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Early Outcomes of Surgical Repair of Atrial Septal Defect with Right Anterolateral Minithoracotomy versus Traditional Median Sternotomy

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ORIGINAL ARTICLE

Early Outcomes of Surgical Repair of Atrial Septal Defect with Right Anterolateral Minithoracotomy versus Traditional Median Sternotomy

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Abstract

Background: ***For decades, traditional methods have been used to repair ASD through sternotomy; with the advancement of expertise, methods have been developed to simplify the repair through limited incision, such as anterolateral-mini-thoracotomy.***

Aim of the study: ***Contrasting early outcomes of median-sternotomy versus anterolateral-thoracotomy technique.***

Method: ***Our study was carried out within the Department of Cardiothoracic-Surgery, Al-Azhar University Hospital, Egypt.***

Inclusion ***Criteria: Patients with ASD who urged surgical ASD repair were included in this study.***

Results: ***Both groups shared comparable demographic and clinical characteristics, especially preoperative and intraoperative ones. However, the female patient count had significantly exceeded the male patient count in Group A (P value = .02). Moving to operative data, total bypass time was significantly lower in Group B as compared to Group A (p =.004) while Group A had significantly lower skin incision size (Cm) compared to Group A (p = 0.001). Regarding postoperative outcomes, ventilation time superiority was depicted by Group A as it showed significantly less ventilation time compared to the other group (P = .002). Conversely, Group B showed a significantly higher wound infection rate (4 cases) compared to Group A (0 cases) (P = .035). As a result, wound satisfaction was in favour of group A (93% of cases were satisfied) versus group b (13% of cases were satisfied) (P = .001).***

Conclusion: ***The RALT technique is recommended for its superiority in terms of safety profile, cosmetical shape, minor trauma, and high efficacy.***

Keywords: ASD; RALT; Atrial septal defect

1. Introduction

When ranking congenital heart defects worldwide, atrial septal defect (ASD) occupies the third most popular type, with an estimated incidence of 56 per 100,000 live births .[1] As a gold standard technique, conventional median SternotomySternotomy has been deployed for a long time in ASD surgical repair for many reasons, including its ability to provide unobstructed field.[2] Due to its asymptomatic nature, ASD diagnosis is usually delayed beyond the childhood stage; therefore, many undesired complications, such as pulmonary hypertension along with restriction in cardiac function, can develop over time in undiagnosed cases. As a result, it is a medical necessity to repair a relatively large ASD, especially among the children population.[3] Currently, there is a trend in adopting minimally invasive surgical approaches due to their better safety profile and cosmetic outcomes, which are comparable to the efficacy of old cardiac techniques. These methods include partial Sternotomy, right Mini thoracotomy, and total endoscopic repair for adult ASD. Nevertheless, various technologies and approaches are still being studied to achieve even better results. For example, surgical robots (remote surgical tele-manipulators) have been recently introduced to service to perform many general and cardiac surgical procedures .[4] There is an agreement on the superiority of the RALT technique for ASD repair when compared to the percutaneous ASD closure technique; hence, the latter requires the introduction of foreign material, which necessitates both using antiplatelet therapy and monitoring the device to avoid its potential migration .[5]

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This work aimed to Contrast the early outcomes of median Sternotomy versus the anterolateral-thoracotomy technique.

2. Patients and methods

In our study, thirty non-randomly selected patients diagnosed with second ASD were enrolled for ASD operative repair. Patients were split into two surgical groups: Group A (n=15) underwent RALT ASD repair while Group B (n=15) underwent traditional median SternotomySternotomy ASD repair. Aorto-bicaval central cannulation was deployed in all patients to monitor homeostasis. The study took place at Alazhar University Hospital, Egypt, after obtaining signed informed consent from all patients and being fully briefed about the two surgical options. Inclusion criteria: Patients who are cardiac surgery candidates for the first time in their life, Patients with a confirmed diagnosis of secundum type ASD, and Patients with body weight exceeding 6 Kg at the time of enrollment. Exclusion criteria: Patients who had ever suffered from bleeding diathesis., Known kidney or liver impairment, Previous chest wall deformity, trauma, or radiation, Confirmed history of severe fixed pulmonary hypertension, Confirmed obesity at the time of enrollment, Having any cardiac valve dysfunction, CAD, or any other congenital anomaly.

