortality	1 (0.9)	1 (0.9)	2 (1.8)	1.0

TABLE-III

NYHA classification

Parameter	Semi n (%)	Interrupted n (%)	Total n (%)
NYHA I	22 (20.2)	26 (23.9)	48 (44.0)
NYHA II	31 (28.4)	24 (22.0)	55 (50.5)
NYHA III	2 (1.8)	4 (3.7)	6 (5.5)

TABLE-IV

Suture Technique Vs X-Clamp time

Parameter	N	Mean ± SD	P-Valve
Semi	55	68.75 ± 22.2	<0.001
Interrupted	55	91.7± 27.3	

DISCUSSION

Mitral valve replacement in rheumatic heart disease is technically challenging due to annular calcification, fibrosis, and thickening of the subvalvular apparatus. We compare the impact of interrupted vs semi-continuous technique on paravalvular regurgitation, operative mortality, and cross-clamp time. In both semi-continuous and interrupted group, the incidence of PVR is not statistically different (p = 0.5), which is the same as compared to previous findings that both interrupted and semi-continuous techniques are same in terms of preventing paravalvular regurgitation.[13] In another study paravalvular regurgitation was considerably higher 76% in mitral position with continuous technique as compared to interrupted technique which was 33%.[14]

In our study we found out that there is considerable reduction of aortic cross-clamp time with semi-continuous suturing 68.8 ± 22.2 min as compared to interrupted technique which is 91.7 ± 27.3 min. Similar findings were already mentioned by Kitamura T, et al, showing semicontinuous technique is associated with less cross-clamp time as compared to the interrupted technique.[15] Meta-analysis and data from minimally invasive mitral surgery also showed that the semi continuous technique is associated with reduced cross clamp time, which is further associated with less renal and myocardial injury as long as cross-clamp time remains in a 60- 90-minute duration, but mortality and morbidity increase when the duration exceeds 90–120 min.[16]

In our study, there was no difference in operative mortality (0.9 % both groups; total 1.8 %), which reinforces the technical safety of both methods in isolated rheumatic mitral replacement, which is consistent with prior data and shows comparable mortality irrespective of suture technique.[13] Regarding NYHA class incidence 1.8 % vs. 3.7 % are likely clinically non-significant keeping of the overall low complication rates and similar PVR incidence. Our study suggests that in rheumatic mitral valve replacements, the semi-continuous suture has the advantage to reduced cross-clamp time, with similar overall outcomes in terms of mortality and only a small, non-significant higher incidence of moderate PVR in the semi continuous technique. This balance between efficiency and equivalence in efficacy supports semi-continuous as a reasonable approach—particularly when clamp time reduction is clinically important.

CONCLUSION

Semi-continuous and interrupted suture methods show similar effectiveness in preventing paravalvular regurgitation after rheumatic MVR, with no notable differences in operative mortality or postoperative functional status. However, the semi-continuous approach provides the added benefit of shorter cross-clamp duration. Additional prospective research is needed to confirm these results and assess long-term outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Yasir Bilal Khan:** Manuscript writing.
2	**Muhammad Ali Gohar:** Data collection.
3	**Prerna Rani:** Data interpretation.
4	**Ahmad Abdullah:** Data analysis.
5	**Aamir Iqbal:** Data entry.
6	**Zeeshan Afzal:** Critical revisions.