

# EARLY OUTCOME OF THORACOSCOPIC MINIMALLY INVASIVE VERSUS CONVENTIONAL MITRAL VALVE SURGERY IN MITRAL VALVE DISEASES

By

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## ABSTRACT

**Background:** Minimally Invasive Mitral Valve Surgery (MIMVS) is fast becoming an established treatment option for the treatment of mitral valve disease internationally. Increased recognition of advantages, of minimizing surgical trauma and its direct impact on reduced postoperative pain, quicker recovery, improved cosmesis and earlier return to work has spurred the minimally invasive cardiac surgical revolution.

**Objectives:** Comparing the postoperative pain, cost, hospital stay, recovery speed and pulmonary function between minimally invasive and conventional mitral surgery. Moreover, assessment of thirty day mortality and early post-operative morbidity in both techniques.

**Patients and methods:** This study was conducted on 50 patients requiring mitral valve surgery classified into 2 equal groups:

**Group A** (Minimally invasive group), who were approached through a right Anterolateral video-assisted minithoracotomy.

**Group B** (Sternotomy group), who were approached through a conventional median sternotomy.

**Results:** There was no statistical difference between the two groups in baseline pre-operative characteristics regarding their age, sex, NYHA class, EF%, LA dimension and spirometric study. There was no operative mortality in both groups. Incision length, ventilation time, blood drainage, blood transfusion, ICU stay, total hospital stay were less in group A.

**Conclusion:** In patients with mitral valve disease, MIMVS can be an alternative to conventional mitral valve surgery with comparable short-term mortality and in-hospital morbidity.

**Key words:** Minimal invasive, Scar, Pain, Cost.

## INTRODUCTION

Historically, most mitral valve surgery has been performed using conventional full median sternotomy (*Antunes, 2015*). In the late 1990s, a new procedure termed minimally invasive mitral valve surgery

(MIMVS) was suggested (*Ailawadi et al., 2016*) MIMVS is fast becoming an established treatment option for the treatment of mitral valve disease internationally (*Schmitto et al., 2010*).

Merits of MIMVS in well trained hands are enormous. Routine use of

MIMVS showed less surgical trauma with its sequelae reaching earlier resumption of normal activities (*Atluri et al., 2013*).

## PATIENTS AND METHODS

This study is prospective cohort study including 50 patients requiring mitral valve surgery. All the patients completed the study. The patients were classified into 2 equal groups:

- **Group A:** Minimally invasive group. This group were approached through a right Anterolateral video-assisted minithoracotomy.
- **Group B:** Sternotomy group. This group were approached through a conventional median sternotomy.

Patients were selected from National Heart Institute, and underwent mitral valve surgery from April 2014 to August 2015 in National Heart Institute. All patients approved to have the surgery and signed consents.

All patients with acute mitral regurgitation, concomitant aortic valve disease, concomitant ischemic heart disease, previous open heart surgery or prior right lung surgery or radiotherapy to the right side of the chest, pulmonary artery pressure more than 80mm and impaired preoperative pulmonary function were excluded from the study. Duplex of femoral vessels was done for group A and those with contraindication to femoral

cannulation were excluded from the study.

Conventional general anesthesia, standard cardiopulmonary bypass, antegrade cold blood cardioplegia and standard left atriotomy were conducted in all patients regardless the surgical approach. In group B, Standard aortic and bicaval cannulation while in group A, Femoral (venous and arterial) cannulation with TEE guidance was done and patients underwent 4-6 cm video-assisted right anterolateral mini-thoracotomy.

### Statistical analysis:

Data were collected, verified and edited on a personal computer then analysed by SPSS, EPICalc software program to get the final result. Arithmetic mean and standard deviation were collected. t-test was used to compare values. The chi-square test ( $X^2$ ) was used for qualitative values. P value < 0.05 was considered significant.

## RESULTS

The two groups were matched with no statistically significant difference regarding age, sex, body mass index (BMI) (Table 1), NYHA class, preoperative echocardiography and preoperative spirometric studies.

