A PROSPECTIVE STUDY ON LIMITED ACCESS APPROACH FOR CARDIAC SURGERIES

Cardiology

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ABSTRACT

The application of limited access approaches in cardiac surgery is widely accepted at present. We routinely perform minimally invasive cardiac surgeries at our institution. In this study, we review our experience of minimally access cardiac surgeries performed between March 2018 to October 2019 using standard instruments. 12 patients underwent AVR through upper ministernotomy, 7 patients underwent Atrial septal defect repair, 9 patients underwent Mitral valve replacement, 1 patient underwent Left atrial Myxoma excision, 3 patients underwent Coronary artery bypass graft through a thoracotomy approach and 1 patient had a pacemaker placement through a limited access approach by a subxiphisternal incision. The mean cardiopulmonary bypass time is 98.48 min, the mean cross clamp time was 60.0130 minutes and the mean overall hospital stay was 4.9 days.

KEYWORDS

Limited access; cardiac surgery; Minimally invasive.

INTRODUCTION:

Minimally invasive cardiac surgery has been evolving rapidly in the recent years. The recorded incidence of trauma, infection and blood loss by this approach is lesser when compared with the results of the full sternotomy method. Newer techniques for cardiac operations are being evaluated for their potential to reduce perioperative morbidity and accelerate postoperative recovery. Careful evaluation of the ministernotomy technique is required to determine its usefulness as a uniform approach for most cardiac operations, as compared with the standard procedure.⁽¹⁾

AIMS AND OBJECTIVE:

To study and compare the advantages and disadvantages of a limited access sternotomy when compared with a full median sternotomy in our institution by assessing various intraoperative and postoperative outcomes of limited access sternotomy and full median sternotomy.

METHODS:

Patients of either sex undergoing atrial septal defect closure, mitral valve replacement, aortic valve replacement under general anaesthesia from March 2018 to October 2019 scheduled for in CTVS OT . I.P.G.M.E&R. 50 patients undergoing limited access sternotomies were included in the case group. 50 patients undergoing full median sternotomies were included in the control group.

Patients undergoing redo cardiac surgeries, with body mass index of more than 35, with uncontrolled diabetes mellitus and pre existing chest wall deformities were excluded from the study. Each group was studied under specific intraoperative and postoperative parameters. The results obtained were compared with the existing data in the literature to draw the conclusions. This is a prospective, case-control descriptive study.

Each group was studied under the following intraoperative and postoperative parameters:

- Cannulation time
- Cardiopulmonary bypass time
- Cross clamp time
- Transfusion requirement
- Chest drain (24hours)
- Ventilator extubation time
- Inotropic support required
- Requirement of analgesia
- Visual analog scoring of pain post extubation
- Number of cases requiring re exploration and the reasons
- Number of days in ICU
- Overall hospital stay
- Wound assessment at day 1, 3, 5, 7

• Mortality

The data was entered in Microsoft excel 2010 and imported to SPSS 23 for analysis. The results were expressed in percentages and proportions.

12 patients underwent Aortic valve replacement (AVR) through upper ministernotomy, 7 patients underwent atrial septal defect (ASD) repair, 9 patients underwent mitral valve replacement (MVR), 1 patient underwent Left atrial myxoma excision, 3 patients underwent coronary bypass grafting (CABG) through a thoracotomy approach.

TECHNIQUES:

UPPER MINISTERNOTOMY FOR AVR:

Fig.1: Incision For Upper Ministernotomy

Fig.2: Post Operative Scar Of An Upper Ministernotomy

A manman electric saw is used to cut sternum from suprasternal notch to tip of arrowhead. The saw is then engaged in the 3rd intercostal space to cut the sternum on line previously made to join arrow tip.

Lower Mini Sternotomy For Mitral Vave Replacement, Atrial Septal Defect Closure, Ventricular Septal Defect Closure And La Myxoma Excision:

Fig:3: Incision For A Lower Ministernotomy

The 3rd intercostal spaces is identified on either side one space below sternal angle and space is created lateral to sternum, carefully avoiding injury to intercostal vessels.

Midline from 3rd space level to tip of xiphoid is marked with arrow shaped marking at top end, with tip at level of one space above marked intercostal space.

Sternotomy is done below upwards with manman saw , first from midline and then spaces to midline on the marking.

THORACOTMOY FOR MITRAL VALVE REPLACEMENT AND ASD CLOSURE:

Fig 4: Marking Of The Incision For Thoracotomy For ASD Repair

An incision of 3-5 cm is placed in the submammary crease. Adequate undermining of the soft tissue is done to gain better access. An anterior or anterolateral thoracotomy is done to carry out the surgeries. Standard procedures of establishing cardio pulmonary bypass is undertaken. Peripheral cannulation of the femoral vessels was done when necessary. We have used VATS in cases where direct visualization of the field was difficult.

THORACOTOMY FOR CABG:

Fig: 5: Thoracotomy For CABG

A posterolateral thoracotomy is done over the 4th intercostal space. The skin incision is 8-9 cm and we perform adequate undermining of the soft tissue in order to achieve good access without having to extend the skin incision further. We have been able to graft the left internal mammary artery to the left anterior descending artery by this approach. In cases where the Ramus intermedius artery or the Obtuse marginal artery needed to be grafted, we have used a reverse saphenous vein graft after anastomosis to the aorta through the same access.

However, when the aorta cannot be accessed, after completing the distal anastomosis, we perform an upper ministernotomy and then anastomose the reverse saphenous vein to the aorta.

