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A CASE-CONTROL STUDY TO EVALUATE RIGHT MINI THORACOTOMY WITH CENTRAL CANNULATION VERSUS CONVENTIONAL STERNOTOMY FOR MITRAL VALVE REPLACEMENT IN RHEUMATIC HEART DISEASE

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Abstract:
Introduction: The number of patients getting mitral valve replacement (MVR) surgery for severe mitral regurgitation and mitral stenosis has increased and is expected to climb further. Mitral valve surgery can be conducted using either a direct vision method or an endoscopic and robotic procedure.The purpose of this case-control study was to compare the feasibility and safety between Right Mini Thoracotomy with central cannulation versus Conventional Sternotomy for mitral valve replacement
MATERIAL AND METHODS: A total 100 patients underwent Mitral Valve Replacement were included, among them group A 50 patients were underwent for Mini Right Thoracotomy performed through right anterolateral mini thoracotomy with central cannulation. Fifty patient of group B were underwent mitral valve replacement through conventional median sternotomy.
RESULTS: Our study found that a statistically significant high length of incision, blood loss, number of blood transfusions, ICU stay, hospital stay and re-exploration was found among the sternotomy group compare to the thoracotomy group. While a statistically significant less cross lamp time and total bypass time was found among the sternotomy group compare to the thoracotomy group.
Conclusion: Based on these findings, a minimally invasive approach should be explored for all patients who require mitral valve replacement
Keywords: Mitral Valve, thoracotomy, sternotomy, mitral regurgitation, mitral stenosis

INTRODUCTION:

The number of patients getting mitral valve replacement (MVR) surgery for severe mitral regurgitation and mitral stenosis has increased and is expected to climb further. There are many ways to do minimally invasive cardiac operations, depending on the type of surgery, the equipment that is available, and the technical experience of the team.[1]
As RHD advances, it can result in severe mitral stenosis (MS) and/or mitral regurgitation (MR) , as well as aortic valve damage in more than 30% of patients. When patients attain New York Heart Association functional class III/IV, they require surgical treatment, with indications including significant calcification or concomitant valve/coronary disease. Because damages of the valve and subvalvular apparatus in RHD are more severe than in non-RHD illness, MV repair is technically more challenging than MVR.[2-4]

Most of the time sternotomy is used to do mitral valve surgery. This means completely separating the sternum to make it easy to get to the heart and central cannulaion of the major arteries to set up cardiopulmonary bypass. It offers greater flexibility in myocardial protection techniques and may facilitate de-airing and hemostasis at the end of the procedure. [5-6]

The disadvantages of a sternotomy incision include an increase in bleeding due to the incision's size. [7] Wound infections affect 2%–3% of patients, and they can cause severe morbidity and mortality. [8-9]

Mitral valve surgery can be conducted using either a direct vision method or an endoscopic and robotic procedure. [10] Minimally invasive surgery aims to improve cosmetic results, reduce trauma, and shorten hospital stays while retaining the safety and effectiveness of this access. The literature on the utilization of minimally invasive techniques for mitral valve replacement in rheumatic heart disease is limited. The purpose of this case-control study was to compare the feasibility and safety between Right Mini Thoracotomy with central cannulation versus Conventional Sternotomy for mitral valve replacement.

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MATERIAL AND METHODS:

Current study was prospective comparative study conducted at the Cardio Thoracic & Vascular Department of Swai Man Singh Medical college Jaipur , Rajasthan from the period of January 2020 to June 2022. A total 100 patients underwent Mitral Valve Replacement were included, among them group A 50 patients were underwent for Mini Right Thoracotomy performed through right anterolateral mini thoracotomy with central cannulation. Fifty patient of group B were underwent mitral valve replacement through conventional median sternotomy . Patients with previous cardiac surgery, significant coronary artery disease, associated aortic valve disease needing intervention and calcified ascending aorta, external iliac or femoral artery stenosis were excluded from the study. This study was approved by ethics committee of our institute and prior written informed consent was taken from the patients.

Procedure:

The research group included 50% of patients who operated for MVR through right mini anterolateral thoracotomy and the control group included 50% of patients who underwent MVR via median sternotomy. Both groups received the same general anaesthetic techniques as well as routine arterial and venous monitoring. In the thoracotomy group, an incision was made in the right sub-mammary fold, 3-5 cm from the sternum's lateral edge. The breast tissue in females was gently mobilized and the right chest cavity was entered through the fourth intercostal space. Heparinized the Patient according to body wt. Aortic and bi-caval cannulation were subsequently performed as usual and cardiopulmonary bypass was initiated. The aorta was cross clamped using a long curved aortic clamp after cooling to 32°C to keep it out of the surgeon's field, and aortic root blood cardioplegia was administered. The left atrium was opened by making an incision posterior and parallel to the interatrial groove, which allowed access to the mitral valve. The diseased mitral valve was removed and replaced with a prosthetic valve attached to the annulus with interrupted ethibond suture. Before removing the aortic cross clamp, the left atrium was closed with a single layer 3-0 RB, double arm prolene suture and de-airing was conducted through the suture line. The heart was permitted to take over circulation after being re-warmed to 37°C. Before administering the protamine, decannulation was performed and the suture line was ssecured. Pacing wire on RV and connect to pacemaker for temporary if needed. Following that the pericardium was completely closed with continuous sutures, leaving a small drain. The chest was then closed in stages, with a separate thoracic drain remaining. The approach for the control group was through the conventional median sternotomy, but the operational procedure was virtually the same.

