

MINIMALLY INVASIVE OPEN HEART SURGERY AN EXPERIENCE AT NICVD

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SUMMARY

Objective: This study was done to show that open heart surgical procedures can be done through a small sternal incision. **Design:** This was a single center prospective study. **Place and Duration of study:** Department of cardiac surgery, National Institute of Cardiovascular Diseases, Karachi. The study was completed in two years i-e Jan 1998 to Dec 1999. **Subjects and Methods:** A total of 40 patients underwent open heart surgery via minimally invasive approach through a lower median sternotomy. Of these 22 patients had ASD Closures, 8 underwent CABG Surgery and 10 patients had MVR procedure. The approach was via a small incision 8-10cm in length from xiphoid upwards and asymmetrical lower median sternotomy upto the 2nd 1. C. S. deviated from midline on to the right side. **Results:** 22 patients had ASD Closure of these 21 patients had secundum defects while 1 had sinus venosus defect. In IHD group 2 patients had single vessel disease and 6 patients had 2 vessel disease (LAD & RCA). 10 patient had MVR of these 5 patient had MR while 5 had mixed lesions. These patients had less postoperative pain. Early mobilization was achieved. No incidence of sternal dehiscence was noted. The scar was cosmetically much better than the conventional sternotomy scar and was completely hidden under the shirt.

Conclusion: Open heart surgery is possible through a minimally invasive procedure. The advantages of the procedure are less trauma, less postoperative pain, reduced risk of infection. Patient recovery is quick and excellent cosmetic result.

INTRODUCTION

The longitudinal median sternotomy (with 20cm long skin incision) has been, since the beginning of Cardiac Surgery, the best approach for most cardiac operations. It allows wide exposure of the heart and origin of great vessels. One approach to an operative procedure may be depicted as minimally invasive if the said procedure can be effective and safely carried out with less postoperative morbidity compared to the conventional technique. In general surgery, minimizing the invasiveness has been widely accepted to be synonymous with minimizing access. In the specific context of heart operations, however many believe that it is avoiding the use of cardiopulmonary bypass that is the most effective method of reducing the morbidity of Cardiac Surgery operations. It is important to appreciate that median sternotomy itself does entail significant morbidity, including notable incidence of rib fractures, brachial plexus injury. So the quality of life is paid by the

patient in terms of surgical invasiveness (i.e. postoperative bleeding, wound infection, thoracic wall instability, wound scar etc). Many surgeons introduced alternative approaches than median sternotomy few years ago to avoid the morbidity. So the minimal invasive approach is designed to prevent possible complications of median sternotomy. The aim of this study was to prove that some open heart surgery procedures can be safely performed through limited lower median incisions.

METHODS

A total number of 40 patients underwent open heart surgery through a lower median sternotomy incision during the period from 1998 to 1999.

These patients were subdivided into three groups.

- A. Patients requiring CABG Surgery.
- B. Patients undergoing MVR (Mitral valve replacement).
- C. Patients undergoing ASD Closures.

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Anaesthetic Consideration and operative procedure: The patient was placed supine on the table. Monitoring utilized was a CVP line, arterial line, ECG display, oesophageal temperature probe. The surgical field was prepared and draped as for classical sternotomy. A low dose narcotic based anaesthesia with short term postoperative sedation with midazolam was used.

A lower midline incision 10-12cm was given from xiphoid upwards. Skin and subcutaneous tissues were divided with cautery then asymmetrical median sternotomy was done upto 3rd C.C. and was deviated to 2nd C.C. S. on the right. A small single blade spreader was used, pericardiotomy was done and stay sutures were applied to the pericardium.

Hypothermic CPB was established with systemic heparinization. Aortic and bicaval cannulation and snaring for MVR and ASD Closures. For CABG single 2 stage venous drainage was used.

Moderate systemic hypothermia and intermittent ischemic arrest was used for CABG Surgery. For ASD Closure and MVR generally cold crystalloid cardioplegia of the St. Thomas type was used. However some ASD's were closed under fibrillatory arrest when difficulty in X clamping the aorta was encountered.

A. IHD: The patient who underwent CABG Surgery had only LAD or LAD & RCA disease. Patients with Cx disease were excluded from the study. A total of 8 patients had CABG Surgery via this approach. These were patients with either LAD or LAD & RCA disease. LIMA was utilized in 7 patients. Two patients had single LAD and 6 patients had 2 vessel disease of LAD & RCA, 5 patients had CCS 111 angina while 3 patients had CCS 111 anginal symptoms.