**Table (1):** Demographic data.

Parameters	Group A	Group B	P value
Age	39.24 ± 11.061	48.76 ± 11.36	0.004
Gender (Males)	13/25 (52.0%)	12/25 (48.0%)	0.777
BMI	28.48 ± 4.823	28.08 ± 4.15	0.755

**Total cross-clamp time (TCCT) and total bypass time (TBT) were longer in group A, but with no statistically significant difference (Table 2).**

Group “A” included 18 cases of mitral valve replacement, 6 cases of mitral valve

replacement plus tricuspid valve repair, 1 case of mitral valve repair. In group “B”, there was 18 cases of mitral valve replacement, 7 cases of mitral valve replacement plus tricuspid valve repair, no case of mitral valve repair.

**Table(2): TBT and TCCT.**

Surgical procedures		Group A	Group B	P-value
TBT (min)	Mean ± SD	135.92 ± 28.34	119.48 ± 22.57	0.028
	Range	95 - 215	72 - 185	
TCCT (min)	Mean ± SD	101.36 ± 18.34	87.20 ± 18.82	0.010
	Range	70 - 147	55 - 145	

There was a high stastically significant difference between the two groups regarding length of the surgical incision, ventilation time, amount of blood drainage, postoperative spirometric study and total hospital stay.

There was a statistically significant difference between both groups in blood transfusion units and ICU stay (Table 3).

Post-operative pain score using the visual analogue scale was high stastically significant with less pain in group A (Table 4).

Comparison between pre and postopera-tive echocardiography revealed no stastically significant difference (Table 4).

MIMVS group was more expensive than conventional group with no stastically significant difference (Table 4).

**Table(3): Postoperative data.**

ICU courses		Group A	Group B	P value
Ventilation (hours)	Range	0-5	6 - 24	<0.01
	Mean ± SD	2.84 ± 1.93	10.72±4.96	
Blood loss (ml)	Range	120 - 400	160 - 1160	<0.01
	Mean ± SD	241.42 ± 76.61	489.87 ±188.86	
Blood transfusion	Range	0 - 2	0 - 3	<0.05
	Mean ± SD	0.12 ± 0.43	0.6 ± 0.95	
ICU stay (day)	Range	1 - 7	2 - 10	<0.05
	Mean ± SD	2.56 ± 1.42	3.76 ± 1.74	
Incision (cm)	Range	5 - 7	16 - 24	<0.01
	Mean ± SD	5.60 ± 0.65	20.16 ± 2.32	

**Table (4):** Follow-up data.

Postoperative data		Groups		p-value
		Group A	Group B	
Range	Mean $\pm$ SD	56.72 $\pm$ 6.07	56.08 $\pm$ 3.46	0.649
	Range	40 - 67	51 - 65	
PAP	Mean $\pm$ SD	43.48 $\pm$ 9.01	46.24 $\pm$ 10.37	0.320
	Range	30 - 70	25 - 67	
FVC(L)	Mean $\pm$ SD	2.21 $\pm$ 0.61	1.46 $\pm$ 0.46	0.001
	Range	1.41 - 4.54	0.96 - 2.7	
FVC%	Mean $\pm$ SD	57.72 $\pm$ 12.15	38.46 $\pm$ 10.70	0.001
	Range	39.1 - 80.2	27.6 - 65.2	
FEV1(L)	Mean $\pm$ SD	2.05 $\pm$ 0.63	1.37 $\pm$ 0.43	0.001
	Range	1.41 - 4.19	0.95 - 2.7	
Post-operative pain	Mean $\pm$ SD	3.44 $\pm$ 1.00	7.56 $\pm$ 1.45	<0.01
Total hospital Stay (days)	Mean $\pm$ SD	6.04 $\pm$ 1.10	11.20 $\pm$ 2.45	<0.01
	Range	5 - 10	6 - 15	
Operative Cost (Thousand LE)	Mean $\pm$ SD	17.84 $\pm$ 0.67	14.61 $\pm$ 1.08	0.001
	Range	16.9 - 19	13 - 16	

## DISCUSSION

The age groups in this study were relatively younger which may be attributed to earlier and repeated affection by rheumatic fever, which is endemic in most developing countries including Egypt.

