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A Comparative Study between Postoperative Arrhythmia Between Bilateral Trans-Septal Approach and Left Atriotomy in Mitral Valve Surgery

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ABSTRACT

Background: Although the intra-septal method offers better access to the mitral valve, there are concerns over the increased likelihood of postoperative atrial fibrillation and full heart block.

Aim: To compare incidence of postoperative arrhythmia between bi-atrial trans-septal approach and left atrial approach in mitral valve surgery, to improve outcome and quality of life to reduce morbidity and mortality.

Patients and methods: This comparative prospective clinical trial was done in Cardio-Thoracic Surgery Department and Clinic in Faculty of Medicine in Suez Canal University Hospital for Health Insurance and Ismailia Medical Complex. This study included 100 participants who were separated into 2 groups: group A: 50 patients who were going to have trans-septal approach and group B: 50 patients who were going to have left atriotomy.

Results: Operative details of the studied groups found that the mean cross-clamp time in trans-septal group was statistically significantly higher than in left atriotomy group (p=0.020). The mean CPB time in trans-septal group was statistically significantly higher than in left atriotomy group (p=0.022). Postoperative assessment of the studied groups found that the mean EF in trans-septal group was statistically significantly higher than in left atriotomy group (p=0.015).

Conclusion: The findings of our trial demonstrate that compared to left atriotomy, the TS approach was linked to longer pump as well as cross-clamp times, as well as an increased risk of postoperative atrial fibrillation, pleural effusion, postoperative mean EF, and mean duration of inotropic use.

Keywords: Mitral Valve diseases, Postoperative Arrhythmia, Bilateral Trans-Septal Approach, Left Atriotomy.

INTRODUCTION

An irregular or aberrant heartbeat is known as dysrhythmia or arrhythmia. Bradycardia is when the heartbeat is too slow, whereas tachycardia is when it is too rapid. While palpitations and dizziness are common symptoms of arrhythmias, many of them can have more dangerous outcomes, such as unexpected death. One of the main causes of morbidity following heart surgery is arrhythmias, which are a recognized complication. In the postoperative phase, bradyarrhythmias and tachyarrhythmias can both manifest [1].

The most prevalent abnormality of the heart rhythm is atrial fibrillation. Although postoperative atrial fibrillation frequently resolves on its own, it may need to be managed with anticoagulant medication and either rhythm or rate control. Ventricular arrhythmias and conduction abnormalities, however, are also possible. If there are no reversible reasons, sustained ventricular arrhythmias during the recovery phase following heart surgery may require immediate care as well as a long-term preventative approach [2].

Arrhythmia management involves targeted therapy for the arrhythmia itself in addition to addressing temporary and modifiable underlying factors. The clinical appearance of the arrhythmia determines the type and urgency of the necessary therapy. When self-terminating arrhythmias occur after a brief stressful episode and there is no obvious heart illness, they frequently require no treatment at all. Conversely, individuals under critical stress who develop hemodynamically severe arrhythmias require medication in order to return to a stable clinical position. The highly specialized cells known as cardiac myocytes are in charge of both mechanical contraction and electrical impulse conduction. Some myocytes exhibit automaticity, which is characterized by the cardiac cells' capacity to spontaneously depolarize during diastole and to generate an electrical impulse in the absence of an external electrical stimulus [3].

One of the most common valvular heart conditions is mitral valve disease, which requires surgery to replace or repair the mitral valve. When removing a previously implanted synthetic valve prosthesis or calcifying the original valve, good exposure is definitely necessary for mitral valve operation [4].

The tiny size of the left atrium and the substantial enlargement of the right ventricle may make mitral visualization insufficient. Previous heart surgery may also make mitral valve exposure more difficult because of the likelihood of adhesions and decreased movement in the surrounding tissues [5].