B. Mitral Valve Operation: The patients undergoing mitral valve replacements were the ones with MR or mixed mitral valve diseases with large LA. Patient with small LA were excluded from study. Only adult patients were included in the study. The LA was opened just behind and parallel to the interatrial groove. The mitral valve was replaced through this approach. An LV vent for deairing was left in after valve replacement through the mitral

valve. Heart was defibrillated with paediatric internal paddles. After cardiac function returned normal CPB was discontinued, cannulae were removed and chest closed in layers after inserting mediastinal drains.

This group comprised of 10 patients. 5 of them had MR while other 5 had mixed mitral valve disease. These valves had rheumatic pathology and were beyond repair

C. ASD Closure: Only isolated secundum type of ASD were considered, one was sinus venosus defect. CPB was established by conventional aortic and bicaval venous drainage and snaring. In cases where difficulty was achieved in exposing and X clamping of the aorta, ASD's were repaired with fibrillatory arrest. Deairing was achieved with LV venting through RSPV. Direct closure done in 8 patients while 14 required patch closure.

Table I
Minimal invasive open heart surgery Age of patients with male/female ratio

Age Range	14 years to 45 years	
Mean age	34 years	
Males	26 patients	65%
Females	14 patients	35%
Male/female Ratio	1.85 : 1	

Table 2
Minimal invasive open heart surgery ASD Closure, CABG and Mitral valve replacement.

Types of Surgery	No. of patients	Percentage
ASD Closure	22	55%
CABG	8	20%
MVR	10	25%

Postoperatively the average duration of intubation was 3 hours and ICU stay on the average was < 30 hours. Average blood loss was < 250mls/24hrs. The hospital stay on average was 5 days. One patient required reexploration for bleeding, transient heart block was seen in one patient, one patient required conversion to full sternotomy. There was one mortality. This was a patient for ASD Closure. The patient required a lot of support while coming off CPB & died the following day in I. C. U. from low output syndrome.

Figure I

Diagram showing lower median sternotomy incision

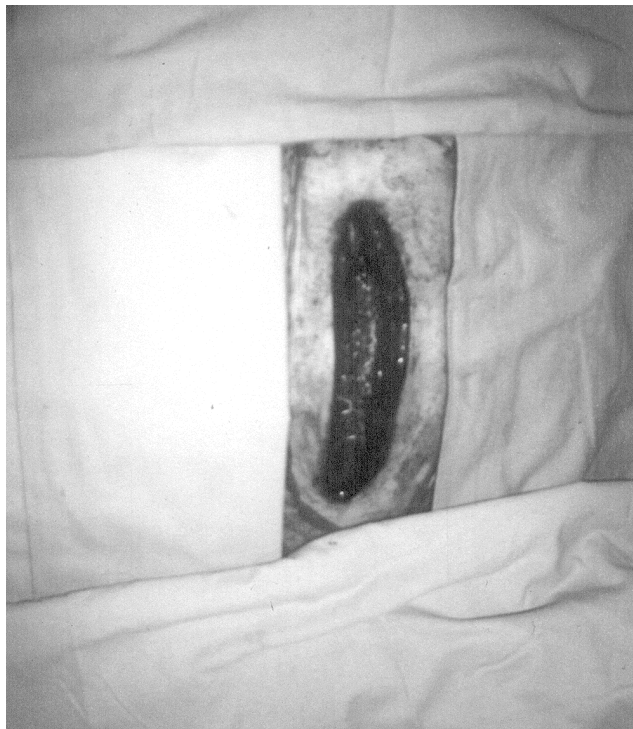


Figure II

Diagram showing patients on cardiopulmonary Bypass via lower median sternotomy incision.