*De Praetere et al. (2015)* found no statistically significant difference in demographics of patients undergoing MIMVS in his study. *Holzhey et al. (2011)* report MIMVS in patients over 70 years.

Preoperative echocardiography showed patients with isolated mitral valve disease (stenosis or regurg) or mitral and tricuspid valve disease with no preferences in assigning patients for each group. *Mariscalco and Musumeci (2014)* found that mitral valve surgery can be routinely done endoscopically.

*Ailawadi et al. (2016)* reported that patients with depressed LV function, more than mild aortic regurg, depressed RV function and PAP more than 80 mmHg should be approached with caution in MIMVS. We found that the smaller the left atrium, the easier the procedure in contrast to the conventional technique.

*Glauber et al. (2015)* showed that one of the disadvantages of MIMVS is that it needs a learning curve for the surgeon and team to be able to perform the procedure through a smaller incision in a faster time. In this study, the cross clamp time and the total bypass time were longer in MIMVS group but without statistically significant difference,

*Modi et al. (2008) and Moscarelli et al. (2016)* found that there was no significant difference between cross clamp

time and the total bypass time between both groups.

In our study, there were attempts for extubating the patients in the operating theatre which already done in six patients. The postoperative ventilation time and total ICU stay in MIMVS group was significantly lower *Modi et al. (2008) and Shah et al. (2013)* showed that post-operative mechanical ventilation and total ICU stay are significantly lower in patients undergoing minimally invasive mitral valve surgery.

We found significant decrease in blood loss and blood transfusion requirements in MIMVS group. As a result of decreasing the demands for blood transfusion, the hazards of blood transfusion are lessened, and the patient's costs are decreased. *Wang et al. (2009) and Ward et al. (2013)* showed that MIMVS is associated with less blood loss and decreased blood transfusion requirements postoperative.

Evaluation of pain by visual analogue pain scale in the study revealed high statistically significant change with low pain sensation in MIMVS group *Santana et al. (2011)* reported less pain in hospital land, after discharge, less analgesic usage, greater patient satisfaction, and a return to normal activity. A statistically significant difference in length of incision was found between the two groups and the same result was found in similar studies (*Modi et al., 2008; Gao et al., 2012 and Shah et al., 2013*).

In group "A", postoperative spirometric study revealed that all mechanical pulmonary function tests had no significant reduction one month after surgery denoting better postoperative pulmonary functions than sternotomy

group. Pulmonary functions deteriorated more in group "B". This was highly statistically significant. Similar results found in (*Modi et al., 2008; Gao et al., 2012 and Shah et al., 2013*).

There was no significant difference in EF%, LV dimensions, LA diameter or PAP between both groups 1 month post operatively. TTE showed well-functioning mitral prosthesis with no paravalvular leak and mild decrease in pulmonary artery pressure in both groups.

*Holzhey et al. (2011)* showed that MIMVS is feasible for mitral valve surgery without affecting the core of surgery or compromising the surgical target. In group A, no patient had superficial wound infection. While in group B three patient had superficial wound infection.

*Aybek et al. (2006); Iribarne et al. (2010) and Shah et al. (2013)* reported that MIMVS were less prone to infection while sternal wounds were more vulnerable to infection.

In our study, the total hospital stay significantly decreased in MIMVS group. Most patients in MIMVS group can be discharged on the third or fourth postoperative day, and the only reason for staying in the hospital was to manage anticoagulation protocols as most of the patients were living outside of Cairo.

*Galloway et al. (2009) and Suri et al. (2009)* reported that MIMVS patients had a shorter length of stay than sternotomy patients.

In this study, MIMVS has more cost than conventional group as it is a starting program in our institute. *Iribarne et al. (2011) and Ritwick et al. (2013)* reported

that MIMVS was associated with a significant reduction in costs. The cost savings associated with MIMVS could potentially be an underestimate in our analysis because we only included costs associated with the surgical admission. Further cost savings associated with MIMVS could be realized if the time horizon of our economic analysis was expanded to one year.

