14) A MODIFIED ANAESTHESIA PROTOCOL FOR PATIENTS UNDERGOING MINIMAL INVASIVE CARDIAC SURGERY BY RIGHT THORACOTOMY- A SINGLE CENTER EXPERIENCE.

Thosani R.M.¹, Shah B.K.², Gandhi H.G.³, Sharath Kumar K.⁴, Rawal J. R.⁵,

U N Mehta Institute of Cardiology & Research Centre, B. J. Medical College, Ahmedabad - 16

1. Asst. Professor in Cardiac anaesthesia
2. Professor and H.O.D. in Cardiac anaesthesia
3. Asst Professor in Cardiac anaesthesia
4. Assistant Professor, Department of Cardiology
5. Professor and Head of the Department of Cardiology

Correspondence Address:
Thosani R. M., Assistant Professor of Cardiac Anesthesiology,
U N Mehta Institute of Cardiology & Research Centre,
B. J. Medical College, Ahmedabad - 16

Abstract:

Objectives: Median sternotomy is a well accepted incision for most cardiac surgical procedures. However due to some obvious advantages, now right thoracotomy incision is preferred for some cardiac surgical procedures. The patient position for right thoracotomy necessitates some modifications in anesthesia protocols. In this study we evaluated the feasibility of this approach in selected procedures.

Methods: Between February 2009 and October 2012, 41 patients underwent Cardiac surgery via right thoracotomy. The patients selected for this approach were in ASA Grade-II to III without diabetes or hypertension. The surgeries conducted were Atrial septal defect closure (28 cases), valve replacements (12 cases) and one case of thoracic mass excision. A standardized protocol of anaesthesia induction and maintainence was administered with injection propofol, fentanyl and vecuronium bromide dosed according to the patient’s body weight. Tracheal intubation was carried out with Left sided DLT (double lumen tube) followed by single lumen tube after the surgery for post operative ventilation. A cardiac surgery was performed through right thoracotomy in fourth inter costal space with incision of 4 to 6 cm in size. There was no mortality or significant morbidity in any of these patients and there was decreased bleeding and shortened duration of ICU stay.
**Results:** Feasibility of undergoing complex cardiac surgery by lateral thoracotomy is shown by our experience and we also observed less bleeding and early post operative recovery and ambulation. The approach was highly accepted for cosmetic reasons also.

Keywords: General anaesthesia, Double lumen tube, TEE.

**Introduction:**

In the past 150 years Cardiac surgery has seen rapid growth and significant advances. The first heart surgery was performed by Larrey in 1810 when a stab wound to the heart was operated\textsuperscript{[13]}. Milton from Cairo developed a technique for median sternotomy in cadavers and subsequently excised a tuberculous sternum from young patient\textsuperscript{[12]}. Since then, the approach for all major cardiac surgeries has been a median sternotomy. This incision is well accepted to carry out most of the cardiac surgeries and the anaesthesia management is standardised in most of the centers. This incision is predominantly used in cardiac surgery, but it is a useful incision for many other operations\textsuperscript{[3]}. The incision also allows excellent access to the mediastinum and both pleural spaces; hence it can be used for thoracic operations such as retrosternal goiter excision and esophagectomy. Modifications of median sternotomy such as hemisternotomy have been used for minimally invasive aortic and mitral valve surgery. Median sternotomy is a long incision which begins above the sternal notch and extends 1-2 cm below the xiphoid\textsuperscript{[4]}. The incision may associate with significant bleeding and cosmetic issues.

In the past 25 years minimally invasive Cardiac surgery has been catching up with a quest for better cosmetic results with minimal invasion. Lateral thoracotomy is a less invasive approach with advantages such as lesser bleeding, early ambulation, lower infection rates and minimal trauma and better cosmetic appearance with a less noticable scar. This approach is advantageous in younger patients especially in females. Vernick et al have also observed that minimally invasive mitral valve surgery may also reduce Atrial fibrillation incidence\textsuperscript{[2]}. Another advantage of this approach may be in the patient who undergoes repeat cardiac surgery after a prior midline sternotomy. Re-sternotomy in this situation may be hazardous leading to bleeding and damage to
adjacent structures. It is also noted that a sternotomy after a prior thoracotomy does not increase bleeding risks. So a thoracotomy may be advantageous in either ways when a repeat cardiac surgery is contemplated \[^{10}\].

