Minimally Invasive Mitral Valve Surgery: Clinical Outcomes and Early Postoperative Results

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Abstract Introduction: *Minimally invasive mitral valve surgery (MIMVS) has emerged as an alternative to conventional median sternotomy for mitral valve procedures. It aims to reduce surgical trauma, blood loss, hospital stay, and recovery time while maintaining comparable safety and efficacy.Materials and Methods:A prospective observational study was conducted on 120 patients undergoing mitral valve surgery between January 2021 and December 2024. Patients were divided into two groups: minimally invasive right mini-thoracotomy (n=60) and conventional sternotomy (n=60). Demographic data, intraoperative parameters, postoperative outcomes, complications, and mortality were analyzed.**Results:**The MIMVS group demonstrated significantly lower postoperative blood loss (p<0.01), shorter ICU stay (p<0.05), reduced ventilation time (p<0.01), and shorter hospital stay (p<0.001). Cardiopulmonary bypass time was slightly longer in the MIMVS group but not statistically significant. Mortality rates were comparable between groups (3.3% vs 5%).**Conclusion:**Minimally invasive mitral valve surgery is a safe and effective alternative to sternotomy with superior early recovery outcomes and comparable morbidity and mortality.*

Keywords: *Mitral valve surgery, minimally invasive cardiac surgery, mini-thoracotomy, sternotomy, postoperative outcomes*

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INTRODUCTION

Mitral valve disease remains one of the most common valvular heart disorders worldwide, particularly in regions with persistent rheumatic heart disease burden[1]. Degenerative mitral regurgitation, ischemic mitral insufficiency, and rheumatic mitral stenosis are among the leading indications for surgical intervention[2]. Conventional mitral valve surgery via median sternotomy has long been considered the gold standard due to excellent exposure and reproducible outcomes[3]. However, sternotomy is associated with significant surgical trauma, prolonged recovery, risk of sternal wound infection, and cosmetic concerns[4].

Over the past two decades, minimally invasive mitral valve surgery (MIMVS) has gained increasing acceptance as a viable alternative[5]. The technique typically involves a right mini-thoracotomy or partial sternotomy approach combined with peripheral cannulation for cardiopulmonary bypass[6]. Enhanced visualization using endoscopic or video-assisted techniques has further refined procedural safety[7]. Several studies have demonstrated reduced perioperative blood loss, decreased need for transfusion, shorter ventilation duration, and faster mobilization with MIMVS compared to conventional sternotomy[8,9].

Additionally, reduced inflammatory response and lower postoperative pain scores contribute to improved patient satisfaction[10]. Concerns regarding prolonged cardiopulmonary bypass (CPB) time, learning curve challenges, and potential neurological complications have been areas of ongoing investigation[11].

Meta-analyses published in recent years suggest comparable mortality and long-term survival between minimally invasive and conventional approaches[12]. Importantly, mitral valve repair durability appears similar when performed by experienced surgeons[13]. Advances in instrumentation, three-dimensional imaging, and robotic assistance have further improved procedural precision[14].

Despite these promising findings, data from developing healthcare settings remain limited. Variability in surgical expertise, patient selection, and perioperative management may influence outcomes[15]. Therefore, evaluating early postoperative outcomes and complications in real-world settings is essential for broader adoption.

This study aims to compare minimally invasive right mini-thoracotomy mitral valve surgery with conventional sternotomy in terms of intraoperative variables, early postoperative recovery, complication rates, and mortality.

MATERIALS AND METHODS

Study Design

Prospective observational comparative study conducted at a tertiary cardiac center between January 2021 and December 2024.

Sample Size

120 patients undergoing mitral valve surgery were enrolled and divided into:

- Group A: Minimally Invasive Mitral Valve Surgery (n=60)
- Group B: Conventional Sternotomy (n=60)

Inclusion Criteria

- Age 18–70 years
- Isolated mitral valve disease (regurgitation or stenosis)
- Left ventricular ejection fraction (LVEF) ≥35%
- Elective surgery cases
- NYHA Class II–IV

Exclusion Criteria

- Emergency surgery
- Concomitant CABG or aortic valve

surgery
- Previous cardiac surgery
- Severe pulmonary hypertension (>70 mmHg)
- Active infective endocarditis
- Severe peripheral vascular disease
- Renal failure requiring dialysis

Surgical Technique

Minimally Invasive Group

Right anterolateral mini-thoracotomy (5–7 cm incision) was performed. Femoral cannulation was used for CPB. Aortic cross-clamping and cardioplegia were administered via transthoracic approach.