For the majority of surgeons, the typical procedure is conventional left atriotomy. However, when there are simultaneous surgeries requiring right atriotomy, when the left atrium is small, or when adhesions from prior procedures exist, the trans-septal [TS] method may provide greater exposure to the mitral valve. However, despite all of the benefits that the TS method provides, there is still debate over its results [6].

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Once Sondergaard's groove develops, the left atrium can be used to directly reach the mitral valve, or the right atrium can be sliced to reveal the interatrial septum. Although surgeons have historically preferred the left atrium (LA) method, accessing and seeing the mitral valve can occasionally be problematic and complicated, particularly when it comes to the anterior leaflet as well as annulus [(7)].

Superior access is provided by the interatrial trans-septal (TS) approach, which can be transverse or vertical. **Lillehei *et al.*** revealed the valve by performing a left atriotomy from the right thorax posterior to the interatrial groove. By doing surgery on the mitral valve from the right chest via the interatrial septum [(8)], **Effler *et al*.** altered this method [(9)]. Using a TS incision, **Dubost** and associates were able to stretch the right superior pulmonary vein medially past the interatrial septum and into the right atrium [(10)]. Rebuilding the atria's wall and the interatrial septum, along with the potential for transecting the sinus node artery and the intermodal routes, have all been deemed significant constraints. Concerns exist around full heart block necessitating a lifelong pacemaker and postoperative atrial fibrillation, which may be of greater incidence in intra-septal approach than for conventional methods even though the superior access to the mitral valve which is afforded [(11)].

Aim of the work

This trial was directed to equate incidence of postoperative arrhythmia between bi-atrial trans-septal approach and left atrial approach in mitral valve surgery, to enhance outcome as well as quality of life to reduce morbidity and mortality.

PATIENTS AND METHODS

This research was performed as an observational comparative prospective clinical trial. This study was done in:

1- Cardio-Thoracic Surgery Department and Clinic in Faculty of Medicine in Suez Canal University Hospital.
2- Cardio-Thoracic Surgery Department and Clinic in Suez Hospital for Health Insurance.
3- Cardio-Thoracic Surgery Department and Clinic in Ismailia Medical Complex.

- **Study population:**

Patients who needed mitral valve surgery, attending our clinic in the aforementioned departments and clinics, were candidates to be involved in this research. These 100 patients were distributed into 2 groups group A: 50 cases who were going to have trans-septal approach and group B: 50 patients who were going to have left atriotomy

Cases aging 18-60 years old, both males and females, patients with an echocardiograph showing severe mitral regurge or stenosis needing surgical intervention and isolated mitral valve surgery with or without tricuspid persons were involved in the study.

Patients with severe impairment of contractility with left ventricular ejection fraction (LVEF %) <35%, patient with IHD needing for CABG, association of other heart valvular disease needing surgical intervention, ischemic mitral valve disease, patient with a preoperative arrhythmias and patient with liver, renal or multi-organ failure were excluded from the study.

METHODS

Following participant selection, counseling, a detailed explanation of the process to each participant, a written agreement to engage in the study was acquired. The following was administered to the patients:

1. **Preoperative procedures**:

A) Recording history: A complete and comprehensive history was obtained, including information on sex, age, diabetes and/or hypertension, prior myocardial infarction, renal impairment, prior cardiac intervention and the functional class of dyspnea as defined by the New York Heart Association (NYHA).

B) Clinical examination: A thorough clinical evaluation of the local and general cardiology was carried out.

C) Investigations:

• Laboratory investigations, which included complete blood count (CBC), liver function tests (total and direct bilirubin, fasting blood sugar, serum albumin, liver enzymes "AST", "ALT", prothrombin time and concentration, serum proteins), kidney function tests (serum urea, creatinine), and HbA1C.

• Electrocardiogram (ECG): 12 leads ECG was performed for all cases.

• Radiological examination: Plain chest X-ray posteroanterior in the erect position, and plain CT chest for patients ≥ 60 years old to assess aortic calcifications.

