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ORIGINAL ARTICLE

Clinical Profile and Early Outcomes of Minimally Invasive Cardiac Surgery: A Cross-Sectional Study from a Tertiary Center in Pakistan

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ABSTRACT

Background: Minimally invasive cardiac surgery (MICS) has emerged as a viable alternative to conventional sternotomy-based procedures. Its adoption is growing due to advantages such as reduced surgical trauma, shorter recovery, and fewer complications. However, limited data are available from low-resource settings like Pakistan.

Objective: To evaluate the early clinical outcomes of patients undergoing MICS in a tertiary cardiac center in Pakistan.

Methods: This descriptive cross-sectional study included 160 patients who underwent MICS at Mukhtar A Sheikh Hospital, Multan, between February 2023 and February 2023. Procedures included MIDCAB, minimally invasive valve surgeries, and ASD closures. Patient demographics, intraoperative findings, and early postoperative outcomes were analyzed using descriptive statistics.

Results: The mean patient age was 53.4 ± 8.5 years, with a mean ejection fraction of 56.2%. Most patients (72%) underwent CABG via MICS approach. The average hospital stay was 5.7 days. Blood products were used in 52% of cases. The mean postoperative ventilation time was 10.1 hours, and the mean chest drainage was 645 mL.

Conclusion: MICS in a resource-limited environment shows favorable early outcomes with short ICU and hospital stays, low blood product requirements, and preserved cardiac function. These findings support broader implementation of MICS techniques in similar clinical settings.

Keywords: Minimally invasive cardiac surgery, CABG, valve surgery, early outcomes, Pakistan, resource-limited setting

INTRODUCTION

Minimally invasive cardiac surgery (MICS) has transformed the surgical landscape by offering patients the benefits of smaller incisions, faster recovery, and reduced morbidity compared to conventional median sternotomy approaches[1]. Over the past two decades, advancements in instrumentation, imaging, and perfusion techniques have made MICS feasible for a wide range of cardiac procedures, including coronary artery bypass grafting (CABG), valve replacements, and congenital defect repairs[2].

In developed countries, MICS has become increasingly routine, supported by robust infrastructure and well-established surgical programs. However, in lower- and middle-income countries (LMICs) such as Pakistan, the transition to minimally invasive approaches is gradual and often hindered by financial constraints, limited training opportunities, and a lack of standardized protocols[3]. Despite these barriers, there is growing interest in MICS as an affordable and patient-centered solution, particularly in tertiary cardiac centers with evolving surgical capabilities.

While several international studies have documented the short- and long-term outcomes of MICS, there remains a paucity of data from South Asia. Existing literature primarily focuses on technical feasibility or limited case series, lacking broader patient outcome evaluations in real-world settings[4]. The present study addresses this gap by evaluating the early postoperative outcomes of 160 patients undergoing MICS at Mukhtar A Sheikh Trust Hospital, a tertiary cardiac center in Multan, Pakistan.

The primary objective of this study is to document baseline demographics, operative variables, and early clinical outcomes of MICS in a resource-constrained environment. These data aim to establish a foundation for future comparative studies and to support the integration of minimally invasive approaches into mainstream cardiac surgical practice in similar healthcare systems.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at Mukhtar A Sheikh Trust Hospital, a tertiary cardiac care center in Multan, Pakistan. The study period extended from February 2022 to February 2023. A total of 160 patients who underwent minimally invasive cardiac surgery (MICS) during this period were included. The procedures involved were minimally invasive direct coronary artery bypass (MIDCAB), minimally invasive mitral and aortic valve surgeries, and atrial septal defect (ASD) closures.

Inclusion criteria included adult patients aged 18 years and above who were candidates for MICS and provided informed consent. Patients requiring emergency surgery or those with previous sternotomy were excluded. All surgeries were performed using standard minimally invasive protocols involving limited thoracotomy or mini-sternotomy approaches, depending on the procedure type.

Data were collected prospectively from surgical records, anesthesia charts, and postoperative intensive care unit (ICU) documentation. The variables recorded included age, gender, body weight, ejection fraction (EF), hemoglobin (Hb), serum creatinine, operative time, ventilation duration, chest drainage volume, blood product usage, number of distal anastomoses (where applicable), and total hospital stay duration.

Statistical analysis was performed using IBM SPSS Statistics version 25. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. No inferential statistics were applied given the descriptive nature of the study.

