Original article

Comparative Study of Aortic Valve Replacement Using Interrupted Versus Semi-Continuous Suture Technique

[1]Dr. Arun kumar, [2]Dr M. Abid Geelani* , [3]Dr. Shalem raj

[1,3] MCH CTVS SENIOR RESIDENT, GB PANT HOSPITAL(GIPMER)

[2]DIRECTOR, PROFESSOR, HEAD OF THE DEPARTMENT CTVS. GB PANT HOSPITAL (GIPMER)

*CORRESPONDING AUTHOR**

ABSTRACT

Background: *Aortic valve replacement (AVR) is the standard surgical treatment for severe aortic valve disease. The suturing technique used for prosthetic valve implantation significantly influences operative duration, valve stability, and postoperative outcomes. This study compared the interrupted and semi-continuous suture techniques in AVR to evaluate their efficacy, safety, and clinical outcomes.*

Methods: *A prospective comparative study was conducted on 48 patients undergoing isolated AVR. Patients were divided into two groups—Group A (interrupted suture, n=24) and Group B (semi-continuous suture, n=24). Operative parameters, intraoperative findings, and postoperative outcomes were recorded and analyzed statistically using SPSS version 23.*

Results: *Baseline demographic and clinical profiles were comparable between groups. The semi-continuous group showed significantly shorter cross-clamp time (71.6 ± 10.8 min vs. 84.5 ± 12.3 min, p=0.001) and cardiopulmonary bypass time (95.8 ± 14.1 min vs. 110.2 ± 15.4 min, p=0.002). Postoperative complications, hospital stay, and improvement in ejection fraction were similar in both groups, with no significant difference in mortality or paravalvular leak rates.*

Conclusion: *Both techniques are safe and effective for AVR. The semi-continuous technique offers shorter operative times, while the interrupted method provides excellent valve security and precision.*

Keywords: *Aortic valve replacement, Interrupted suture, Semi-continuous technique*

INTRODUCTION

Aortic valve replacement (AVR) remains the definitive treatment for patients with severe aortic valve diseases such as stenosis or regurgitation, particularly when medical therapy fails to provide symptomatic relief or hemodynamic stability. (1) Surgical techniques for AVR have evolved considerably over the past decades, with the choice of suture technique—interrupted or semi-continuous—playing a crucial role in determining postoperative outcomes. (2,3) The interrupted suture technique provides superior precision and reduced risk of paravalvular leak but is time-consuming, while the semi-continuous method offers shorter cross-clamp and cardiopulmonary bypass times but may carry an increased risk of dehiscence or leak in certain situations.(4,5,6) Optimal suture technique selection thus has significant implications for operative efficiency, valve durability, and patient prognosis. Comparative evaluation of these methods helps in understanding their influence on intraoperative parameters, postoperative morbidity, and long-term outcomes. (7) Our study aims to analyze and

compare the efficacy, safety, and hemodynamic performance of interrupted versus semi-continuous suture techniques in patients undergoing aortic valve replacement, thereby providing evidence-based guidance for surgical decision-making in cardiac valve surgery.

METHODOLOGY

Our study was conducted as a prospective comparative observational study in the Department of Cardiothoracic and Vascular Surgery at a tertiary care center. The study included 48 patients who underwent isolated aortic valve replacement (AVR). Institutional ethical committee approval was obtained prior to initiation, and written informed consent was secured from all participants. Patients with combined procedures such as coronary artery bypass grafting or mitral valve surgery were excluded to maintain uniformity.

The study population consisted of adults diagnosed with severe aortic valve disease, either stenosis or regurgitation, indicated for surgical valve replacement. Based on the suturing technique used for prosthesis fixation, patients were divided into two groups: Group A (n=24) underwent AVR using the interrupted suture technique, while Group B (n=24) underwent AVR using the semi-continuous suture technique. Both mechanical and bioprosthetic valves were included, with appropriate selection based on patient age and clinical profile.

All surgeries were performed under cardiopulmonary bypass with standard median sternotomy. Operative parameters such as total cross-clamp time, bypass time, and total operative duration were recorded. Intraoperative findings, technical ease, and occurrence of paravalvular leaks were carefully documented. Postoperatively, patients were monitored for complications including bleeding, arrhythmias, infection, and valve-related issues during hospital stay and follow-up.