### CONCLUSION

In patients with mitral valve disease, minimally invasive surgery can be an alternative to conventional mitral valve surgery. Right anterolateral mini-thoracotomy provided excellent exposure of the mitral valve and offers a better cosmetic scar.

There was comparable short-term mortality and in-hospital morbidity between both groups. Pain perception, transfusions, postoperative blood loss, duration of ventilation, ICU, hospital length of stay and early return to normal life activity were reduced in mini-thoracotomy group than conventional sternotomy group.

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## النتائج المبكرة للجراحات محدودة التداخل باستخدام منظار تجويف الصدر مقارنة بالجراحات التقليدية في أمراض الصمام الميترالي

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**خلفية البحث:** جراحات الصمام الميترالي محدودة التداخل باستخدام منظار تجويف الصدر تتميز بأن لها مظهر تجميلي بديلاً للطريقة التقليدية التي ينتج عنها ندبه سيئة، والتي هي أكثر عرضة لحدوث الإلتهابات وتلوث الجرح.

**الغرض من البحث:** المقارنة بين النتائج المبكرة للجراحات محدودة التداخل باستخدام منظار تجويف الصدر مقارنة بالجراحات التقليدية في أمراض الصمام الميترالي  
**المرضي وطرق البحث:** أجريت هذه الدراسة على ٥٠ مريضاً.

تم تصنيف المرضى إلى مجموعتين متساويتين:

- المجموعة (أ): (مجموعة التداخل المحدود) الذين يحتاجون إلى جراحات الصمام الميترالي باستخدام منظار تجويف الصدر.
- المجموعة (ب): (مجموعة التدخل التقليدي) الذين يحتاجون إلى جراحة الصمام الميترالي عن طريق شق عظمة القص.

**النتائج:** لم يكن هناك فروق ذات دلالة إحصائية فيما يتعلق بالعمر، والجنس، وأعراض المرض ودرجة شدته، كما كشفت نتائج الموجات الصوتية على القلب قبل الجراحة ودراسة وظائف الرئة قبل الجراحة عن عدم وجود دلالة إحصائية.

وفيما يتعلق بالمقارنة أثناء العملية، لم يكن هناك فروق ذات دلالة إحصائية في وقت إيقاف عضلة القلب ووقت ماكينه القلب الصناعي، ولكن هناك فرق في مجموع وقت الجراحة الكامل داخل غرفة العمليات وقد يكون هذا الاختلاف بسبب حداثة الطريقة الجديدة باستخدام منظار تجويف الصدر.

وقد كان طول الجرح أقل بشكل ملحوظ في المجموعة "أ" عما كان في المجموعة "ب"، كما كان هناك اختلافاً كبيراً في وقت الرعاية المركزة. وكان وقت استمرار المريض على جهاز التنفس الصناعي أقصر في مجموعة "أ"، وكان فقدان الدم ونقل الدم أقل في مجموعة "أ".

وكانت مدة استمرار المريض في وحدة العناية المركزة أقصر في مجموعة "أ". وتم إنخفاض الوظائف الرئوية بعد الجراحة بشكل ملحوظ في المجموعة "ب"، عنها في المجموعة "أ"، وكان هناك ألم أقل بكثير بعد العملية الجراحية في المجموعة (أ) عنها في المجموعة (ب) كما كانت مدة الإقامة في المستشفى أقل في المجموعة (أ) منها في مجموعة (ب).

**الخلاصة:** جراحات التدخل المحدود باستخدام منظار تجويف الصدر لعلاج أمراض الصمام الميترالي الصحيح ليست متميزة فقط بصغر شكل الجرح الأفضل من حيث المظهر التجميلي، ولكنها تتميز أيضاً بقصر مدة الإقامة في الرعاية المركزة وقصر فترة التواجد في المستشفى، وسرعة العودة لممارسة الحياة بصورة طبيعية بعد الجراحة، كما تتيح التدخل بطريقة أسهل في حالة الإحتياج إلى جراحة قلب مفتوح مرة أخرى.