• Echocardiography: Every individual had M mode, two-dimensional, as well as Doppler echocardiography. Measurements were taken of the various diameters of the heart chambers, along with the ejection fraction, detailed examination of the mitral valve, as well as evaluation of the other valves.

2. **Intraoperative procedures: (according to our facility protocol)**

A) Anesthetic procedure: The intraoperative anesthetic approach was standardized for all patients, involving the administration of fentanyl at a dosage of five to ten µg/Kg, as well as the facilitation of endotracheal intubation through the use of pancuronium at a dosage of 0.02 mg/Kg.

B) Cardiopulmonary bypass (CPB): A further dose of fentanyl, ranging from 100 to 200 µg, was administered when needed. Following complete muscular relaxation, the trachea was orally intubated using a properly sized endotracheal tube (a single lumen tube was used for all persons). The anesthesia for all patients was sustained by inhalation of isoflurane at a concentration of 0.5-1.0%. Following the induction process, a triple lumen central venous catheter, along with a single lumen catheter (Angiocath 16 gauge), was placed into the right internal jugular vein. Additionally, a urethral catheter as well as a nasopharyngeal temperature probe were implanted. Membrane oxygenators were utilized, while maintaining a hematocrit level of around 28% during cardiopulmonary bypass. Myocardial preservation was achieved via antegrade warm blood cardioplegia. A solution of cardioplegia was administered into the ascending aorta at a pressure of 200 mmHg. Cardiac arrest was typically induced within a minute. The administration of cardioplegia involved a dosage of 15-20 milliliter per kilogram of body weight, repeated every 20 minutes.

C) Surgical technique: The person being examined was reclined on the side with their arms resting on either side of them. Under each set of knees and beneath each set of shoulders, we placed a sandbag. Subsequently, the patient was dressed according to standard procedure, which included exposing the sternum until it reached the mid-clavicular line, covering at least one groin, as well as draping the leg that had the vein taken. The sternal notch and the tip of the xiphoid process were identified by palpation, as well as the medial malleolus. The incision began approximately 2 cm below the sternal notch and extend approximately 2 cm beyond the distal tip of the xiphoid process and was extended with electrocautery down to the sternal periosteum. The incision was extended with electrocautery in the midline by electrocauterization between the insertion points of the pectoralis major muscle.

A separation of the linea alba occurred at the xiphoid process, and a blunt finger dissection was performed above the suprasternal ligament to create a plane behind the sternum. Subsequently, the sternum was bisected from top to bottom by inserting the saw's nose plate underneath the suprasternal ligament. To minimize harm to the underlying pleura, it was deemed safer to elevate the sternum and request the anesthesiologist to deflate the lungs. Subsequently, electrocautery was employed to manage bleeding of the sternal periosteum. We utilized bone wax in numerous instances of significant marrow hemorrhage.

A sternal retractor with broad blades was positioned and progressively opened, with the retractors cross arm at the lower end of the incision. Two sponges soaked in povidone iodine were put on the sternal margins. The amount of opening in the sternum was limited to what was required to achieve sufficient exposure. After locating the left innominate vein and dissecting the thymus gland, the pericardium was accessed. Usually, enough exposure was obtained by hanging the pericardium to the edges of the incision and using thick silk stay sutures. The next step involved aorto-caval cannulation and the insertion of an aortic root cannula for the administration, venting, and de-airing of cardioplegia. The procedure employed was warm intermittent blood cardioplegia, with a repeat dosage every 20 minutes until the distal anastomoses were completed. The patient's temperature was kept around 34 degrees.

In group (A): trans-septal approach

When inserting a superior venous cannula, the superior vena cava was used instead of the inferior vena cava. To circumvent the right atrium's appendage, caval cannulas were positioned in a more lateral manner within the right atrium. To ensure proper closure, a piece of tissue from the atrium was intentionally left on the ventricular side during the surgical procedure. This was done by making an incision parallel to the atrioventricular groove and extending it upwards to the appendage, where it met the upper part of the interatrial septum. Cardioplegia was administered during the retrograde coronary sinus cannulation procedure, which was conducted out under close observation.

