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Comparing Short-Term Outcomes of Right Mini-Thoracotomy and Median Sternotomy for Isolated Left Atrial Myxoma Excision

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Abstract

Background: Left atrial myxoma (LAM) is the most common heart tumor in adults, requiring prompt surgical removal to prevent complications like valvular obstruction or embolization. **Objectives:** This study aimed to compare early postoperative outcomes between two surgical approaches—right mini-thoracotomy and median sternotomy—for the removal of isolated left atrial myxoma. **Methods:** We conducted a prospective observational study at the Department of Cardiac Surgery, National Heart Foundation Hospital & Research Institute (NHFH&RI), Mirpur, Dhaka, from March 2017 to August 2019. Twenty-eight patients undergoing surgery for isolated left atrial myxoma were included. The surgical approach was determined by the operating surgeon. We analyzed outcomes like intubation time, Intensive Care Unit (ICU) stay, pain levels (Visual Analogue Scale score), and overall hospital stay using SPSS. Statistical significance was set at $p < 0.05$. **Results:** Patients in the right mini-thoracotomy group had longer mean intubation times (11.43 vs. 5.93 hours, $p < 0.001$) and ICU stays (68.20 vs. 30.34 hours, $p < 0.001$) compared to the median sternotomy group. They also reported higher pain levels (VAS score 5.00 vs. 3.21, $p < 0.003$) and had a longer hospital stay (8.93 vs. 5.71 days, $p < 0.001$). **Conclusion:** Despite longer intubation and ICU times, the right mini-thoracotomy approach offers a minimally invasive alternative for isolated left atrial myxoma excision, with favorable outcomes overall.

Keywords

Left Atrial Myxoma, Mini-Thoracotomy, Median Sternotomy, Cardiac Surgery

1. Introduction

Cardiac tumors present a unique and complex clinical challenge. They are classified into primary and secondary (metastatic) types. Primary cardiac tumors are rare, with a prevalence of 0.001% - 0.03% in autopsy studies. Among these, approximately 75% are benign, with myxomas accounting for over 50% of cases. The remaining 25% are malignant, with cardiac sarcomas being the most common. Secondary cardiac tumors, however, are significantly more prevalent, occurring 20 to 40 times more often than primary tumors. In fact, about 15% of patients with any form of cancer may develop heart metastases [1] [2].

As the most common benign primary cardiac tumor, myxoma typically occurs between the third and sixth decades of life, with 94% of cases presenting as solitary tumors [3]. While myxomas can develop in any cardiac chamber, about 75% are found in the left atrium, 10% - 20% in the right atrium, and the remainder in the ventricles [4]. However, left atrial myxoma (LAM) is particularly common among adults, requiring prompt surgical removal due to the risk of valvular obstruction or embolization [5].

Advances in diagnostic and surgical techniques have significantly improved the prognosis for patients with cardiac myxoma [6] [7]. Traditionally, the median sternotomy has been the standard approach for treating this condition. However, as surgical techniques have progressed, minimally invasive approaches have gained attention as promising alternatives. Several studies have shown favorable outcomes using a right thoracotomy for valve surgeries [8] [9]. Yet, due to the rarity of cardiac tumors, research specifically focused on cardiac myxoma remains limited. In this study, we present the clinical outcomes of a single-center comparison between the median sternotomy and right mini-thoracotomy approaches for treating cardiac myxoma involving the left atrium.

2. Materials and Methods

2.1. Study Design

This observational, analytical, case-control study was conducted at the Department of Cardiac Surgery, National Heart Foundation Hospital & Research Institute (NHFH&RI), Dhaka, Bangladesh, from March 2017 to August 2019. The study aimed to compare the surgical outcomes of two approaches—median sternotomy and right mini-thoracotomy—for excising isolated left atrial myxoma.

2.2. Study Population and Sample Size

The study included 28 patients with isolated left atrial myxoma who required surgical excision. They were divided into two groups:

- Group A (n = 14): Underwent median sternotomy.
- Group B (n = 14): Underwent right mini-thoracotomy.

2.3. Sampling Technique

Purposive sampling was used to select patients who met the specific inclusion

criteria for the study.