Patients were electively ventilated after surgery. After thoroughly analyzing the patients' general condition and hemodynamic as well as baseline investigations and Arterial blood gas report than extubated and stay in ICU some days than shift from ICU. On the second postoperative day, acenocoumarol was started as an oral anticoagulant to maintain an International normalized ratio (INR) of 2.5 to 3.0 . During the hospitalization, intravenous antibiotics, a combination of ceftriaxone/sulbactam and amikacin, were administered and changed based on the clinical situation. Antibiotics were administered intravenously throughout the hospital stay.

Outcome assessed: Length of incision, surgical exposure, mean cross clamp time, mean bypass time, ICU stay, hospital stay, overall comorbidity with sternotomy. Sepsis, dehiscence, healing and cosmetic quality were studied for comparison.

Data were analysed in SPSS v- 24. Independent t-test and Chi-square test were applied. Pearson correlation coefficient was calculated between the BP (SBP and DBP) and RDW. p value <0.05 was considered statistically significant.

RESULTS:

In the present study, both the group were matched for demographic and initial clinical characteristics and found no statistical significant difference among these feature between both the groups. (Table 1)

Table 1: Demographic and clinical characteristics of study participants

	Group A (Thoracotomy)	Group B (sternotomy)	p-value
Age	30.71±12.01	28.42±11.62	0.561
Gender (Male:female)	10:40	13:37	0.781
NYHA	3.1±0.52	2.9±0.64	0.642

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Mitral stenosis	23 (46%)	20 (40%)	0.452
Mitral insufficiency	15 (30%)	20 (40%)	0.401
LVEF (%)	52.2±6.1	55.6±5.6	0.628
Left atrial size	20 (40%)	18 (36%)	0.648
AF	18 (36%)	20 (40%)	0.648
TR	12(24%)	15 (30%)	0.782

Our study found that a statistically significant high length of incision, blood loss, number of blood transfusions, ICU stay, hospital stay and re-exploration was found among the sternotomy group compare to the thoracotomy group. While a statistically significant less cross lamp time and total bypass time was found among the sternotomy group compare to the thoracotomy group. No significant difference were noted in others outcome variables. (Table 2)

Table 2: Comparison of outcome variables

	Group A (Thoracotomy)	**Group B (sternotomy)**	**p-value**
Length of incision (in cm)	15.23±2.12	24.42±2.41	0.001
Cross lamp time (min)	89.23±17.21	72.34±18.45	0.001
Total bypass time (min)	116.24±14.34	105.34±13.23	0.001
Total operative time (min)	220.16±18.21	218.67±17.92	0.568
Blood loss/24 hours (ml)	430.32±52.56	921.22±102.41	0.001
Number of blood transfusion	1.98±0.89	6.18±2.21	0.001
ICU stay (hours)	52.54±9.31	63.12±8.82	0.001
Post-op hospital stay (days)	6.24±2.13	12.22±2.42	0.001
Post-op mechanical support	1 (2.0%)	1 (2.0%)	1.000
Wound infection	3 (6.0%)	5 (10.0%)	0.212
Wound dehiscence	0 (0%)	2 (4.0%)	0.412
Re-exploration for bleeding	3 (6.0%)	6 (12.0%)	0.02
30 days mortality	1 (2.0%)	2 (4.0%)	0.117

DISCUSSION:

The median sternotomy, which is commonly utilized to gain access to mitral valve surgeries, presents a high risk of postoperative infection and dehiscence. Furthermore, particularly in young women, the ensuing big scar is of low visual quality and may have negative psychological implications. [5] A restricted anterolateral thoracotomy with central cannulation are part of a less invasive technique that can prevent these complications. We investigated if such issues could be addressed. So current study was an age, gender, NYHA class and initial clinical parameters matched case control study conducted among the 100 participants with equal ratio of case and control. In this study cases were considered those underwent through right mini thoracotomy and controls were underwent through a conventional sternotomy for mitral valve replacement in rheumatic heart disease.

Current study revealed that a statistically significant shorter length of incision, blood loss, number of blood transfusions, ICU stay, hospital stay and re-exploration was found among patients underwent mini thoracotomy compare to the patients underwent standard sternotomy. While a statistically significant less cross lamp time and total bypass time was found among the sternotomy patients compare to the min thoracotomy patients. We found that mini thoracotomy MVR did not outperform standard MVR in terms of survival, surgical complications, and hospital stay in patients with Rheumatic heart disease.

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There is presently insufficient evidence to support the use of minimally invasive methods for rheumatic mitral valve disease. Chahal et al. [11] published randomized case-control research comparing right-sided mini-thoracotomy with sternotomy in patients with rheumatic MV lesions, which revealed that the mini-thoracotomy group required less ventilation time, hospitalization, and time in the ICU. In addition, the mini-thoracotomy group had less bleeding, pericardial effusion, and blood transfusions and required fewer blood substitutes than the sternotomy group. Shah ZA et al [12] also found similar results and revealed that mini thoracotomy had less shorter incision, cross lamp time, duration of ICU and hospital stay and in contrast to the current study, mini thoracotomy had less wound infection and wound dehiscence. Our study findings were also consistent with the study done by Melih Hulusi Us et al. [13] Chitwood et al. [14], Cohn et al. [15] and Navia et al [16]

Chernov I et colleagues [17] reported some comparable results, with total operation time, postoperative complications, and mortality not differing between mini thoracotomy and normal sternotomy, and CPB duration being shorter in the sternotomy group than in the mini-thoracotomy group. In contrast to the current study, both groups had similar durations of mechanical ventilation, ICU stay, and total hospital stay.

Conclusion:

The minimally invasive approach to MVR is feasible and provides great cosmetic results without increasing the risk of surgical complications. Based on these findings, a minimally invasive approach should be explored for all patients who require mitral valve replacement, and a prospective randomized trial on a large patient population is required before this technique can be used routinely.

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