The change in positioning of the patient necessitates changes in anesthesia protocols, in this article we describe our experience in administering anesthesia for 41 patients who underwent Cardiothoracic surgery by thoracotomy. The problems inherent with lateral thoracotomy include: limited exposure of the heart during surgery which poses challenges with management of arrhythmia, problems in achieving haemostasis, myocardial protection and de-airing at the end of surgery. Patient selection for this approach is of paramount importance to avoid complications. Prolonged single-lung ventilation and limited access for rapid intervention pose a great challenge for the anesthesiologist. Occasionally, conversion to median sternotomy may be required and the vigilant anesthesiologist should be ready to manage these situations.

**Material and Method:**

From February 2009 to October 2012, we carried out MICS in 41 patients out of which 27 were female and 14 were male. Mean age was 32.16 years. Patients were in ASA Grade II and III. None of the patients had diabetes or hypertension. There were 28 cases of ASD, 11 cases of valve replacement (9- Mitral Valve Replacements, 2- Aortic Valve Replacements) and one case for double valve replacement surgery and one patient with right thoracic mass excision. Intra operative TEE was used to monitor card activity and complications during surgery.

All patients were anesthetized by a standard protocol of induction by - Inj. Propofol 0.5 to 1mg/kg, Inj. Midazolam 0.05 to 0.1 mg/kg, injection, Fentanyl 3-5 µg/kg and Inj. Vecuronium bromide 0.1 to 0.15mg/kg intravenously. They were intubated endo bronchially by appropriate size of left sided double lumen tube for Right side lung isolation. The Right lateral decubitus position was set by patient lying down in supine position with 15 degree tilt on the right. A sand bag is placed behind the right scapula and one behind the buttock for support. The right arm is placed over the patients head with forearm flexed at the elbow, to facilitate exposure of the 4\(^{th}\) inter costal space. A neck was maintained in neutral position with a pillow. The pelvis was half rotated towards the back to allow access to femoral vessels. The ipsilateral arm was suspended by well padded and held so as to expose the axilla. The surgical repair was done through Right thoracotomy in the 4\(^{th}\) intercostal space with the incision of 4-6cm in size and anaesthesia was maintained by continuous infusion of Inj. Protocol 1mg/kg/hr, Inj. Fentanyl 1-2 mg/kg/hr and Inj. Vecuronium by 0.05mg/kg/hr with the help of 50%
concentration air with oxygen and trace of volatile inhaled anaesthetic agent savoflurane. The cardio pulmonary bypass was performed under standard protocol of heparinisation 300 units/kg and ACT maintained between above 400. The systemic venous returns were done by two stage femoral venous cannula on right side and systemic arterial perfusion carried out by femoral arterial cannulation on the same side. All patients were given thoracic intercostal block by Inj. Bupivacaine in dose of 1mg/kg with the dilution of 0.25%. The endo bronchial intubation was switched to endo tracheal intubation on table after the operation was over by proper size single lumen endo tracheal tube. All patients who were extubated successfully on fast track protocol with 3-4hrs in post operative recovery room after assessing the basic vital parameters, drain and satisfactory criteria of extubation.

Proposed advantages of Median Sternotomy vs Thoracotomy

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<tr>
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<th>Median Sternotomy</th>
<th>Thoracotomy</th>
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<tbody>
<tr>
<td>Mortality</td>
<td>More</td>
<td>Less</td>
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<td>Bleeding</td>
<td>More</td>
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<td>Duration of ventilation</td>
<td>Longer</td>
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<td>Wound infection</td>
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<td>Duration of ICU stay</td>
<td>Longer</td>
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<td>Atrial fibrillation</td>
<td>More</td>
<td>Less ?</td>
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<tr>
<td>Cosmetic appearance</td>
<td>Less</td>
<td>Good cosmetic results.</td>
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**Results:**

In our experience we found less bleeding (average 114 to 290ml in 48hrs), early post operative recovery (average hospital stay 3.5 to 4.5 days) and early ambulation with excellent pain relief. There was no operative or postoperative mortality. In the post operative phase there was no significant morbidity and the Electrocardiogram was normal. We did not encounter any pneumothorax during the post operative period. The patients were happy with the post operative results.