Statistical analysis was performed using SPSS version 23. Continuous variables were expressed as mean ± standard deviation and compared using the Student's t-test, while categorical variables were analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Results

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n=48)

Parameter	**Interrupted Suture (n=24)**	**Semi-Continuous Suture (n=24)**	**Total (n=48)**	**p-value**
Mean Age (years)	54.2 ± 10.3	52.7 ± 9.8	53.5 ± 10.0	0.48
Male : Female	16 : 8	17 : 7	33 : 15	0.75
Aortic Stenosis (%)	70.8%	66.6%	68.7%	0.68
Aortic Regurgitation (%)	29.2%	33.4%	31.3%	0.74
Mechanical Valve Used (%)	62.5%	58.3%	60.4%	0.79
Mean LVEF (%)	52.3 ± 7.5	53.1 ± 6.8	52.7 ± 7.2	0.67

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Table 2: Intraoperative Parameters Comparison Between the Two Groups

Parameter	Interrupted Suture (n=24)	Semi-Continuous Suture (n=24)	Mean Difference	p-value
Cross-Clamp Time (min)	84.5 ± 12.3	71.6 ± 10.8	12.9	0.001*
Cardiopulmonary Bypass Time (min)	110.2 ± 15.4	95.8 ± 14.1	14.4	0.002*
Total Operative Time (min)	210.6 ± 18.9	185.3 ± 17.5	25.3	0.001*
Intraoperative Blood Loss (mL)	480 ± 85	460 ± 75	20	0.52
Paravalvular Leak (n, %)	1 (4.1%)	2 (8.3%)	–	0.55

*Significant difference at $p < 0.05$

Table 3: Postoperative Outcomes and Complications

Outcome Parameter	Interrupted Suture (n=24)	Semi-Continuous Suture (n=24)	p-value
Mean ICU Stay (days)	2.6 ± 0.9	2.4 ± 0.8	0.43
Mean Hospital Stay (days)	8.7 ± 1.5	7.9 ± 1.4	0.06
Postoperative Arrhythmia (%)	2 (8.3%)	1 (4.1%)	0.55
Surgical Site Infection (%)	1 (4.1%)	0 (0%)	0.31
Early Mortality (within 30 days)	1 (4.1%)	1 (4.1%)	1.00
Postoperative Ejection Fraction (%)	55.6 ± 6.5	56.8 ± 6.1	0.52

DISCUSSION

The present study was conducted to compare the outcomes of two suture techniques—interrupted and semi-continuous—in patients undergoing aortic valve replacement (AVR). A total of 48 patients were evaluated, with equal distribution between the two groups. The results demonstrate that both techniques are effective and safe for valve implantation, but they differ in terms of operative efficiency and certain intraoperative parameters. (7)

In this study, the mean age of patients was 53.5 years, with a male predominance (68.7%), consistent with existing literature indicating that aortic valve disease is more common in middle-aged and elderly males. The distribution of aortic stenosis and regurgitation was similar across groups, and baseline characteristics such as left ventricular ejection fraction (LVEF) and type of prosthesis used were statistically comparable. These findings suggest adequate randomization and comparability between groups, eliminating demographic bias.

Intraoperative parameters revealed a significant difference in operative efficiency. The semi-continuous suture technique was associated with shorter cross-clamp, cardiopulmonary bypass, and total operative times compared to the interrupted technique. These results align with previous studies by Alsoufi et al. and Nair et al., which reported that semi-continuous suturing reduces operative time without compromising surgical quality. The reduction in bypass duration is clinically important, as prolonged bypass and cross-clamp times are known to increase postoperative morbidity and myocardial injury risk. However, while the semi-continuous group

demonstrated a slight trend toward increased paravalvular leak (8.3% vs. 4.1%), the difference was not statistically significant, implying that meticulous surgical technique can mitigate this potential drawback. (8,9,10)

Postoperative outcomes such as ICU stay, hospital stay, and ejection fraction improvement showed no significant difference between the two groups. Both groups exhibited satisfactory early recovery and comparable improvement in left ventricular function postoperatively. The low incidence of complications—arrhythmia, infection, and early mortality—further supports the safety of both methods. Notably, the semi-continuous technique demonstrated marginally shorter hospital stay, reflecting faster recovery possibly due to reduced operative stress and cardiopulmonary bypass time.

Previous literature supports that interrupted suturing provides superior security and allows precise tension adjustment at each suture point, thereby minimizing the risk of paravalvular leak, especially in calcified annuli or fragile tissue. Conversely, the semi-continuous method, by distributing tension along a continuous suture line, ensures uniform pressure and faster valve seating, which explains its advantage in operative time. Studies by Shahian et al. and Milano et al. have similarly observed that semi-continuous sutures offer efficiency benefits, especially in high-volume centers where reduced cross-clamp time contributes to improved overall outcomes. (11,12)

In the present study, both methods provided comparable early postoperative outcomes, suggesting that the choice of suture technique may depend more on surgeon experience, patient anatomy, and intraoperative circumstances rather than on inherent superiority of one method over the other. However, careful attention during semi-continuous suturing is essential to prevent suture line dehiscence or leakage.

Conclusion:

In conclusion, the semi-continuous suture technique offers the advantage of shorter operative times without compromising patient safety or valve function, while the interrupted technique remains reliable for complex or high-risk cases. Long-term follow-up with echocardiographic evaluation would be valuable to assess durability, valve competence, and freedom from reoperation over time.

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