All our patients were subjected to preoperative assessment, which included taking their medical history, thorough routine lab tests, imaging, chest X-rays, ECG, and echocardiographic assessment. Intraoperative assessment: Total bypass time (mins) and cross-clamping (ischemic) time, overall surgical duration, and wound-closure type. Postoperative assessment: Mechanical ventilation (MV) timing (hrs), Overall drains monitoring (ml), Blood product transfusion rate (ml), Wound infection and developing seroma, Mortality rate, Intensive care unit (ICU) stay in days, Hospital staying (days), Echocardiographic assessment pre-discharge and one-month post-discharge to detect residual shunt, Checking wound cosmoses and patient satisfaction, Postoperative complications as bleeding, chest infection, and re-exploration. Operative procedure: Under a proper sterilization atmosphere, all patients were anaesthetized and exposed to the limit of the desired surgical incision. Patients' group predefined the incision: Group A was the RALT group, while Group B was the sternotomy group. In Group A, an incision of 8 to 10 cm in length was conducted within the sub-mammary area, allowing for dissection of the ipsilateral breast and pectoralis major muscle of the chest wall. The fourth intercostal space was employed to achieve proper transient lung deflation, which secured access towards the patient's right hemithorax. Then, the pericardial sheath was split to be harvested in part, and terminal parts were sutured (applying traction) towards the chest wall for stability. After the establishment of aorto-bicaval cannulation and cross-clamping, the Rt atrium was then fully prepared for the ASD closure intervention. In Group B, After achieving a subcutaneous skin incision, the interlacing fibres of the pectoralis major muscle were dissected, allowing for cutting open of the sternum using a bone saw. Then, the same technique for opening and suturing (under traction) of the pericardium was applied. After securing the aorto-bicaval cannulation and putting on cross-clamping, the Rt atrium was then fully prepared for the ASD closure intervention.

3. Results

Following table shows demographic data of the study patients with a significant P-value (0.022) Regarding patients' gender. There are non-significant results regarding age and BMI.

Table 1. comparison between both group Demographic data

	GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
AGE MEAN ± SD	25.25±8.67	19.55±18.01	0.151	NS
MALES	3 (20%)	8 (53%)	0.022	Sign.
FEMALES	12 (80%)	7 (47%)		
BMI MEAN ± SD	23.82 ± 2.99	22.30 ± 2.83	0.13	NS

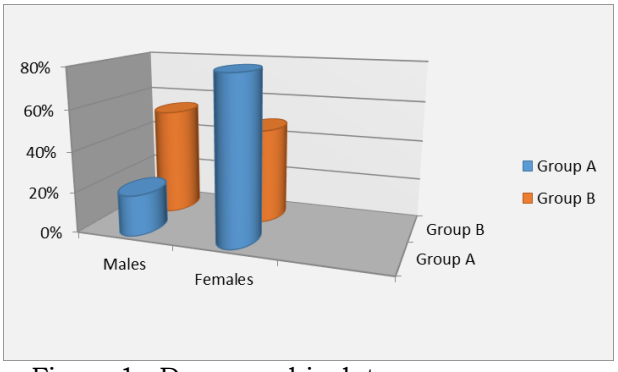

Figure 1. Demographic data

Table 2. Preoperative Echocardiographic Assessment

		GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
ASD SIZE (CM)		2.14±0.67	2.08±44	0.718	NS
TR	Mild	14 (93%)	13 (86%)	0.598	NS
	Mild to Moderate	1 (7%)	1 (7%)		
	Moderate	0 (0%)	1 (7%)		
PAP		30-50	25-45	0.113	NS
EF%		55-70% Mean ±SD was 60.50± 3.59 %.	50-70% Mean ±SD was 62.25± 6.38 %	0.292	NS

Table 3. Intra operative results

	GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
TOTAL BYPASS TIME (MINUTES)	Mean+SD 57.25 ±6.97 Range 50-75	48.5 ±10.77 40-90	0.004	Sign.
TOTAL OPERATIVE TIME (HOURS)	Mean+SD 3.3±.3 Range 3-4	3.43±.47 3-4. 5	0.320	NS
TYPE OF CLOSURE (PERICARDIAL PATCH)	15 (100%)	15 (100%)		-
SKIN INCISION (CM) MEAN ± SD	6- 12 6.92± 0.93	19-26 22.47±2.23	< 0.01	Sign.