2.4. Inclusion and Exclusion Criteria

- Inclusion: Patients with isolated left atrial myxoma.
- Exclusion: Redo cases, including those with additional cardiac conditions or who declined participation.

2.5. Variables Measured

- Demographics: Age, sex, Body Mass Index (BMI).
- Preoperative New York Heart Association (NYHA) functional classification
- Clinical: Cerebrovascular accident, hypertension, diabetes, arrhythmia.
- Per-operative: Operation time, cardiopulmonary bypass time, aortic cross-clamp time, incision length.
- Postoperative: Intubation time, ICU stay, hospital stay, pain, blood transfusion, neurological deficit, wound infection, mortality.

2.6. Study Procedure

Patients presenting to the Department of Cardiac Surgery at NHFH&RI in Mirpur, Dhaka, with isolated left atrial myxoma were assessed according to the study's inclusion and exclusion criteria. Each patient underwent a comprehensive medical history review, clinical examination, and evaluation of coexisting risk factors. To minimize bias in the choice of surgical approach, the same surgical team alternately assigned patients to either right mini-thoracotomy or median sternotomy. Despite the different approaches, the fundamental principles of surgical excision for left atrial myxoma, including the use of cardiopulmonary bypass and myocardial protection, were consistently applied in both groups. Data were collected, compiled, and analyzed using the Statistical Package for the Social Sciences (SPSS). Quantitative data were reported as mean ± standard deviation (SD), and group comparisons were performed using appropriate statistical tests.

2.7. Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS). Group comparisons were made using the Unpaired Student's t-test for quantitative data and Chi-Square or Fisher's exact tests for qualitative data. Significance was set at $p \leq 0.05$.

2.8. Ethical Approval

This study involved human participants and was conducted in accordance with the Declaration of Helsinki. Ethical approval was granted by the Ethics Committee of the National Heart Foundation Hospital and Research Institute (Reference Number: N.H.F.H & R.I 4-1417/1/Ad-12761). Informed written consent was obtained from all participants, ensuring the protection of their dignity, rights, safety, and confidentiality.

2.9. Study Funding

This study was self-funded.

3. Results

Table 1 presents the demographic data preadmission New York Heart Association (NYHA) functional classification, showing that the mean age in Group A was 51.00 ± 8.06 years, with 28.6% of patients aged 36 - 45, 35.7% aged 46 - 55, and 35.7% aged 56 - 65. Group B had a mean age of 51.60 ± 9.68 years, with similar age distributions. The majority of patients in both groups were female, with 64.3% in Group A and 78.6% in Group B. The mean BMI was 23.40 ± 1.10 in Group A and 21.99 ± 2.09 in Group B. The distribution of NYHA functional class between Group A (35.7% in Class II, 64.3% in Class III-IV) and Group B (42.9% in Class II, 57.1% in Class III-IV). There were no statistically significant differences in age, gender, BMI or preadmission NYHA functional classification between the groups.

Table 1. Comparison of demographic characteristics and preadmission NYHA functional classification.

Demographic variables and NYHA functional class	Respondents (N = 28)		
	Group A f (%) n = 14	Group B f (%) n = 14	P value
Age groups (years)			
37 - 45	4 (14.29)	5 (17.86)	
46 - 55	5 (17.86)	4 (14.29)	
56 - 65	5 (17.86)	5 (17.86)	
Mean age (years), and ± SD	51.00 ± 8.06	51.60 ± 9.68	0.859^{ns}
Sex			
Male	5 (17.9)	3 (10.7)	0.234^{ns}
Female	9 (32.1)	11(39.3)	
BMI catagogries (kg/m^2)			
18.5 - 21	1 (3.6)	6 (21.3)	
21 - 23	3 (10.7)	2 (7.1)	
23 - 25	10 (35.7)	6 (21.3)	
Mean BMI (kg/m^2), and SD	23.40 ± 1.10	21.99 ± 2.09	0.092^{ns}
NYHA functional class			
II	5 (35.7%)	6 (42.9%)	1.0^{s}
III - IV	9 (64.3%)	8 (57.1%)	

Chi square & Unpaired t-test was performed to compare between the groups. N = total no. of study subjects, n = total no. of study subjects in each group, f = frequency of study subjects in each group; ns = not significant. NYHA = New York Heart Association.

