Journal of Advanced Zoology

ISSN: 0253-7214

*Volume **44** Issue **S-6 Year 2023** Page **115:119***

Video-Assisted Mini-Thoracotomy Versus Anterior Thoracotomy Mitral Valve Replacement: Intraoperative Time and Hospitalization

Fetoh Alaaeldin Fetoh*, Gehad Ibrahim Awad, Sameh Mostafa Amer, Usama Ali Mohamed Hamza, Amr Abdellateef Hassan

cardiothoracic surgery department, Faculty of Medicine, Mansoura University, Egypt

Corresponding author E-mail: fetohsarhan91@mans.edu.eg

Article History

Received: 17 June 2023
Revised: 18 Sept 2023
Accepted: 22 Nov 2023

Abstract

Objectives: *Minimally invasive mitral valve surgery (MIMVS) was introduced to avoid a full sternotomy through smaller or alternative chest wall incisions to reduce complications. We present our experience with MIMVS through two of its techniques.* ***Methods****: This prospective single-centre study was conducted on a total of 34 cases, divided into two groups: Group A (VAMVR) included 17 patients who underwent video-assisted mitral valve replacement. Group B (ATMVR) included 17 patients who underwent right anterior thoracotomy mitral valve replacement, comparing intraoperative procedures and the results of both techniques.* ***Results****: In the studied cases, the mean intraoperative time was 4.38 ± 0.69 hours, which widely ranged from 3 to 6 hours, with no significant difference between both techniques. It was 4.35 ± 0.7 hours in VAMVR and 4.41 ± 0.7 in ATMVR. mean ventilation time of 3.96 ± 1.08 hours. The mechanical ventilation time was 4.24 ± 1.1 hours in VAMVR cases and 3.68 ±1.1 hours in the ATMVR group. The mean overall ICU stay duration was 1.75 ± 0.33 days, with no impact of the technique used on this time, as it was 1.71 ± 0.25 days in VAMVR patients and 1.79 ± 0.4 in ATMVR patients. The total hospital stay time was about 5.71 ± 0.91 days, ranging from 4 to 8 days, with no impact of the procedure used on this time as it was 5.6 ± 0.94 days in VAMVR cases and 5.8 ± 0.88 days in ATMVR cases.*

Conclusions: *There was no impact of the technique used in MIMVS, whether video-assisted or right anterior thoracotomy mitral valve replacement, on intraoperative time and ICU and hospital stays.*

Keywords*: minimal invasive, mitral valve replacement, video assisted.*

1. Introduction

Surgery is the conventional treatment for severe mitral valve disease, whether by repair or replacement with a mechanical or biological prosthesis when repair is not possible (1). Minimally invasive cardiac surgery is a fast growing specialty that strives to give comparable patient results to traditional surgery while reducing morbidity associated with a typical median sternotomy (2). Parasternal incision, minimal-access J-sternotomy (ministernotomy), anterior thoracotomy, and video assisted right minithoracotomy have all been utilised for minimally invasive Mitral valve surgery (3).

Pioneers like as Navia, Cosgrove, Cohn, and Carpentier, as well as the Leipzig group, have pushed the boundaries and demonstrated that minimum access cardiac surgery is safe and repeatable. Although minimum access surgery necessitates a shift in mentality from an incision that exposes the heart and major vessels to a tiny incision that exposes only the target site (4)

In many hospitals, right anterior thoracotomy has become the conventional technique for mitral valve surgery, and it is considered a sort of minimally invasive mitral valve replacement access (3). Anterior thoracotomy is an excellent option to median sternotomy for mitral valve surgery. Excellent cosmetic outcomes and the avoidance of sternal problems are significant benefits. It is also designed to reduce patient harm by reducing blood loss, the quantity of blood transfusion, and the risk of infection by minimising wound dimensions, so shortening the patient's hospital stay and lowering expenses (5).

The purpose of video assisted mitral valve surgery (VAMVS) is to decrease surgical stress to the patient (postoperative bleeding, deep wound infection, discomfort, scarring, critical care, and overall hospital length of stay) while keeping the established surgical efficacy of the open technique (6).

This procedure has become a well-established alternative to median sternotomy mitral valve surgery, as well as an increasingly popular choice for managing patients with mitral valve disease who require surgery (7).

This study compares between two different types of minimally invasive mitral valve replacement; video assisted approach versus anterior thoracotomy without video assistance.

Patients and methods:

This prospective single-center descriptive study was carried out in the hospitals of Mansoura University. We studied two groups after ethics committee clearance and informed written consent. The first group comprised 17 patients for video aided minimally invasive mitral valve replacement (VAMVR), while the second group included 17 patients for anterior thoracotomy without video assistance (ATMVR). Patients with degenerative or rheumatic mitral pathology who were candidates for the first time isolated mitral valve replacement, regardless of gender, were chosen for this study. Age and BMI were among the preoperative variables obtained. Patients above the age of 40 had a preoperative diagnostic coronary angiography to rule out related coronary artery disease. Exclusion criteria included the requirement for further coronary artery bypass grafting or a low ejection fraction of 40%. Patients were also barred.