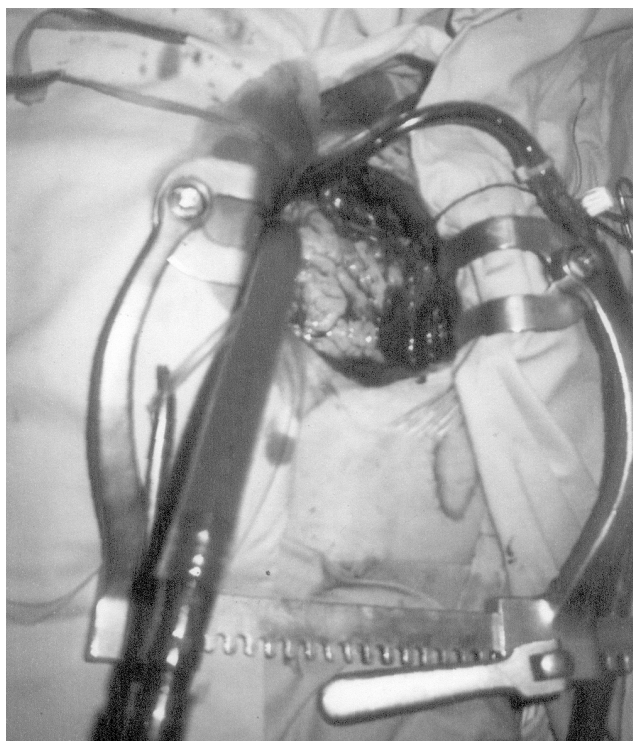


Figure III

Diagram showing cosmetic scar following an open heart surgery via lower median sternotomy



DISCUSSION

The current increase in interest in minimally invasive technique has in part been stimulated by the recognition of their efficacy in other surgical specialties. As modern cardiac surgery improved, the cardiac surgeons all over the world felt to perform these operations by minimally invasive procedures.

Cosgrove & associates first describe the innovative minimal access approach to the aortic/mitral valve operation. Konertz (Berlin) proposed an interesting approach to valve operation, the superior partial para median sternotomy that can permit the surgeon to expose both the aortic & mitral valve. Several other approaches utilizing video assistance through thoracotomy have been published but the elective indications seem to be directed to selected patients. However the definition as to what is minimally invasive remain clouded & often is focused as to the size & location of the incision. Each option should be considered as a trade-off between the exposure provided, the ease & speed of the operation & the postoperative recovery.

The lower median sternotomy, the approach use in

this study, remains faithful to the principle of median approach to the heart & great vessels. A small incision associated with limited sternotomy with a limited opening of the mediastinum usually provides adequate exposure to the heart . 1 5 Routine cannulation can be carried out to establish CPB. In none of our patients, femoral vein/artery cannulation was required. Only one of our patients required conversion to full sternotomy that took place at the end of the operative procedure when difficult was encountered in weaning of CPB. In coronary artery bypass grafting minimal invasive surgical technique without CPB have been used mainly in the management of SVD involving LAD. We have tried a different approach where CPB was used but lower asymmetric sternotomy was used to decrease the morbidity of full sternotomy . However there are certain potential problems with this incision pertaining to revascularization of LAD only or LAD & RCA disease . First full mobilization of IMA is not easily accomplished & exposure of full length of ascending aorta for distal cannulation to allow space for proximal end is not possible . Moreover, placement of aortic clamps on aorta can pose problem particularly side biting clamp for proximal end anastomosis. . The other consideration is exposure of the posterior surface of the heart (circumflex territory) cannot be accomplished through this small incision. This approach also dose not allow complete mobilization of IMA leaving the highest intercostal branch leading to angina due to coronary steal.

We are satisfied with this incision in repairing ASD's, although we have only utilized it for secundum defects but more confidence with this incision will allow us to close the other type of ASD's as well. Whenever difficulty is encountered in X-clamping the aorta, fibrillatory arrests for short time can be used to close the ASD. Deairing with this incision is not a problem. The minimal access approach has been said to contribute rapid recovery & earlier discharge from the hospital. This is because there is less incision pain. less postoperative mediastinal bleeding. In our cases the time of extubation is less than 3 hours & the patient were out of I.C.U. in less than 30 hours. Another important advantage is that the sternum remains very stable as the manubrium is not divided . Moreover cosmetic results are good & all over patients were satisfied with this small thin scar. These patients have an added advantage where

stable manubrium helps preventing sternal dehiscence. The minimal invasive nature of this incision has been the potential of decreasing post operative mediastinitis & wound infection. We encountered no case of sternal infection in our study.

CONCLUSION

Our study shows that minimal invasive approach to many cardiac operations are possible through a modified sternotomy less than full sternotomy. This technique provides many advantages like less trauma, less post operative pain reduces the risk of blood loss & infection. Patient recovery is expedited, quick functional recuperation & excellent cosmetic results. However, the general acceptances to this approach as a routine procedure require long term analysis, a larger series of patients. Although it is safe & cosmetically attractive to many surgeons but should be undertaken by experienced, rather than new surgeons.

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