The heart was subjected to cold blood cardioplegia while the aorta was narrowed. The cut in the septum was extended upwards to join with the right atriotomy as well as continued for a distance of two to three millimeters towards the upper part of the left atrium. In addition, a vertical incision was performed in the fossa ovalis. Two sutures with pledgets were placed at each end to redirect the ventricular side of the incision in the septum. Following the mitral surgery, a 3-0 prolene suture was assessed to seal the left atrial roof to the septum. A second 3-0 prolene suture was then used to close the septal incision, beginning from the inferior pole of this incision.

Evacuation of air occurred from the left side, and the aorta was released from clamping. The right-sided surgery was performed, when necessary, typically involving the unclamping of the aorta. The closure of the right atriotomy involved using a 4-0 prolene suture, which was initiated from the two extremities and extended towards the center of the right atrial wall.

In group (B): Left atrial approach

The right atrial appendage was used to introduce a superior venous cannula, and the inferior vena cava was used to insert an inferior venous cannula. The interatrial groove and the confluence of the right pulmonary veins were the sites of the surgery.

The patient was weaned off cardiopulmonary bypass after achieving a stable intrinsic or paced cardiac rhythm, metabolic optimization, suitable pharmacologic support, and the start of efficient mechanical breathing.

All cannulas—apart from the aortic cannula—were withdrawn after the patient was weaned off cardiopulmonary bypass. A calculated dose of protamine sulfate was used to reverse the anticoagulant condition, and the aortic cannula was removed when the amount had been down to half. Adequate hemostasis was confirmed, and all surgical sites were suitably strengthened. Thoracostomy drainage tubes were meticulously put into any accessible pleural space and the mediastinum, followed by the insertion of pacing wires. Finally, the chest was closed using layered sutures. The sternum was subsequently brought together using either five or seven stainless steel wires. The contorted wires were thereafter delicately inserted into the sternum to prevent outward protrusion. The linea Alba was joined together using thick absorbable sutures, just as the pectoralis fascia. The subcutaneous tissue of the chest as well as leg was subsequently sutured using continuous absorbable 0 sutures, followed by closure of the skin using 3/0 subcuticular suture.

Intraoperative parameters:

1. Total bypass time: This is the time from initiating the cardiopulmonary bypass until weaning from the cardiopulmonary bypass.
2. Aortic cross clamp time: The ischemia time is the duration measured from the moment the aortic clamp is applied to the moment it is removed.
3. Total operation time: This is the time calculated from the beginning of the skin incision to the end of skin closure.
4. Use of inotropic drugs: The number of patients requiring inotropic drugs after completion of the procedure.

3. Postoperative evaluation of both groups:

Each individual underwent comprehensive evaluations throughout their stay in the intensive care unit, as well as during their hospitalization.

I. Intensive care unit evaluation:

1. Ventilator time.
2. Inotropic support.
3. Postoperative blood loss, blood transfusion and reassessment for significant hemorrhage:
4. The incidence of any neurological events during Intensive care unit (ICU stay).
5. Need for IABP.
6. Total intensive care unit stay.

II. One-week evaluation:

Persons were assessed one week after operation by the following:

1. 12 leads ECG: 12 leads ECG was completed for all persons to detect new ECG changes in the form of ischemia, infarction and arrhythmias.
2. Echocardiography: Each person underwent M mode, two-dimensional, as well as Doppler echocardiography to assess the ejection fraction, regional wall motion abnormalities, and the existence of pericardial collection.
3. Postoperative complications: as embolic, cerebral, renal, hepatic, etc.