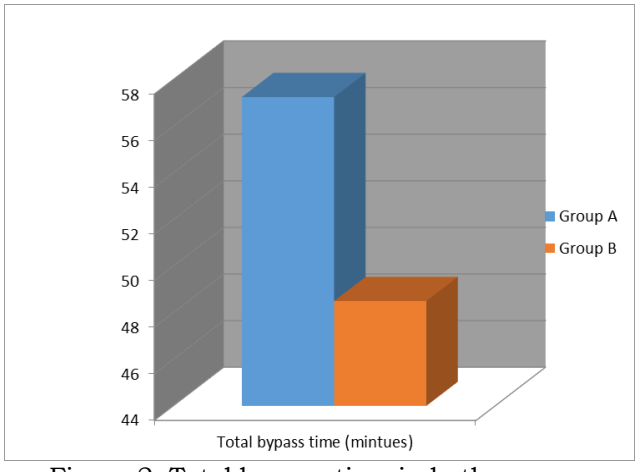

Figure 2. Total bypass time in both groups

Intra-operative results were almost similar in both group except for total bypass time which was significantly higher in Group B with P value (<0.05); also skin incision (Cm) differed significantly between the two groups in favor of Group A with P value (< 0.01) .

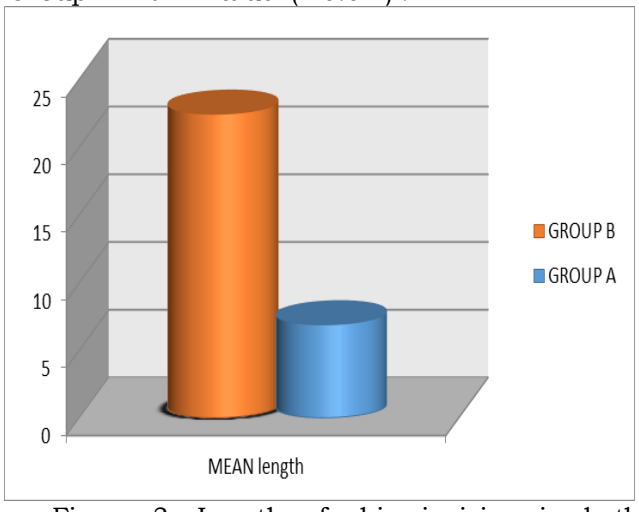

Figure 3. Length of skin incision in both groups.

Table 4. Intensive care events

	GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
VENTILATION TIME (HOURS)	Mean+SD 4.85±2.03 Range 2-10	Mean+SD 6.85±1.76 Range 3-12	0.002	Sign.
TOTAL DRAINAGE (ML)	50-370 Mean+SD 133.33±22.03	50-350 Mean+SD 140±21.03	0.364	NS
AMOUNT OF TRANSFUSED BLOOD (ML)	Mean+SD 1075±244.68 Range 1000-2000	1075.50±393.88 450-1500	0.649	NS
ICU STAY (DAYS)	Mean+SD 2.05±.22 Range 0-3	2±.32 1-3	0. 574	NS
TOTAL HOSPITAL DELAY (DAYS)	Mean+SD 6.8±2.48 Range 5-16	7±1.38 5-10	0.754	NS

Post-operative ICU period with other parameters is considered the same in both groups except for Ventilation time which differed significantly (p <0.002) in favor of Group B.