RESULTS:

Table1: Group Statistics

	Type of Procedure	N	Mean	Std. Deviation	Std. Error Mean
CPB(Min)	Minimal Intervention	46	98.48	52.072	7.678
	Conventional	46	72.85	27.461	4.049
CROSS CLAMP(Min)	Minimal Intervention	46	60.9130	41.76699	6.15821
	Conventional	46	49.4965	26.39810	3.89219
VISUAL ANALOG SCORING	Minimal Intervention	50	2.96	1.470	.208
	Conventional	50	7.14	.729	.103
ICU STAY(Days)	Minimal Intervention	50	1.30	.931	.132
	Conventional	50	1.14	.351	.050
OVERALL HOSPITAL STAY(days)	Minimal Intervention	50	4.90	1.216	.172
	Conventional	50	5.00	.700	.099
AGE	Minimal Intervention	50	44.86	14.786	2.091
	Conventional	50	46.70	12.256	1.733
EXTUBATION TIME(Hours)	Minimal Intervention	49	9.31	2.374	.339
	Conventional	50	11.14	1.678	.237

1. Mean age in the limited access group was 44.86+/-14.786 (sd) and 46.70+/- 12.256 in the conventional group
2. 61% of the patients were male and 39% were female.
3. The mean cardiopulmonary bypass time was 98.48 +/-52.072 min for the limited access group and 72.85+/-27.461 min for the conventional group
4. The mean cross clamp time for the limited access group was 60.9130 +/-41.76699 min and 49.4965 +/-26.39810 min for the conventional group.
5. The mean time required for cannulation was 46.76 min for the limited access approach cases and 32.96 minutes for the conventional group.
6. The mean visual analog score was 2.96+/-1.470 for the limited access group and 7.14+/-0.729 for the conventional group.
7. The mean number of days of ICU stay are 1.30+/-0.931 for the limited access group and 1.14+/-0.351 for the conventional group.
8. The mean number of overall hospital days are 4.90+/-1.216 for the limited access group and 5.00+/-0.700 for the conventional group.
9. The mean number of hours to extubation in the limited access group is 9.31+/-2.374 hours and 11.14 +/-1.678 for the conventional group.
10. Significantly higher proportion of minimal intervention cases had single chest drains compared to conventional surgeries . p value < 0.001
11. Significantly higher number of conventional cases required inotropic support. P value < 0.001
12. Significant higher percentage of Conventional procedures require reexploration. p value is .046
13. The mean number of packed red blood cells transfused for the limited access group patients was 2.22 and for the conventional group was 2.64.
14. 2 patients who underwent the limited access approach had wound infection and 3 patients in the conventional group had wound infection.
15. 3 patients in the limited access group had died and 2 patients in the conventional group had died.

DISCUSSION:

In recent times, minimal access cardiac surgery has been advocated in all age groups. This is due to reduced cost , better cosmesis , reduction in pain and respiratory compromise as well as faster recovery leading to reduced hospital stay.²

With continuing improvement in mortality and morbidity after surgery for valvular and congenital heart disease, parameters for patient outcome such as recovery time, pain and discomfort, duration of

hospital stay, cost effectiveness and cosmesis have become significant.³

Specialized equipment to access the heart through smaller incisions were developed, often relying on femoral cannulation for cardiopulmonary bypass. Newer incisions were also developed.² Patient awareness about minimally invasive procedures has also increased with widespread introduction of laparoscopic procedures in various surgical disciplines.

ASD is common especially in adults in developing countries. Closure of ASD and MVR in adults is approached through full sternotomy (18-25 cm), right minithoracotomy (10-12 cm) or lower right sided sternotomy (10-12 cm). There is now scope to reduce the length of these incisions. Cosmesis is particularly important in paediatric and female patients. A right thoracotomy has been used for female patients since several years. A lower mini sternotomy is possible with the use of newer retractors and specially designed cannulas.⁴

In our technique, incision less than 5 cm was used, which was shorter than those in previous reports.

There are several advantages to a lower mini sternotomy: the right atrium lies directly under the lower sternum, hence, the exposure is better and manipulation more comfortable. It is also easy to convert to a full sternotomy if necessary. The sternum can be maintained stable without mobilization of breast tissue. It is also less painful than a mini sternotomy.² There is, of course, better cosmesis with a 3-5 cm incision.

There are alternative incisions, some facilitated by femoral arterial or venous cannulation. But the lower mini sternotomy seems far superior for most patients on the basis of overall safety and reproducibility and no increase in operative time.

Key issues in minimally invasive ASD closure is mode of cannulation and access to vena cavae, made technically difficult by limited exposure.⁴

In congenital heart disease, issues for the surgeon are adequacy of exposure, safe application of cardiopulmonary bypass through central or peripheral site, effective myocardial protection and de-airing before resumption of cardiac ejection.⁵

The limited exposure makes the process of establishing CPB difficult in cases of ASD repair.⁴

The IVC purse string sutures is a frequent source of post operative bleeding which can be prevented by first removing the cannula and placing a hemostatic suture with the atrium partially empty.⁶

In our study, it has been established that the pain is much less for patients who underwent the limited access approach. This led to better patient satisfaction in the postoperative period.

CONCLUSION:

We have been able to achieve satisfactory results with the limited access approach. Hence, it can be concluded that a limited access approach can be successfully applied for a variety of, carefully selected, cases in cardiac surgery.

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