III. 3- and 6-months' evaluation (follow up):

Patients were evaluated 3 and 6 months after surgery by the following:

1. New York Heart Association functional class.
2. Echocardiography.
3. Follow up of complications if any.

Ethical Considerations: The patient provided written informed permission to participate in the trial. Permission to conduct the study was received from the Cardiothoracic Surgery Department at Suez Canal University Hospitals, in addition to clearance from the Research Ethics Committee of the Faculty of Medicine in Suez Canal. For the purpose of conducting research involving human subjects, this study has been carried out in conformity with the Declaration of Helsinki, which is the Code of Ethics of the World Medical Association.

<u>**Data Collection**</u>

The clinical data, encompassing preoperative information as well as assessment, intraoperative data, postoperative data, as well as previously described complications, were gathered and analyzed. During the 3-month follow-up, all cases underwent regular physical examination, EKG, and transthoracic echocardiography (TTE).

Data management and statistical analysis:

- Data were analyzed with SPSS software version 24.0 (SPSS Inc., Chicago, IL, USA).
- Quantitative data were represented as the mean value plus or minus the standard deviation (SD), whereas qualitative information was represented as numerical values as well as percentages (%).
- Continuous variables were analyzed using independent t-test, while categorical variables were analyzed using either the χ^2 test or Fisher's test.
- A P-value below 0.05 was deemed statistically significant.

RESULTS

Table 1 displays that regarding age, gender, diabetes, and COPD, there was no statistically significant difference between the two groups.

Table 1: Demographic and clinical characteristics of the studied groups:

		Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
Age (years)		51.26 ± 13.456	53.18 ± 10.179	-6.7, 2.8	0.423
Gender	Male	18 (36.0%)	23 (46.0%)	-	0.309
	Female	32 (64.0%)	27 (54.0%)		
DM		19 (38.0%)	12 (24.0%)		0.130
COPD		25 (50.0%)	18 (36.0%)		0.157
Data are expressed as mean and standard deviation or as frequency and percentage. CI: Confidence interval, DM: Diabetes mellitus, COPD: Chronic obstructive pulmonary disease					

Table 2 demonstrates that regarding the New York Heart Association Classification of the studied groups, there was no significant variance amongst the two group.

Table 2: New York Heart Association Classification of the studied groups:

NYHA	Trans-septal group (n= 50)	Left atriotomy group (n= 50)	P
2	12 (24.0%)	12 (24.0%)	0.939
3	33 (66.0%)	34 (68.0%)	
4	5 (10.0%)	4 (8.0%)	
Data are expressed as frequency and percentage.			

Table 3 shows the duration and nature of mitral valve disease of the studied groups, it was found that the difference in mean duration of complaints and mitral valve nature was not statistically significant between the two groups.

Table 3: Duration and nature of mitral valve disease of the studied groups:

		Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
Duration of complaints (years)		1.75 ± 0.687	1.70 ± 0.763	- 0.2, 0.3	0.731
Mitral valve	Regurgitation	39 (78.0%)	40 (80.0%)	-	0.806
	Stenosis	11 (22.0%)	10 (20.0%)		
Data are expressed as mean and standard deviation or as frequency and percentage. CI: Confidence interval					

Table 4 demonstrates the baseline assessment of the studied groups; it was found that the mean EF, the mean PAP, as well as the frequency of cases having normal ECG or AF, were not statistically different between the 2 groups.

Table 4: Baseline assessment of the studied groups:

Baseline		Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
EF (%)		56.86 ± 8.249	56.24 ± 8.608	-2.7, 4.0	0.714
PAP (mmHg)		44.94 ± 9.382	44.60 ± 13.052	-4.2, 4.9	0.881
ECG	Normal	39 (78.0%)	40 (80.0%)	-	0.806
	AF	11 (22.0%)	10 (20.0%)		

Data are expressed as mean and standard deviation or as frequency and percentage. CI: Confidence interval, EF: Ejection fraction, PAP: Pulmonary alveolar proteinosis, ECG: Electrocardiogram, AF: Atrial fibrillation

Table 5 shows the operative details of the studied groups; it was found that the mean cross-clamp time and the mean CPB time in trans-septal group were statistically significantly higher than in left atriotomy group. The mean blood transfusion was not statistically significantly different between the two groups.