In all cases, a double lumen endotracheal tube was inserted after intravenous anaesthesia, and an arterial pressure line was put in the right radial artery. Patients were then positioned supine with the right side of the chest slightly raised and the right arm slightly abducted to clear out the axillary region for prospective ports of the transthoracic aortic cross-clamp (Chitwood clamp) and telescope (Scanlan International, St Paul, MN, USA). The right shoulder was 30 degrees raised. External defibrillation pads were used. In all cases, a single lumen endotracheal tube was employed. Tidal volume was temporarily lowered by deflating the lung as needed until the lungs were detached following full cardiopulmonary bypass (CBP).

Group (A)Video assisted minimally invasive mitral valve replacement:

A 6-8 cm skin incision is done immediately over the proposed thoracotomy line in male patients, commonly around the fourth intercostal space. A skin incision is done along the submammary fold in female patients. The chest was accessed by the third or fourth intercostal gap. A 3cm supra inguinal oblique incision was used to expose the femoral vessels synchronously. During surgery, the right femoral artery and vein were revealed. A femoral arterial cannula (17F to 21F) was placed into the femoral artery after systemic heparinization. In the femoral vein, a conventional multistage femoral venous cannula (22- 24F) was inserted and progressed to the right atrium. In virtually all cases, 5/0 polypropylene purse suture was used to fix the cannula and close the vein at the end of operation.

A 6-8 cm skin incision is done immediately over the proposed thoracotomy line in male patients, commonly around the fourth intercostal space. A skin incision is done along the submammary fold in female patients. The chest was accessed by the third or fourth intercostal gap. A 3cm supra inguinal oblique incision was used to expose the femoral vessels synchronously. During surgery, the right femoral artery and vein were revealed. A femoral arterial cannula (17F to 21F) was placed into the femoral artery after systemic heparinization. In the femoral vein, a conventional multistage femoral venous cannula (22- 24F) was inserted and progressed to the right atrium. In virtually all cases, 5/0 polypropylene purse suture was used to fix the cannula and close the vein at the end of operation. We performed some surgical steps with video assistance, such as placement of sutures on the anterior annulus of the mitral valve, or the area of the posteromedial commissure.

Following the surgery, the left atrium was closed with continuous suturing. Dearing was accomplished by filling the left atrium with saline before to closure or by suction into the ascending aorta via the cardioplegic cannula. It was related with pulmonary inflation. The arterial and venous cannulas were withdrawn after adequate reperfusion, and the femoral vessels were rebuilt. After placing two drainage chest tubes (1st between the heart and hilum, 2nd apical), we closed the chest incision and inserted a redivac 18 basal in the pleural space.

Figure (**1**) video assisted view for prosthetic mitral valve insertion

Group (B) right thoracotomy mitral valve replacement:

The incision is 6-8 cm long and inserted immediately below the nipple over the fourth intercostal gap (in the infra-mammary crease in most women). For fourth intercostal space thoracic entrance, the pectoralis muscles are activated. To spread the ribs, an intercostal chest retractor is employed. Under direct view, the pericardium is opened 2 cm ventral to the phrenic nerve and carried cephalic to the aortic reflection. The anterior pericardium ridge is tacked to the incision borders with silk sutures, while the posterior edge is distracted posterolaterally with transthoracic sutures. This movement causes the heart to spin counterclockwise, pushing the left atrium laterally and ventrally. This configuration allows for direct visibility and access to the aortic origin, atriocaval junction, and right superior pulmonary vein. Trans-incision implantation of aortic purse string suture and direct aortic cannulation in the ascending aorta. Then, using 3/0 polypropylene purse suture, direct venous cannulation in the SVC and IVC to secure the cannula and closure following their removal. We utilized a cross clamp from the thoracotomy opening and performed the identical processes as described before, but solely with direct eyesight and no camera.

All patients' total hospital and ICU stay in days were evaluated. All patients were evaluated by echocardiography three months after surgery and before discharge for prosthetic mitral valve performance and pressure gradient, paravalvular leak, LV function and pericardial effusion, LV, and LA dimensions.

Results and Discussion

The current study evaluated and compared intraoperative time and the ICU and hospital stay of 34 patients who underwent Video-assisted mini-thoracotomy (VAMVR) versus anterior thoracotomy mitral valve replacement surgery (ATMVR) at Cardiothoracic Surgery Department - Mansoura University Hospital. Patients' demographic data are presented in table 1.