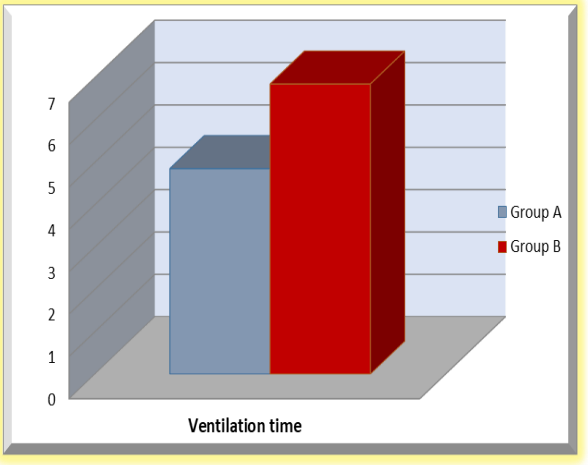

Figure 4. Ventilation time in both groups

Table 6. Patients satisfaction about their wound scar

COMPLICATIONS	GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
BLEEDING	1 (7%)	0 (0%)	0.311	NS
RE-OPERATION	0(0%)	0(0%)	_	
WOUND INFECTION	0(0%)	4 (27%)	0.035	Sign.
MORTALITY	0(0%)	0(0%)	_	
RESIDUAL SHUNT	0(0%)	0(0%)	_	

Table 5. post operative complication

	GROUP A	GROUP B	P-VALUE	SIGNIFICANCE
WOUND SATISFACTION	14 (93%)	2 (13%)	< 0.001	Sign.

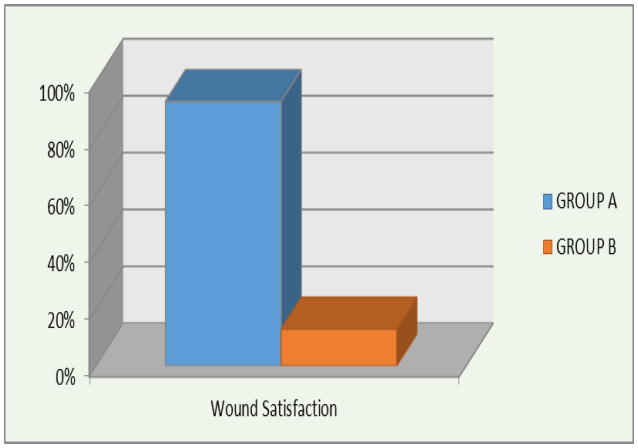

Figure 5. Patients satisfaction about their wound scar

There is highly significant P value (< 0.001) about satisfaction of wound healing and scar left

Table 7. Post-Operative Pain score among the two groups

PAIN SCORE	GROUP A	GROUP B
1ST DAY POST-OPERATIVE	7.7 ± 0.65	9.6 ± 0.59
2ND DAY POST-OPERATIVE	5.7 ± 0.97	7.9 ± 0.64
PRE-DISCHARGE	3.5 ± 1	5.25 ± 1.11