Table 5: Operative details of the studied groups:

	Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
Cross-clamp time (min)	94.10 ± 33.907	80.70 ± 21.189	2.2, 24.6	**0.020***
CPB time (min)	129.20 ± 34.142	116.10 ± 20.536	1.9, 24.3	**0.022***
Blood Transfusion (unit)	1.32 ± 0.653	1.28 ± 0.882	-0.3, 0.3	0.797
Data are expressed as mean and standard deviation. CI: Confidence interval. *: Significant.				

CPB: Cardiopulmonary bypass.

Table 6 illustrates the postoperative assessment of the studied groups; it was found that the mean EF in trans-septal group was statistically significantly higher than in left atriotomy group. The mean PAP was not statistically significantly different between the two groups. Regarding the findings of the ECG, there was significant difference between the 2 groups.

Table 6 Postoperative assessment of the studied groups:

Postoperative		Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
EF (%)		46.66 ± 9.244	42.16 ± 8.950	0.9, 8.1	**0.015***
PAP (mmHg)		37.02 ± 9.717	37.32 ± 13.807	-5.0, 4.4	0.900
ECG	**Normal**	27 (54.0%)	40 (80.0%)	-	**0.045***
	AF	14 (28.0%)	6 (12.0%)		
	SVT	8 (16.0%)	4 (8.0%)		
	Heart block	1 (2.0%)	0 (0.0%)		

Data are expressed as mean and standard deviation or as frequency and percentage. CI: Confidence interval. *: Significant. EF: Ejection fraction, PAP: Pulmonary alveolar proteinosis, ECG: Electrocardiogram, AF: Atrial fibrillation, SVT: Supraventricular tachycardia

Table 7 demonstrates the postoperative recovery profile of the studied groups. Regarding the mean intubation days, the inotropic support, and the mean length of the hospitalization, they were not statistically significantly different between the two group. The mean duration of inotropic use in trans-septal group was statistically significantly higher than in left atriotomy group.

Table 7 Postoperative recovery profile of the studied groups:

Postoperative	Trans-septal group (n= 50)	Left atriotomy group (n= 50)	95% CI	P
Intubation days	0.95 ± 0.407	1.09 ± 0.330	-0.3, 0.0	0.062
Inotropic support	38 (76.0%)	35 (70.0%)	-	0.499
Duration of inotropic use (day)	1.64 ± 0.636	1.06 ± 0.359	0.3, 0.8	**< 0.001***
Length of ICU stay (day)	4.20 ± 1.161	4.16 ± 1.235	-0.4, 0.5	0.868
Length of hospitalization (day)	14.98 ± 3.074	14.06 ± 2.938	-0.3, 2.1	0.129

Data are expressed as mean and standard deviation or as frequency and percentage. CI: Confidence interval. *: Significant.

Table 8 shows the postoperative complications of the studied groups, it was found that in this study, bleeding, infection, need for revision, cardiopulmonary resuscitation, pacemaker implantation and mortality were higher among TS group but with statistical insignificant variances. While 7 of trans-septal group and no one of the left atriotomy group had postoperative pleural effusion, with a statistically significant alteration among the two groups.

