How-to-do-it

Reversed-J inferior sternotomy for awake coronary bypass

Kaan Kırali,*, Nihan Kayalar, Tuncer Koçak, Cevat Yakut

*a Department of Cardiovascular Surgery, Koşuyolu Heart and Research Hospital, 34718 Kadıköy, Istanbul, Turkey
b Department of Cardiovascular Anesthesia, Koşuyolu Heart and Research Hospital, Istanbul, Turkey

Received 13 September 2004; received in revised form 5 January 2005; accepted 17 January 2005; Available online 7 March 2005

Abstract

Many approaches for minimally invasive coronary bypass surgery are available and to further decrease the invasiveness, coronary artery bypass grafting has been performed under high thoracic epidural anesthesia without endotracheal intubation in the last years. Less invasive approach to coronary artery bypass graft operations is possible through combination of the high thoracic epidural anesthesia and a reversed-J sternotomy, and coronary revascularization can be accomplished without any additional technical difficulties and with a good exposure of both the left anterior descending artery and the left internal thoracic artery. This technique is less traumatic for patients and provides practical better oxygenation and shorter hospital stay.

© 2005 Elsevier B.V. All rights reserved.

Keywords: Thoracic epidural anesthesia; Awake coronary bypass; Skeletonized internal thoracic artery; Partial sternotomy; Reversed-J sternotomy

1. Introduction

Many approaches for minimally invasive off-pump coronary artery bypass grafting (CABG) have gained widespread interest in the last decade. It has been claimed that coronary revascularization approach through a partial inferior sternotomy (reversed-J inferior sternotomy) decreases the invasiveness because of avoidance of splitting of the proximal part of the sternum (manubrium sterni) and preservation of the stability of the superior thoracic aperture which is the main factor of chest stability [1,2]. This approach is the best alternative for single vessel awake coronary bypass.

2. Surgical technique

During operation, high thoracic epidural anesthesia (HTEA) is used to achieve somatosensory and motor block at the T1 to T8 level and motor block of the intercostal muscles while preserving diaphragmatic respiration. No muscle-paralyzing agent, general or local anesthetic agent is used. During the procedure, the head of operation table is lift upwards (<30°) to anaesthetize the lower part of sternum (around xiphoid) with epidural anesthesia. Monitoring of patients includes only continuous electrocardiogram, direct arterial and central venous pressures, and pulse oxymetry. Heparin (5000 IU) is used for anticoagulation. The operating room is kept warm and only warm intravenous fluids are used. Patients spontaneously breath oxygen (4 L/min) through a face mask (Fig. 1(A)).

The skin incision is made from the angle of Louis (at the second rib) down to the xiphoid process. The lower part of the sternum is divided up to the second intercostal space beginning from the bottom. At the level of the second intercostal space the sternum is transected obliquely to the left side with great caution not to damage the left internal thoracic artery (LITA). The LITA is harvested using the semiskelention technique and care is taken not to open the pleural space (Fig. 1(B)). An initial small incision (~1 cm) of the endothoracic fascia is performed by electrocautery along the medial side of the accompanying internal thoracic vein at the third rib. Then the endothoracic fascia is taken down and incised by electrocautery distally at full length of the LITA. The lateral incision is never necessary. All branches are ligated with double hemostatic clips and divided by a scissors. Terminal division usually occurs at the sixth intercostal space, before lateral musculophrenic and superior epigastric branches, to preserve this distal bifurcation for avoidance of excessive sternal devascularization. The second branch must be divided to get more mobility, whereas the first branch is left intact. The LITA is wrapped in a papaverine-soaked sponge. Then, the pericardium is opened over the left anterior descending artery (LAD) leaving the pericardium intact over the aorta. The LITA-LAD anastomosis is performed with a running 7-0 or 8-0 polypropylene suture using a mechanical stabilizer (Fig. 1(C)). One drain is
positioned in the pericardial cavity (Fig. 1(D)). The lover part of the sternum is then closed with sternal wires.

Between September 2003 and December 2004, 19 patients (52.3 ± 10.9 years) underwent elective single vessel revascularization under HTEA without endotracheal intubation. A reversed-J inferior sternotomy was performed in all patients. An additional dose of a local anesthesia at the xiphoid was not necessary. The opening of the left pleura was as a small hole in three patients, which were repaired, and unilateral pneumothorax developed in the other four patients. The main drainage was 370 ± 215 mL (min 50 mL), the main stay in the intensive care unit (ICU) was 13.2 ± 8.8 h (min 2 h) and in hospital 2.8 ± 1.1 days (min 2 days).

3. Comments

With increasing popularity of minimally invasive cardiac surgery using HTEA without general anesthesia in fully awake patients became possible [3-6]. Benefits of using HTEA during CABG procedures are avoidance from potential complications caused by general anesthesia and intubation; block of cardiac sympathetic nerve activity and inhibition of the myocardial stress response, dilatation constricted coronary vessels, increasing myocardial blood flow, decreasing ventricular and supraventricular arrhythmia; beneficial effects on coagulation profile and reduction of intraoperative stress and postoperative pain.

Combination of HTEA with a mini-sternotomy technique decreases the invasiveness of the operation and provides certain benefits. We believe that the reversed-J sternotomy has a beneficial effect on pulmonary function as a result of the preservation of the stability of the superior thoracic aperture, especially intra-operatively. This may not be so apparent in patients undergoing intubation and general anesthesia but it will be important in patients spontaneously breathing throughout the operation. When it is necessary to revascularize the right coronary artery, we prefer using of the right internal thoracic artery through a mini-T sternotomy [7].

Because the heart lies more left in the thorax, it is more difficult to open the left pleura during the reverse J sternotomy, because the left pleura cannot find any place between the lower part of the sternum and the pericardium. The reversed-J sternotomy also decreases postoperative bleeding. The extensive dissection of mediastinal tissues, excessive use of cautery and multiple chest tube sites are the sources of excessive bleeding, wound infection and increased pain, which are the well known side effects of full median sternotomy.

In conclusion, the reversed-J sternotomy is less traumatic for awake patients and provides practical advantages. Its advantages can be normal ventilation during surgery, less postoperative pain, faster postoperative recovery, better postoperative pulmonary function, cost-effective with short ICU and hospital stay, and earlier return to work. The last advantage of the partial J sternotomy technique is easily application by every cardiac surgeon. Furthermore, a conversion to full sternotomy is much easier than the other small thoracotomy approaches. Cosmetic disadvantage of a longer incision scar is also important from the patient’s perspective.

References