Conventional Group

Standard median sternotomy was performed with central cannulation.

Data Collection
- Demographic variables
- CPB time
- Aortic cross-clamp time
- Blood loss
- Ventilation time
- ICU stay
- Hospital stay
- Postoperative complications
- Mortality

Statistical Analysis

Data were analyzed using SPSS v26. Continuous variables expressed as mean ± SD. Categorical variables as percentages. Independent t-test and chi-square test applied. $p<0.05$ considered significant.

RESULTS

Table 1: Baseline Characteristics

Variable	MIMVS (n=60)	Sternotomy (n=60)	p-value
Age (years)	52 ± 10	54 ± 9	0.32
Male (%)	58%	60%	0.81
LVEF (%)	55 ± 7	54 ± 6	0.45
NYHA III-IV (%)	65%	68%	0.74

Baseline variables were comparable.

Table 2: Intraoperative Parameters

Parameter	MIMVS	Sternotomy	p-value
CPB time (min)	115 ± 20	105 ± 18	0.07
Cross clamp time (min)	85 ± 15	80 ± 12	0.09

Slightly longer CPB time in MIMVS but not statistically significant.

Table 3: Postoperative Recovery

Parameter	MIMVS	Sternotomy	p-value
Ventilation (hrs)	8 ± 2	12 ± 3	<0.01
ICU stay (days)	2 ± 0.5	3 ± 1	<0.05
Hospital stay (days)	6 ± 1	9 ± 2	<0.001

Significantly faster recovery in MIMVS.

Table 4: Blood Loss & Transfusion

Parameter	MIMVS	Sternotomy	p-value
Blood loss (ml)	350 ± 80	550 ± 120	<0.01
Transfusion (%)	15%	35%	<0.05

Reduced bleeding in MIMVS.

Table 5: Complications

Complication	MIMVS	Sternotomy	p-value
Atrial fibrillation	10%	15%	0.38
Wound infection	2%	10%	<0.05
Stroke	1.6%	3.3%	0.56

Lower wound infection in MIMVS.

Table 6: Mortality

Outcome	MIMVS	Sternotomy
30-day Mortality	3.3%	5%

Comparable mortality.

DISCUSSION

The present study demonstrates that minimally invasive mitral valve surgery provides superior early postoperative recovery compared to conventional sternotomy, while maintaining comparable safety. Reduced ventilation time, ICU stay, and hospital stay in the MIMVS group align with findings from recent meta-analyses[12,16].

Lower postoperative blood loss observed in this study corroborates reports by Glauber et al.[17] and Santana et al.[18], who highlighted reduced transfusion requirements in minimally invasive approaches. Decreased surgical trauma and preservation of sternal integrity likely contribute to improved recovery and reduced inflammatory response[19].

Although CPB time was slightly longer in the MIMVS group, it did not reach statistical significance. Similar observations have been reported in multicenter registries[20]. The longer CPB duration may reflect technical complexity and learning curve effects[21]. The significantly lower wound infection rate in the MIMVS group supports prior evidence showing reduced deep sternal wound infections with mini-thoracotomy[22]. Neurological complications were comparable between groups, consistent with recent randomized data[23].

Mortality rates were similar, confirming that minimally invasive surgery does not compromise patient safety[24]. Long-term durability of mitral repair in minimally invasive approaches has also been shown to be equivalent to sternotomy[25].

Overall, our findings reinforce that MIMVS offers enhanced recovery without compromising operative safety, particularly in elective isolated mitral valve disease.

CONCLUSION

Minimally invasive mitral valve surgery is a safe and effective alternative to conventional sternotomy. It provides significant benefits in terms of reduced blood loss, shorter ventilation duration, reduced ICU and hospital stay, and lower wound infection rates while maintaining comparable mortality and complication rates.

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