Table 1. demographic data of the studied cases:

		VAMVR	**ATMVR**
Sex	Male	9 (52.9%)	6 (35.3%)
	Female	8 (47.1%)	11 (64.7%)
Age (Mean±Sd)		39.8 ± 13.6	35.1 ± 9.8
Body Surface Area (Mean±SD)		1.64 ± 0.14	

Intraoperative time:

In the studied cases, the mean intraoperative time was 4.38 ± 0.69 hours that widely ranged from (3 to 6 hours) with no significant difference between both techniques. It was 4.35 ± 0.7 hours in VAMVR and 4.41 ± 0.7 in ATMVR as shown in table 2.

Table 2. Intraoperative time:

	VAMVR	ATMVR	All cases
Operative Time (Mean±SD) hour	4.35 ± 0.7	4.41 ± 0.7	4.38 ± 0.69

Intensive care unit (ICU) data analysis:

After the operation as revealed in table 3, all patients were mechanically ventilated in the ICU, then they were extubated after a duration ranged from (2 to 7 hours) with a mean ventilation time 3.96 ± 1.08 hours. The mechanical ventilation time was 4.24 ± 1.1 hours in VAMVR cases and 3.68 ±1.1 hours in ATMVR group. The mean overall ICU stay duration was 1.75 ± 0.33 days with no impact of the technique used on this time as it was 1.71± 0.25 days in VAMVR patients and 1.79 ± 0.4 in ATMVR patients. The total hospital stay time was about 5.71 ± 0.91 days ranging from 4 to 8 days with no impact of the procedure used on this time as it was 5.6 ± 0.94 days in VAMVR cases and 5.8 ± 0.88 days in ATMVR cases.

Table 3 Intensive care unit (ICU) data analysis:

	VAMVR	ATMVR	All cases
Mechanical Ventilation Time (Mean±SD) hours	4.24± 1.1	3.68 ±1.1	3.96 ± 1.08
ICU Stay Duration (Mean±SD) days	1.71± 0.25	1.79 ± 0.4	1.75 ± 0.33
Hospital Stay (Mean ± SD) (days)	5.6 ± 0.94	5.8 ± 0.88	5.71 ± 0.91 (4-8)

Mitral valve operations were traditionally performed through a median sternotomy. The procedure has been related to postoperative instability and incidences of sternal osteomyelitis (8,9). Right anterior thoracotomy has been proposed as an alternative to the conventional middle sternotomy for patients undergoing mitral valve replacement (10). Minimally invasive mitral valve surgery (MIMVS) through a right mini thoracotomy has become well-established and widely practiced around the globe (1). The right thoracotomy approach is often used in the redo setting, as it avoids the need for repeat sternotomy and requires less dissection of the heart (11).

Since the first video-assisted mitral valve repair through a minithoracotomy carried out in 1996 and the first minimally invasive mitral valve replacement in the same year (12), an increasing enthusiasm has accompanied the development of minimally invasive mitral valve surgery (13).

These approaches are associated with higher patient cosmetic satisfaction; lesser blood transfusion has been reported in some series, at the expense of longer cross-clamp times (13).

The current study evaluated and compared intraoperative procedures and the short-term outcomes of 34 patients who underwent Video-assisted mini-thoracotomy (VAMVR) versus anterior thoracotomy mitral valve replacement surgery (ATMVR). To the best of our knowledge, no previous studies have compared the two techniques together. The age data from studied population shows that the mean age was about 37.5 ± 11.9 years old, the youngest case was 18 years old and the oldest was 60 years old, most of cases were females (56 %). However, Kastengren et al., (2019) conducted a study on 250 cases who underwent minimally invasive mitral valve surgery at the Karolinska University Hospital, the mean age was 62.9 years, and 21.6% of cases were females (1).

As revealed by our data, the mean body surface area was 1.64 ± 0.14 which is like the body surface areas of cases in the study by Abdel-Kareem et al., (2019) averaged 1.64 ± 0.24 (14).

Although the central cannulation was technically more difficult than the femoral one, our data showed no significant difference in the intraoperative time between the two groups which was 4.38 ± 0.69 hours that widely ranged from (3 to 6 hours). Earlier study revealed that the intraoperative time was about 4.32 ± 1.08 (14)..

In the current study, after the operation, all patients were mechanically ventilated in the ICU, then they were extubated after a duration ranged from (2 to 7 hours) with a mean ventilation time 3.96 ± 1.08 hours with no statistically significant difference between both procedures. The mean overall ICU stay

duration was 1.75 ± 0.33 days with no impact of the technique used at this time. A prior study by Abdel-Kareem et al., 2019 demonstrated that Primary ventilation time was between 1.0 ± 4.0 hours, (mean ± SD = 2.00 ± 0.79 hrs.).