**Discussion:** The Median sternotomy has been a standard approach since many years for all cardiac operations but the disadvantages of this approach are a obvious scar and its cosmetic implications. Lateral thoracotomy has been used to circumvent this problem by many centers especially with young ladies undergoing Atrial septal defect closure. Molavipour et al\(^6\) showed that Atrial septal defect repair can be safely undertaken by this approach and they also showed better cosmetic appearance with this approach. Van Son et al.\(^8\) in their experience of 15 patients showed the feasibility of minimally invasive repair of ASD with good cosmetic results. Aybek et al.\(^7\) recently in their experience of 241 patients who underwent mitral valve operations through right minithoracotomy showed a mortality of 3.3% and acceptable cosmetic results. These results along with ours currently show that in selected patients this approach can be safely used to carry out surgeries such as Atrial septal defect closure and mitral valve operations. Wang et al\(^11\) have also shown the feasibility of operating on ventricular septal defects and Tetralogy of Fallot by right thoracotomy. Lamelas e.t. al.\(^9\) have shown that mitral valve surgery through thoracotomy has distinct advantages over sternotomy in an elderly population. Thus it appears from these studies that minimally invasive cardiac surgery through a thoracotomy is feasible in many subgroups of patients with overwhelming advantages. With advances in surgical technique, the anesthesia protocol also needs to be amended to facilitate the procedure. In our experience of 41 patients we never encountered any significant complication or mortality showing that a modification of anesthesia protocols and surgical technique can result in a successful outcome in most of these patients.
Important aspects of Anesthetic management-

1. Due to a left decubitus position it is very essential and important to place a large bore venous cannula of 16G and intra arterial (radial) cannula of 20 G in left hand to prevent the compression effect in right hand. The groin should be spared for the surgeon for femoral vascular cannulation. The central venous catheter (triple lumen or pulmonary arterial line) should be inserted through the left neck for easy access due to left decubitus position. The right neck should be spared because SVC cannulation may be required from neck through Internal Jugular Vein. So both forms of cannulation require more skill and perfection due to limitations in sites for cannulation.

2. An application of chest lead with aseptic precautions is important to avoid interference in surgical field

3. An application of external defibrillator is a must to treat any arrhythmias throughout the surgery, due to small incision and limitation of excess. This is an important consideration because during lateral thoracotomy treating arrhythmias may be an issue because complete access to the chest is not available.

4. Special care should be taken for pressure points like bony prominences to prevent nerve compressions. Brachial plexus injury is prevented by using cotton pad or roll in axilla.

5. This approach requires special skill and an experience for endo bronchial intubation.

6. The use of intra operative TEE plays a major role in proper placement of systemic venous cannula for cardio pulmonary bypass(CPB), de airing, to detect embolisation and heart pumping(EF) while coming off CPB. Several authors have shown the value of TEE in assessing repair and to detect air in the circulation.

Conclusions

Anaesthesia technique for cardiac surgery by midline sternotomy technique is standardised in most institutes. However, the modifications required for the minimally invasive heart surgery are still developing in many centers. Since it is a relatively new method, there are several aspects worth emphasising like, endo bronchial intubation v/s endo tracheal intubation, use of intra op TEE, de airing of cardiac chambers, defibrillation when required and post op analgesia. We conclude from our initial
experience, that MICS is a cosmetically superior method with less pain and early recovery. It requires special skill on the part of the anaesthetist for endo bronchial intubation, intra op TEE and early recovery anaesthesia. Hence with this approach from the anaesthesia and surgical team, it is possible to reduce hospital stay, post op pain, blood loss and surgery cosmetically more acceptable. Furthermore, studies are needed to compare sternotomy with lateral thoracotomy to establish the superiority of this approach.

References-

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