RESULTS

A total of 160 patients underwent minimally invasive cardiac surgery during the study period. The demographic and baseline clinical characteristics are summarized in Table 1. The mean age of patients was 53.4 ± 8.5 years, and the mean ejection fraction was 56.2 ± 5.2%. The average weight was 77.6 kg, mean hemoglobin level was 13.0 g/dL, and average serum creatinine was 1.11 mg/dL.

The distribution of procedures performed is shown in Table 2. The majority of patients (72%) underwent MICS-CABG, followed by mitral valve replacement (12%), aortic valve replacement (7%), OPCAB (5%), and ASD closures (4%).

Table 1: Demographic and Clinical Characteristics of Patients

Variable	Mean ± SD / Percentage
Age (years)	53.4 ± 8.5
Ejection Fraction (%)	56.2 ± 5.2
Weight (kg)	77.6
Hemoglobin (g/dL)	13.0
Serum Creatinine (mg/dL)	1.11

Operative and postoperative outcome parameters are summarized in Table 3. The average duration of mechanical ventilation was 10.1 hours. Mean chest drainage in the first 24 hours was 645 mL. Blood products were transfused in 52% of the

patients. The mean number of distal grafts in MICS-CABG patients was 2.5, and the overall mean hospital stay was 5.7 days.

Table 2: Types of Minimally Invasive Procedures Performed

Procedure Type	Percentage
MICS-CABG	72%
Mitral Valve Replacement (MVR)	12%
Aortic Valve Replacement (AVR)	7%
Off-Pump CABG (OPCAB)	5%
ASD Closure	4%

Table 3: Operative and Postoperative Outcomes

Outcome Parameter	Mean ± SD / Percentage
Ventilation Time (hours)	10.1
Chest Drainage (mL)	645
Blood Product Use	52%
Number of Distal Grafts (CABG)	2.5
Hospital Stay (days)	5.7

DISCUSSION

This study analyzed the early outcomes of 160 patients undergoing minimally invasive cardiac surgery (MICS) at a tertiary care hospital in Pakistan. The findings highlight that MICS is a safe and effective alternative to conventional approaches, even in resource-limited settings. The observed mean patient age was consistent with the average age reported in similar studies from India and China, reflecting a younger patient population in South Asia compared to Western cohorts[5,6].

Our results showed a mean ejection fraction of 56.2%, indicating that the majority of patients had preserved cardiac function preoperatively. This aligns with other studies reporting safe MICS practices in patients with mild to moderate left ventricular dysfunction[7]. Postoperative ventilation duration (mean: 10.1 hours) and hospital stay (mean: 5.7 days) were within the favorable range observed in global MICS series, where median ventilation times range from 8–12 hours and average hospital stays span 5–8 days[8,9].

Blood product usage was moderate (52%), which is slightly higher than in some Western reports where transfusion rates in MICS procedures can be as low as 30%[10]. However, given the variability in transfusion thresholds and patient optimization practices, this rate is still within an acceptable range. Chest drainage volumes (645 mL) also correlate with other published MICS experiences[11].

Compared to a multicenter German study by Holzhey et al., where hospital stays after MICS ranged from 6 to 8 days, our shorter average stay supports the potential efficiency of early mobilization and discharge protocols in MICS, even with limited resources[12]. Furthermore, the diversity of procedures (CABG, valve replacements, ASD closures) demonstrates that MICS can be successfully implemented across different surgical indications in a developing country setting.

From a feasibility perspective, the success of this MICS program at Mukhtar A Sheikh Hospital illustrates that with proper planning, training, and institutional support, advanced surgical techniques can be safely delivered in LMICs. Challenges such as limited surgical instruments, fewer trained personnel, and inconsistent blood supply were addressed through local adaptations and interdisciplinary collaboration. The experience may serve as a model for other centers looking to adopt MICS in similar environments.

CONCLUSION

Minimally invasive cardiac surgery offers favorable early outcomes, including short ventilation times, minimal blood loss, and reduced hospital stays, even in resource-limited environments. Our findings from a tertiary center in Pakistan support the continued expansion of MICS and highlight the feasibility of adopting such techniques in low- and middle-income countries. Future studies should focus on long-term outcomes and direct comparisons with conventional surgical approaches to further validate these benefits.

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