Table 2 summarizes the coexisting conditions among the patients. In Group A, 35.7% of patients had hypertension (HTN), 21.4% had diabetes mellitus (DM), 21.4% had cerebrovascular accidents (CVA), and 7.1% had arrhythmia. In Group B, 50.0% had HTN, 21.4% had DM, and 28.6% had CVA, with no cases of

arrhythmia reported. There were no statistically significant differences in the prevalence of these coexisting conditions between the two groups.

Table 2. Prevalence of coexisting conditions.

Co-morbidities	Respondents (N = 28)		
	Group A f (%) n = 14	Group B f (%) n = 14	P value
HTN			
Present	5 (17.9)	7 (25.0)	0.445^{ns}
Absent	9 (32.1)	7 (25.0)	
DM			
Present	3 (10.7)	3 (10.7)	0.352^{ns}
Absent	11 (39.3)	11 (39.3)	
CVA			
Present	3 (10.7)	4 (14.3)	0.308^{ns}
Absent	11 (39.3)	10 (35.7)	
Arrhythmias			
Present	1 (3.6)	0 (0.0)	0.500^{ns}
Absent	13 (46.4)	14 (50.0)	

Data were expressed as frequency and percentage. Fisher's exact test was performed to compare between the groups. p value < 0.05 was accepted as level of significance. N = total no. of study subjects, n = total no. of study subjects in each group, f = frequency of study subjects in each group, ns = not significant.

Table 3 details the intraoperative variables. Group A had a mean cardiopulmonary bypass time of 73.65 ± 14.30 minutes, aortic cross-clamp time of 39.36 ± 13.15 minutes, incision length of 20.86 ± 0.86 cm, and total operation time of 154.64 ± 3.59 minutes. In comparison, Group B had a mean bypass time of 94.29 ± 20.57 minutes, cross-clamp time of 51.14 ± 16.22 minutes, incision length of 6.07 ± 0.83 cm, and operation time of 177.07 ± 2.16 minutes. Significant differences were found between the two groups in all these intraoperative measures.

Table 3. Intraoperative variables comparison.

Operative variables	Respondents (N = 28)		
	Group A Mean ± SD n = 14	Group B Mean ± SD n = 14	P value
Cardiopulmonary bypass time (min)	73.65 ± 14.30	94.29 ± 20.57	0.005^{s}
Aortic cross-clamp time(min)	39.36 ± 13.15	51.14 ± 16.22	0.044^{s}
Length of incision (cm)	20.86 ± 0.86	6.07 ± 0.83	0.001^{s}
Total operation time (min)	154.64 ± 3.59	177.07 ± 2.16	0.001^{s}

Data were expressed in Mean ± SD. Unpaired student's t test was performed to compare between the groups. p value < 0.05 was accepted as level of significance. N = total no. of study subjects, n = total no. of study subjects in each group, ns = not significant, s = significant.

Table 4 outlines the postoperative outcomes. In Group A, the mean intubation time was 11.43 ± 2.87 hours, ICU stay was 68.20 ± 20.93 hours, VAS score was

5.00 ± 0.88, and hospital stay was 8.93 ± 2.46 days. Group B showed better outcomes, with a mean intubation time of 5.93 ± 1.73 hours, ICU stay of 30.34 ± 8.25 hours, VAS score of 3.21 ± 1.81, and hospital stay of 5.71 ± 0.91 days. Statistically significant differences were observed in all these postoperative variables. Group A had a 14.3% incidence of wound infections and neurological deficits, while no such complications occurred in Group B, though the difference was not statistically significant.

Table 4. Postoperative outcomes comparison.

Postoperative variables	Respondents (N = 28)		P value
	Group A (n = 14)	Group B (n = 14)	
Duration of mechanical ventilation (hr)	11.43 ± 2.87	5.93 ± 1.73	<0.001[s]
Intensive care unit stay (hr)	68.20 ± 20.93	30.34 ± 8.25	<0.001[s]
VAS score	5.00 ± 0.88	3.21 ± 1.83	0.003[s]
Length of hospital stay (days)	8.93 ± 2.46	5.71 ± 0.91	<0.001[s]
Wound infection			
Yes	2 (7.1%)	0 (0%)	0.240[ns]
No	12 (42.9%)	14 (50%)	
Neurological deficit			
Yes	2 (7.1%)	0 (0%)	0.240[ns]
No	12 (42.9%)	14 (50%)	

Data were expressed in Mean ± SD. Unpaired student's t test and were performed to compare between the groups. P value < 0.05 was accepted as level of significance. VAS = Visual Analogue Scale. N = total no. of study subjects, n = total no. of study subjects in each group, ns = not significant, s = significant.