4. Discussion

Since the launch of the era of open cardiac surgeries, only the conventional sternotomy technique has preserved its place as a gold standard surgical option to manage ASD.[6] Unfortunately, these sternotomy incisions have always been a source of threat regarding many undesirable outcomes, including inevitable serious infections such as osteomyelitis and mediastinitis.[7] Moreover, unsatisfactory cosmetic skin appearance was also one of the major concerns of patients.With further advancements in incision techniques nowadays, various surgical procedures have been employed to achieve excellent cosmetic results despite being invasive. Those approaches involved both upper and lower partial-sternotomy[8], anterior left thoracotomy[9.10], trans-xiphoidal approach without sternotomy[11.12], RALT [6], and posterior lateral thoracotomy.[12] The right anterolateral-thoracotomy technique (also known as RALT) is identified as one of the most acceptable techniques by patients due to its outstanding results in terms of wound cosmetic appearance and cost. From surgeons' perspective, this minimal surgical trauma allows for early patients' mobilization along with extra stabilization of the thoracic cage. This gives an ideal opportunity to redo other thoracic operations due to minimal adhesions behind the sternum.[13] Our study included 30 patients with isolated secundum ASD confirmed diagnosis; they were assigned to either Group A or B. First, Group (A) (15 patients) were subjected to the RALT repair technique; however, group B (15 patients) were operated via the traditional sternotomy technique. The patients' demographic characteristics were comparable between the two groups except for the sex; hence, the female count significantly exceeded the male count by (80%) for the RALT group. Nonetheless, this variation is not considered a major concern as in males' hair growth may interfere with or mask the sternotomy incision's final appearance .[14] However, no major discrepancies were detected between the two surgical groups in our study regarding echocardiographic data, including defect size (Cm), PAP, TR, and EF; this was in line with other studies.[15,16,17,18,19,20] In our study, an estimated incision of 8-10 cm long was done, allowing for proper central Aorto-bicaval cannulation. Through this, we managed to avoid femoral cannulation that may lead to undesired complications; additionally, we managed to obtain better field exposure. This came in accordance with other studies .[16,14,22]. On the other hand, other investigators.[15,18,20,21] deployed smaller incisions along with peripheral cannulation for CPB; using smaller cannulas allowed them to proceed more comfortably with no major concerns. Notably, we employed aortic cross-clamping along with crystalloid ante-grade cardioplegic solution in all patients from both surgical groups. The same technique was applied in other studies .[16,14,21] On the contrary, other studies[15,18,22] ignored the usage of aortic cross-clamp and agreed upon operating a fibrillating heart within the RALT group; this technique allowed for the preservation of continuous heart perfusion, which was sufficient to secure protection for myocardial muscles. Our result depicted that CP bypass time (mins) differed significantly between RALT and sternotomy groups, as the time was greater in group A compared to group B (p-value = 0.004). Although these results were in the same line with some studies[15,16,17,21], they contrasted the results reported by Palma et al.[14] . Nevertheless, the total operation time (hours) did not differ in a significant way when comparing both groups (P value = 0.320). Although these results were the same line with Doll et al.[15], they contradicted the results reported by studies[16,17], which showed significant differences between both study groups. The mean time spent by group A patients on ventilators (hours) was substantially smaller than the time needed for group B (P value = 0.002). Although these results agreed with other studies[15,14&21], they contradicted the results reported by Jung & Kim's study[17,9], which showed no significant difference between both groups (P value = 0.566). Moreover, no substantial differences were detected regarding the overall amount drained by chest tube (ml) and

amount of blood transfusion (ml) between both groups (P value = 0.271 and 0.649, respectively), which agrees with Doll et al. results.[15] Similarly, our two studied groups did not exhibit any difference of statistical significance regarding both the ICU stay (days) and overall hospital stay (days) (P value = 0.574 and 0.754, respectively). Although these results agreed with the results reported by Jung & Kim's study [17,9], they contradicted the results reported by other studies[15,21], which showed significantly shorter ICU stays in the RALT group. They also contrasted with results reported by other investigators[15,16,14,21] they reported significantly shorter hospital stays in the RALT group. Additionally, our investigation highlighted significantly shorter mean skin incision (cm) within the RALT group versus the other study group (P value < 0.001). Any of our patients did not need re-exploration; likewise, none of these studies' patients needed re-exploration.[16,17,24] Meanwhile, other researchers[19,20] reported patients' bleeding that necessitated re-exploration. In our study, the data showed a statistically significant difference in terms of wound infection with a value (0.035) between the two groups, where 4 (20%) cases in the sternotomy group had superficial wound infection. In contrast, no cases were encountered in the RALT group, which is in the same line with other studies[15,17,22,24], while other studies[16,20&23] reported that no wound problems were observed. Although all post-operative follow-up echocardiographic assessments of our patients came free of residual defects, like those studies assessments[17,18,19,20,22,23,25], other studies reported that re-intervention was required in some patients either to fix residual ASD defect or due to patch dehiscence. within the follow-up period in other investigations[14,24], researchers reported non-significant residual shunts in some patients post-operatively.

4. Conclusion

When utilized for ASD repair, the RALT procedure shows a safer surgical profile, a more cosmetic appearance, fewer traumatic events, fewer requirements of analgesia, fewer associations with wound infection, and faster recovery time compared to conventional techniques.

We recommend obtaining better patients' satisfactory esthetic results and saving available resources.

Disclosure

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Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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