Table 8: Postoperative complications of the studied groups:

	Trans-septal group (n= 50)	Left atriotomy group (n= 50)	P
Bleeding	2 (4.0%)	0 (0.0%)	0.153
Infection	3 (6.0%)	2 (4.0%)	0.646
Postoperative pleural effusion	7 (14.0%)	1 (2.0%)	**0.006***
Need for revision	4 (8.0%)	1 (2.0%)	0.169
CPR	4 (8.0%)	2 (4.0%)	0.400
Pacemaker implantation	5 (10.0%)	3 (6.0%)	0.461
Mortality	3 (6.0%)	2 (4.0%)	0.400

Data are expressed as frequency and percentage. *: Significant. CPR: Cardiopulmonary Resuscitation

DISCUSSION

We compared the results of two popular treatments for mitral valve disorders in our study: the TA and LA incisions. Concerns have been raised about the TA approach's increased risk of arrhythmias in addition to sinoatrial nodal ischemia [12]. In order to enhance outcome and quality of life while lowering morbidity and mortality, our study compared the incidence of arrhythmias following mitral valve operation using the bilateral trans-septal technique or the left atrial method.

Surgical repair of the mitral valve in one hundred individuals were included in our prospective research; fifty underwent bilateral trans-septal approach and fifty underwent left atriotomy approach.

Our investigation revealed that there was no significant variance among both groups with respect to the mean age and sex distribution. We were successful in creating a trial with the fewest possible confounding variables and matching the preoperative and baseline features of the cases in the 2 groups.

The bilateral trans-septal approach group in the current study had substantially longer pump and cross-clamp periods than the left atriotomy group (p=0.022 and 0.020, respectively). This aligns with the findings of multiple research that found that the TS method resulted in longer pump and cross-clamp periods, and that these findings might account for the higher incidence of atrial fibrillation following surgery [13,14].

In the current study, 14 (28.0%) of trans-septal group had AF, 8 (16.0%) had SVT, and 1 (2.0%) had heart block, while 6 (12.0%) of left atriotomy group had AF, 4 (8.0%) had SVT, while no one had heart block, with statistically significant alteration among both groups (p=0.045). Our findings concur with those of the **Rezahosseini *et al.*** research, which showed that even after matching the two groups with respect to preoperative atrial fibrillation and LA size variables, the postoperative atrial fibrillation remained greater in the TS group. This observation might have as its explanation the TS approach's susceptibility to the sinus nodal artery, which leads to sinus node dysfunction [14].

Our findings are in line with previous findings by **Kon *et al.*, Kovács and Szabados, Smith, Kumar, Misawa *et al.*** and **Kastengren *et al.***, who highlighted the possibility of a significant rate of postoperative rhythm disruption following the TS technique [15–19].

As opposed to **Nienaber and Glower** who examined the LA strategy and the micro-TS approach and discovered that the former did not result in a higher incidence of postoperative atrial fibrillation. The shorter atrial incision, quicker atrial closure time, and less damage to the sinus nodal artery in the micro TS technique may account for the discrepancies between our findings and the findings published by the **Nienaber and Glower** research [13].It is still unclear exactly how sinus node ischemia affects cardiac rhythm and what function it plays. As it turns out, following complete severance of the sinus node artery, there is often a 1–2-week period of instability that **Smith** dubbed "atrial chaos". Then, in the majority of individuals, a regular atrial rhythm often develops more slowly and has little clinical significance [17] . How to reestablish this new heart rhythm is the main area of concern. Over the years, several justifications have been offered. **Misawa *et al.*** have reported that collateral blood flow to the sinus node region begins as soon as two weeks following surgery [18].

Nonetheless, a stronger concept has been put forth. This theory states that the division of the sinus node artery, which results in the absence of regular sinus rhythm, causes the birth of a new atrial rhythm on the coronary sinus region. There is little to no change in the ECG, and the new rhythm is nearly identical to normal SR. This electrical impulse would ascend Bachman's bundle's anterior tract to reach the left atrial appendage and ascend the posterior internodal tract to reach the right atrial appendage. The development of stability may be the result of a cellular modification in the pacemaking apparatus that makes the low atrial region more prominent and a more dependable pacemaker [20].

