A new approach to cardiac valve replacement through a small midline incision and inverted L shape partial sternotomy

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Abstract

Objective: Minimally invasive cardiac surgery is becoming more popular as an alternative technique in some cardiac operations. We report our experience with an inverted ‘L’ ministernotomy in 25 patients and describe the technical details of this new approach. Methods: From June 1996 to February 1997 we performed 25 ministernotomy approaches for cardiac surgery, 17 aortic and 7 mitral valve replacements and 1 atrial septal defect closure. A comparison group included all patients (n = 126) operated on for mitral or aortic valve replacement through a median sternotomy since June 1996. Results: Ventilatory support, Intensive Care Unit stay and hospital stay were 8.3 h (SD = 4 h), 25 h (SD = 8 h) and 5.5 days (SD = 3 days) in the L ministernotomy group and 11.5 h (SD = 5), 53 h (SD = 11) and 9.1 days (SD = 4 days) in the median sternotomy group (P < 0.05). Mortality and morbidity are similar to conventional sternotomy (hospital mortality 4% vs. 5.5%; P not significant). Conclusions: We conclude that inverted L ministernotomy for cardiac surgery is a safe approach and can offer some advantages over the conventional approach. © 1998 Elsevier Science B.V.

Keywords: Ministernotomy; Cardiac surgery

1. Introduction

The usual incision in cardiac surgery is the median sternotomy [1]. With the development of minimally invasive cardiac surgery, surgeons are performing cardiac operations without or with cardiopulmonary bypass (CPB) through a small incision to achieve a more comfortable postoperative period and an earlier discharge with a good aesthetic result without increasing morbidity and mortality. We report our preliminary experience in 25 patients and describe the technique of inverted ‘L’ ministernotomy through an upper sternal incision for cardiac operations using CPB.

2. Materials and methods

Since June 1996, 25 patients have undergone cardiac surgery via ministernotomy (one atrial septal defect closure, seven mitral valve replacements and 17 aortic valves). The mean age was 56 years with a range of 28–72 years. Fourteen patients (56%) were males. The mean ejection fraction (EF) was 65% (SD = 12%). During the same period 126 patients were operated on for mitral or aortic valve replacement through median sternotomy. There were no differences in demographic data (mean age 61 years, 43% were males and the mean EF was 0.61).

An approximately 8 cm vertical incision is made beginning 4–5 cm below the suprasternal notch. The sternum is divided using the sternal saw at the 3rd or 4th interspace. At this level the sternum is transected to the right. To avoid injury to the mammary artery, a mosquito clamp is placed into intercostal space against the sternum and opened to separate the artery. The sternal edges are separated carefully with a sternal retractor. The upper pericardium is opened and stay sutures are placed. The ascending aorta and right atrial appendage are cannulated under systemic heparinization. An additional inferior vena cava cannula is placed for cases involving atrial septal defect closure. Encircling the inferior vena cava with tape may be rather difficult but is...
possible. Myocardial protection is carried out using retrograde cold blood cardioplegia in aortic and mitral valve surgery and antegrade cold blood cardioplegia in atrial septal defect closure. Coronary sinus retrograde cannulation is done usually before venous cannulation. This procedure is done under transoesophageal echocardiography (TEE) and pressure monitoring. Controlled reperfusion with substrate enhanced warm blood cardioplegia is used in aortic and mitral valve surgery. Left and right ventricular function during weaning from bypass and prosthesis function was evaluated using TEE. Valve replacement and atrial septal defect closure are performed as usual. Mitral valve replacement is done using the standard approach through an incision parallel to the interatrial groove. A Cooley needle is inserted in the ascending aorta to vent the air. We fill the left ventricle using retrograde warm reperfusion. Pericardial drainages are inserted during CPB while the heart is decompressed and brought out below the sternum. Pacemaker wires are brought out through the divided right intercostal space. Sternal closure is made using steel wires in all procedures.

3. Results

The CPB time was 86 min (SD = 47 min) and cross-clamp time was 55 min (SD = 28 min). Total drainage was 270 ml (SD = 41 ml) and four patients required blood transfusion. Ventilatory support time was 8.3 h (SD = 4 h). The mean Intensive Care Unit (ICU) stay was 25 h (SD = 8 h) and the mean postoperative hospital stay was 5.5 days (SD = 3 days). The mean temperature in the early postoperative period was 36.5°C. Oral ketorolac was used for analgesia with a mean dose of 8 mg/day for the first 2 days.

There has been one hospital death (4%) in the aortic valve replacement group due to postoperative refractory low cardiac output. There have been two superficial wound infections and one patient had to be reoperated on because of sternotomy bleeding using the same incision. No patient had to be converted to conventional sternotomy. Ventilatory support time, ICU and postoperative stay were significantly less than observed in the comparison group (Table 1).

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<td>Results: L ministernotomy versus median sternotomy</td>
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<tr>
<td>L ministernotomy</td>
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<td>CPB time (min)</td>
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<td>Cross-clamp time (min)</td>
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4. Discussion

Minimally invasive surgery is one of the great innovations in health care in the 20th century [2]. At present this modality is gaining popularity in cardiac surgery as an alternative technique. Cosgrove et al. has described a minimally invasive approach for aortic and mitral valve operations through a transverse sternotomy and a 10 cm right parasternal incision, respectively, eliminating the need for a median sternotomy but requiring ligation of both internal mammary arteries or femoral cannulation [3,4]. Another minimally invasive technique involves cardiopulmonary bypass, right anterior minithoracotomy and PortAccess [5,6]. These techniques appear very promising and could provide several potential benefits to the patient: less haemorrhage and infection risk, less postoperative hypothermia, earlier extubation and discharge from ICU and hospital, decreased pain and more comfortable postoperative period, earlier return to normal activities, better aesthetic results and less costs. In addition to these advantages our technique [7] avoids femoral artery and vein cannulation and its associated morbidity and preserves the thoracic wall in its entirety without costal cartilage resection. We feel that appropriate patients for this technique are those who are undergoing mitral and aortic valve replacement. These advantages could only be demonstrated conclusively with more patients and longer follow-up and definitively with randomized studies. Although it could be argued that the technical difficulties of implanting a valve through a small incision could lead to increase paravalvular leaks, we have not yet found such difficulties.

Our ongoing experience indicates that with proper selection of patients cardiac surgery via ministernotomy is safe and effective. Undoubtedly the technique is more demanding and there is a learning curve but if technical difficulties arise the sternum can be divided completely.

References