ICU stay ranged between 1.0 ±3.0 day with (mean ± SD = 2.35 ± 1.14), and hospital stay ranged between 5.0 - 7.0 days with (mean ± SD = 6.45 ± 1.43) (14). In a study conducted at the Massachusetts General Hospital, the average length of stay in the ICU of patients who underwent MIMVS was about 24 hours. The reduction in the total length of hospital stay demonstrates a fast recovery of the patient (15).

It was reported that minimally invasive approaches appear to be associated with faster recovery, earlier discharge, and reduced use of rehabilitation facilities (16). Mihaljevic and colleagues reported a shorter hospital stay with a minimally-invasive approach (17).

References

1. Kastengren M, Svenarud P, Ahlsson A, Dalén M. Minimally invasive mitral valve surgery is associated with a low rate of complications. J Intern Med. 2019;286(6):614–26.
2. Nagendran J, Catrip J, Losenno KL, Adams C, Kiaii B, Chu MWA. Minimally invasive mitral repair surgery: why does controversy still persist? Expert Rev Cardiovasc Ther. 2017;15(1):15–24.
3. Van Praet KM, Stamm C, Sündermann SH, Meyer A, Unbehaun A, Montagner M, et al. Minimally invasive surgical mitral valve repair: state of the art review. Interv Cardiol Rev. 2018;13(1):14.
4. Alla GKG, Alla Y, Chinta SR. Minimally invasive mitral valve surgery through right anterolateral thoracotomy—review and personal experience. Indian J Thorac Cardiovasc Surg. 2018;34(2):117–23.
5. AHMED S, MOHAMMED ABDE-HM, HUSSIEN MD, SALEH R. Right Anterolateral Minithoracotomy Versus Median Sternotomy in Mitral Valve Replacement. Med J Cairo Univ. 2018;86(December):4039–45.
6. El Ashkar AM, Khallaf AN. Video-assisted minimally invasive mitral valve surgery: Early experience. J Egypt Soc Cardio-Thoracic Surg. 2016;24(3):223–7.
7. Lorusso R, Gelsomino S, Vizzardi E, D'Aloia A, De Cicco G, Lucà F, et al. Mitral valve repair or replacement for ischemic mitral regurgitation? The Italian Study on the Treatment of Ischemic Mitral Regurgitation (ISTIMIR). J Thorac Cardiovasc Surg. 2013;145(1):128–39.
8. Liu J, Chen B, Zhang Y-Y, Fang L-Z, Xie B, Huang H-L, et al. Mitral valve replacement via minimally invasive totally thoracoscopic surgery versus traditional median sternotomy: a propensity score matched comparative study. Ann Transl Med. 2019;7(14).
9. Paparella D, Fattouch K, Moscarelli M, Santarpino G, Nasso G, Guida P, et al. Current trends in mitral valve surgery: a multicenter national comparison between full-sternotomy and minimally-invasive approach. Int J Cardiol. 2020;306:147–51.
10. Attallah AR, Al-Elwany SE, Ayyad MAKS, Abdelwahab AM. Early clinical outcome after right anterolateral thoracotomy as an alternative for median sternotomy for mitral valve replacement. Egypt Cardiothorac Surg. 2020;2(2):47–54.
11. Murzi M, Miceli A, Di Stefano G, Cerillo AG, Farneti P, Solinas M, et al. Minimally invasive right thoracotomy approach for mitral valve surgery in patients with previous sternotomy: a single institution experience with 173 patients. J Thorac Cardiovasc Surg. 2014;148(6):2763–8.
12. Carpentier A, Loulmet D, Le Bret E, Haugades B, Dassier P, Guibourt P. Open heart operation under videosurgery and minithoracotomy. First case (mitral valvuloplasty) operated with success. C R Acad Sci III. 1996;319(3):219–23.
13. Speziale G, Fattouch K, Romano V, Del Giglio M, Albertini A, Comoglio C, et al. Minimally invasive mitral valve surgery: state-of-the-art and our experience. Eur Hear J Suppl. 2015;17(suppl_A):A49–53.
14. Abdel-Kareem H, Alaa M, Khairy M, Abdel-Wahab A, Mohammed M. Video assisted minimally invasive mitral valve replacement in rheumatic valve disease. Egypt Cardiothorac Surg. 2019;1(1):10–8.
15. Sabik III JF, Raza S, Chavin KD. Safety and benefits of new techniques and technologies in less invasive mitral valve repair. J Card Surg. 2018;33(10):609–19.
16. Ryan WH, Dewey TM, Mack MJ, Herbert MA, Prince SL. Mitral valve surgery using the classical'heartport'technique. J Heart Valve Dis. 2005;14(6):709–14.
17. Mihaljevic T, Cohn LH, Unic D, Aranki SF, Couper GS, Byrne JG. One thousand minimally invasive valve operations: early and late results. Ann Surg. 2004;240(3):529.