Atrial fibrillation was more common in the TS group after surgery, according to our results. This discovery could be owing, in part, to the fact that the sinus nodal artery is more susceptible to damage during the transosseous technique, leading to sinus node dysfunction [14]. We detected that the TS approach did not rise the rate of pacemaker placement or rate of re-operations. However, it was found that statistically significantly upsurge in the postoperative mean duration of inotropic use in trans-septal group than in left atriotomy group. Furthermore, postoperative pleural effusion was detected more significantly among the trans-septal group than those in left atriotomy group. Similarly, there was no increased risk of permanent pacemaker insertion after TS, in addition to the majority of arrhythmias are transient, in accordance to some research [14, 21]. While, in their multivariate study, **Lukac *et al.*** found that the TS method was an independent risk factor for pacemaker insertion (hazard ratio [HR]: 2.2, 95% confidence level).CI: 1.2–4.1; p = 0.014 [22].

In this research, the TS group had greater rates of bleeding, infection, need for revision, cardiopulmonary resuscitation, pacemaker placement, and death, but the differences were not statistically significant.

When compared to the TS group (94 vs. 6; P=0.05), the LA cohort in a research by **Mujtaba and Clark** of 1,017 patients showed a statistically significant increase in transient ischemic attack (TIA) and strokes, respectively [23]. Other frequent postoperative problems, such as angina and cardiac block, did not vary between the techniques (P=0.22 and P=0.14). Between the two cohorts, there was no significant difference in the ACx and CPB timings (P>0.10). There was also no difference in the 30-day mortality, which was 4.3% in the LA group and 3.7% in the TS group (P=0.75). It has been shown that the TS method may lower the risk of TIA and stroke without compromising ACx or CPB time. Similarly, a TS-LA approaches comparison by **Murashita *et al.*** observed no technique-related mortality, but noticed slight increases in ischemia time and surgical bleeding [24].

In a study by **Rezahosseini *et al.*** the OR of AF was determined to be 1.539 (95% CI 1.072-2.210; P=0.019). Their ACx time (90 vs. 61 minutes, respectively; P<0.001) and pump time (160 vs. 107 minutes, respectively; P<0.001) were significantly longer in the TS group than in the LA group, but the mortality rates between the two approaches were not different (P=0.274) [14].

Many of the patients in their research underwent concurrent operations during the operation, and as a whole, their CPB and ACx durations were greater (240 vs. 197 minutes; P<0.0001) and (150 vs. 111 minutes; P<0.0001) than those of patients who had isolated mitral procedures. However, there was no difference between the TS and LA methods in the ACx or CPB time of isolated mitral operations [13]. Furthermore, in patients undergoing repeated mitral valve surgery, **Hitawy *et al.*'s** study assesses the effectiveness of the trans-septal and transatrial techniques for mitral valve replacement. Regarding intraoperative or postoperative data, there was no discernible difference between the two methods [25].

The variations in morbidities amongst TS and LA methods and their association with different ACx or CPB time remain unclear despite the research that is currently available. It is well known that several TS techniques offer better mitral valve vision, to the point where some surgeons believe its technical benefits exceed the danger of arrhythmia [(19)].

CONCLUSION AND RECOMMENDATIONS

Finally, our findings showed that, while the TS approach did not raise the rate of permanent pacemaker placement, re-operations, or mortality, it was associated with increased incidence of atrial fibrillation after surgery, longer pump and cross-clamp periods, pleural effusion, postoperative mean EF, and mean duration of inotropic use. A left atriotomy technique was linked to fewer surgical complications.

When treating persons with a small LA and combined tricuspid and mitral valve surgeries, the TS method is still a useful strategy. With a few traction sutures, the surgeon may also retract the lateral lid of the septum using the TS technique; as such, this strategy is a viable choice when the surgeon is operating with minimal surgical support.

Future prospective studies are required to investigate the long-term impact of both approaches.

DECLARATIONS

- **Consent for publication:** I confirm that every author has given his consent to submit the work.
- **Availability of data and material:** Available
- **Competing interests:** None
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