

RIGHT ANTERIOR THORACOTOMY VERSUS UPPER MINISTERNOTOMY IN AORTIC VALVE REPLACEMENT

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ABSTRACT

OBJECTIVE: to provide a comparison of outcomes between right anterior thoracotomy (RAT) and mini-sternotomy (MS) as approaches for surgical AVR.

METHODS: This is an observational, cohort study of data collected prospectively from patients who underwent aortic valve replacement between January 2019 and December 2019 At National heart Institute, Cairo, EGYPT.

RESULTS: RAT showed increase in bypass and cross clamp time while MS showed more ventilation time.

CONCLUSION: MS should be considered the approach of choice for isolated AVR as it is safe, easy and reproducible technique.

Key words: AVR, right thoracotomy, mini sternotomy.

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INTRODUCTION AND AIM OF THE WORK

The need for less invasive procedures used for AVR is crucial due to the continuous rise in cases of aortic valve diseases especially aortic valve stenosis which is markedly increasing in the old age group.^{1, 2} replacement of the aortic valve through a less traumatic and less invasive procedures, although more technically demanding and time consuming, has good results regarding mortality and outcome in comparison to conventional technique used to replace the aortic valve.³ Among the common techniques for minimal invasive aortic valve replacement (MIAVR) is the upper ministernotomy (MS) and right anterior thoracotomy (RAT). Few studies comparing both techniques regarding mortality

and outcomes are providing a little data about superiority of one technique over the other. Even the recent guidelines are not giving any preference to either of them.^{4,5} With increasing number of centers adopting the concept of minimally invasive procedures, the choice and preference of a technique is becoming crucial. This study aims to compare two techniques RAT & MS used for AVR regarding their outcome.

PATIENTS AND METHODS:

This is an observational, cohort study of data collected prospectively from patients who undergone first do aortic valve replacement between January 2019 and December 2019 At National heart Institute, Cairo, EGYPT. A total of 30 patients were included, 15 of them had RAT (group A) and another 15 underwent MS (group B). All patients with combined cardiac diseases, chest wall deformities, and patients with redo-surgery (previous cardiac and chest surgeries), calcified ascending aorta, small aortic root less than 19mm or aneurysm of aorta or aortic sinuses which may necessitates aortic root dilation or replacement ,previous radiotherapy or pericarditis, were excluded. All patients were subjected for routine preoperative preparation with the patients in RMT group were subjected for a preoperative CT chest to detect feasibility for right anterior thoracotomy(1- The ascending aorta should be shifted to the right by more than its half in relation to the right border of the sternum in the same plane of the main pulmonary artery, 2-space between the ascending aorta and the sternum should be less than 10 cm, 3-Angle between plane of inclination of the ascending aorta and the mid-line should be more than 45 °(6.)

Surgical technique: Group A , all patients were intubated with single lumen , Trans-esophageal echocardiogram TEE is inserted, elevation of right chest slightly about 30 degrees, exposure of the groin for femoral cannulation, a marker is used to identify the midline in case a median sternotomy is used. Entry of the chest wall through the second space. The pericardial cavity is entered after identifying the phrenic n, extending downwards to the inferior vena cava and upwards to the ascending aorta with meticulous hemostasis of the thymic fat. Pericardial stay sutures are placed around the aorta. Aorta is cross clamped using chitwood clamp passing through anterior axillary line after cardioplegia cannula is inserted. Group B: skin is incised with about 8 cm incision extending from the suprasternal notch to the fourth intercostal space, sternotomy was done using oscillating saw

vertically and then to the right side creating a J shaped sternotomy , taking care not to injure the internal thoracic artery. Aorta is cannulated in the highest point in the ascending aorta , venous cannulation through the right atrial appendage, cardioplegia cannula inserted to deliver antegrade cardioplegia.

Statistical analysis

Mean and standard deviations were calculated for continuous variables. Student t test was used to compare continuous variables. Chi-squared was used. A P value <0.05 was considered significant.

RESULTS:

Preoperative demographic and echocardiographic data were almost the same with no statistically significant difference. In group A , age ranged from 18-59 years, while in group B age ranged from 19-62. In group A , there was 8 males (53%) and 7 females (47%), while in group B there was 11 males (73.3%) and 4 females (26.7%) with no statistical significance. The body mass index BMI in group A was 26.4 ± 3.3 and in group B was 31.1 ± 4.1 and A P value 0.001 which is highly significant. Pre-operative echocardiographic assessment including ejection fraction, left atrial dimensions and pulmonary artery pressure were compared for both groups with no statistical difference. Ejection fraction was 62 ± 6.6 in Group A and 61.5 ± 11.0 in group B, giving a P value of 0.710 (NS). PAP was 42.5 ± 7.6 mmhg in group A while in Group B it was 33.2 ± 4.6 mmhg(NS). Cross clamp time was 74.2 ± 28.5 min in group A while in group B it was 51.6 ± 13.5 min with a P value 0.007 showing high statistical significantly difference. Total bypass time was 115.6 ± 30.1 min in group A while in group B it was 72.6 ± 14.7 min giving a P value of <0.007 which statistically has a high significance .Weaning from cardiopulmonary bypass was done without difficulty in both groups , the need for inotropic support in group A was in 9 patients (60%) and in 11 patients (73.3%) in group B with no statistical significance as P value >0.05. Ventilation time was of mean 2.6 hours in group A with 4 patients extubated on table, while in group B it was of mean 5.9 hours with a statistical significance and P value <0.001. blood loss was 330 ± 47 ml in group A while in group B it was 430 ± 77 ml with a P value <0.001 of no statistical significance. ICU stay was 1.9 ± 0.6 days in group A while it was 2.1 ± 0.7 days in group B denoting P value of <0.001 which is considered not significant statistically. No patient in both groups required full sternotomy with no operative mortality . Incidence of post operative atrial fibrillation was (13.3%) in