4. Discussion

This study aimed to compare early postoperative outcomes between right mini-thoracotomy and standard median sternotomy in patients undergoing isolated left atrial myxoma excision. A total of 28 patients met the inclusion criteria, with 14 undergoing median sternotomy and 14 right mini-thoracotomy. Notably, no conversions from mini-thoracotomy to sternotomy were required.

The study found that left atrial myxoma predominantly affects the elderly female population, with patient ages ranging from 37 to 65 years. Similar observations have been reported in previous studies [10] [11]. While some researchers, such as Bire *et al.* [12], noted that left atrial myxoma is exceptionally rare in the elderly. However, Akhter *et al.* [13] found that myxomas can occur at any age, with 80% of their patients ranging from 35 to 76 years old, and the interquartile range between 47 and 69 years. In contrast, Prichard [14], Griffiths [15], and Heath [15] reported a broader age distribution, with most patients presenting in their third to sixth decades. This difference may be due to improved patient monitoring and more selective criteria for surgical resection [16].

Most participants in this study had a BMI of 23 - 25 kg/m^2 and a history of hypertension, diabetes, cerebrovascular accidents, or arrhythmia. Dixit *et al*. [17] reported a mean BMI of 17.5 kg/m^2 in atrial myxoma patients, while Lee *et al*. [18] found that hypertension and diabetes were common among patients undergoing myxoma resection.

Cardiopulmonary bypass time, aortic cross-clamp time, and total operation time were longer in the mini-thoracotomy group, but the incision length was significantly shorter compared to the median sternotomy group. Although sternotomy is the traditional approach for myxoma resection, it carries risks such as postoperative infection and mediastinitis due to longer surgical scars [19]. In contrast, mini-thoracotomy offers benefits like smaller incisions, shorter hospital stays, faster recovery, and better cosmetic outcomes [20].

This study also found that intubation time, ICU stay, postoperative pain (VAS score), and overall hospital stay were significantly shorter in the mini-thoracotomy group, consistent with findings from other studies [11] [18]. Strict asepsis was maintained during surgery, and broad-spectrum intravenous antibiotics were administered for three days. While a few patients in the sternotomy group developed wound infections and neurological deficits, none were observed in the mini-thoracotomy group, aligning with previous research [4] [10] [18] [21].

Despite efforts to maintain optimal care throughout the study, several limitations should be acknowledged. Although the same surgical team performed all procedures using a standardized approach for both groups, variations in patient characteristics such as gender and body weight may have influenced surgical exposure time and were not accounted for in the analysis. Additionally, the study was conducted at a single hospital, which may affect the generalizability of the findings. The use of purposive sampling could introduce selection bias, potentially influencing the results. Moreover, the relatively small sample size and shorter follow-up period compared to other studies are also limitations that must be considered.

To obtain more conclusive results, further studies should consider the following recommendations: conducting similar research with a larger sample size, implementing a multi-center approach, and extending the study period to allow for the comparison of long-term variables, such as tumor recurrence.

5. Conclusion

The right mini-thoracotomy approach demonstrates potential as an effective alternative to median sternotomy for the excision of isolated left atrial myxoma, providing benefits such as reduced surgical trauma, shorter ICU stays, and faster postoperative recovery. However, further research with larger and more diverse patient cohorts is needed to validate these findings and evaluate long-term outcomes, including tumor recurrence and survival rates.

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Authors' Contributions

The first author spearheaded the conceptualization and design of the study, meticulously gathered data from the hospital, performed the data analysis, and drafted the manuscript. The third author contributed significantly to manuscript preparation and offered critical analysis of the study. The last author provided guidance throughout the entire research process. All authors collaborated in interpreting the findings and have jointly approved the final version of the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to the publication of this paper.

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