group A i.e. two patients only, with only one patient in group B (6.7%) all returned to normal sinus rhythm by medical treatment showing no statistically significant difference among the two groups. One patient in each group developed superficial wound infection (6.7%) which both were treated medically. Mean total hospital stay in group A was 5.6 days while in group B it was 5.8 days with P value >0.001 with no statistical difference .

Discussion:

Owing to the good outcome regarding safety, low mortality and complication rates, fast recovery , short hospital stay and good patient satisfaction, Minimally invasive procedures used for aortic valve replacement are increasingly used nowadays and this technique is adopted by many surgeons despite its technically demanding skills. (7)Our study showed that minimal invasive technique for aortic valve replacement using either right anterior thoracotomy RAT or ministernotomy MS is an effective procedure showing good immediate and short term results. By comparing both techniques, they have the same need for inotropic support, same bleeding incidence, same ICU stay, same operative mortality, same incidence of post-operative arrhythmia and same hospital stay. However, right anterior thoracotomy RAT technique have statistically significantly increase in Bypass time and cross clamp time compared with ministernotomy technique. On the other hand, ministernotomy technique has a statistically significant increase in ventilation time. RAT technique needs specific training curve and patient selection as regarding preoperative CT criteria which is not found in every patient compared with ministernotomy technique which does not need specific patient criteria. When Comparing this technique to standard sternotomy, MIAVR showed a low incidence of blood loss, owing to less trauma to the sternum and pericardium and its contents(8).

It is well known and accepted that replacing the aortic valve through right anterior thoracotomy is more technically demanding than conventional procedures, has a limited surgical field and more time consuming . Many surgeons prefer to convert to median sternotomy in case of sub-optimal exposure. Our study showed increase in cross clamp time in RAT group compared to MS denoting that this technique is more technically demanding and consequently time consuming. Despite this more and more surgeons are adopting this technique nowadays. As for less invasive techniques, a learning curve is existing and many authors believe that careful

management of this curve will lead to improvement in outcome (9,10). Surgeons show a great variability in competency, efficiency and number of cases needed to overcome this learning curve. (11).

Right anterior thoracotomy has many advantages over other techniques of aortic valve replacement owing to a small incision and intact sternum. It showed rapid recovery period, better post operative ventilatory parameters and more patient satisfaction due to less post operative pain.(12). Few studies analysing the post operative ventilation time showed that it was a little in favor of right anterior thoracotomy over mini sternotomy , which is beneficial for high risk patients especially older ones. Another study showed that right anterior thoracotomy patients has had a significantly shorter hospital stay than those having mini sternotomy(13). A study containing more than four thousands patients showed that AVR using minimal invasive techniques has a better outcomes regarding low mortality rates, shorter hospital stay, better ventilatory parameters, despite of having more operative and aortic clamp time and longer bypass times(8). Other studies have showed the relative advantages of minimal invasive AVR through the right anterior minithoracotomy approach. Other authors obtained very good results with low mortality rates, low post operative arrhythmias, less need for blood products, better ventilatory parameters and short hospital stay in patients having minimal invasive procedures for AVR.(14,15,16). Another study similar to our study comparing both techniques for AVR to conventional sternotomy, showed that less invasive procedures have less in-hospital stay, better ventilation settings with patients in right anterior thoracotomy constituting about 90% of the total number in less invasive limb.(17). Our study showed that RAT had more bypass time and clamp times than those received MS, owing to the fact that it is a more technically challenging procedure. By overcoming the learning curve needed and evolution of new prosthesis especially suture less ones, time needed for performing this procedures will definitely decrease. Obtaining these good results of less invasive procedures especially those undergoing RAT encouraged many authors to compare it with TAVI procedures. Some studies found comparable results between both techniques in terms of morbidity and mortality(18). Some trials showed that TAVI procedure and conventional valve replacement have comparable results with equal mortality and morbidity rates. On the other hand TAVI procedure was accompanied by higher rate of vascular complications at site of peripheral

cannulations and more risk of stroke and paravalvular leak(19). This runs in the same line of our study as we did not face any vascular complications which renders right thoracotomy as a possible alternative for TAVI procedure in the future.

Conclusion:

Upper ministernotomy MS is a safe and rapid procedure and should be considered the first choice of less invasive procedures for isolated aortic valve replacement surgery. However , with the evolution of suture less prosthetic valves it might be more widely used especially as an alternative for TAVI procedure.

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