The Heart Surgery Forum #2005-1120
8 (4), 2005 [Epub May 2005]
doi:10.1532/HSF98.20051120

Online address: http://cardenjennings.metapress.com/link.asp?id=112496

A Novel Figure A-Shape Sternal Retractor for Off-Pump Coronary Artery Bypass Grafting

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ABSTRACT

A novel figure A-shape sternal retractor was developed to avoid brachial plexus injury caused by sternal wide separation, and facilitate exposure of circumflex artery by elevating a rake and dropping the heart into the right pleural cavity during off-pump coronary artery bypass grafting. In addition, it has several notches to hold deep pericardial stitches in order to enhance the exposure.

INTRODUCTION

Recently, off-pump coronary artery bypass grafting (OPCAB) has evolved into a widely accepted procedure for coronary revascularization [Kamiya 2004, Puskas 2004]. However, some surgeons feel that there is some difficulty in the exposure of circumflex or posterior interventricular artery, and maintenance of blood pressure during anastomoses of such coronary arteries, which results in incomplete revascularization [Desai 2004]. In regard to this matter, they sometimes try to open the sternum relatively widely to obtain a good surgical field, which might result in brachial plexus nerve injury by wide sternal separation. In this report, we introduce a novel figure A-shape sternal retractor, which enables us to avoid nerve injury and enhance the good exposure for OPCAB.

TECHNIQUE

Wide separation of the upper sternum can cause brachial plexus nerve injury. The sternal retractor we developed can solve this problem by minimizing separation of the upper sternum (Figure 1). It consists of 3 essential parts: a chest-opening device with handle, a blade which has several notches to hold deep pericardial stitches, and also the angle of this blade is changeable to avoid extension of brachial plexus nerve, and a retractor rake with screw attachment to facilitate the exposure of left internal thoracic artery (LITA) (Figure 2).

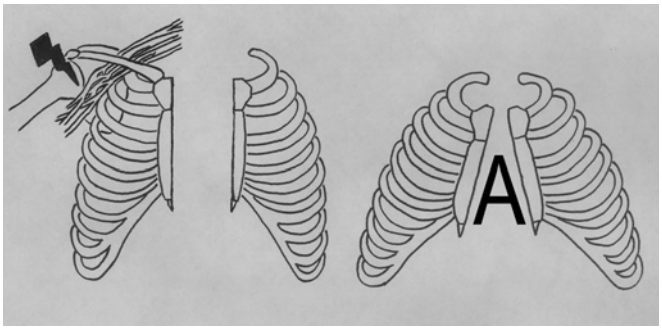

Figure 1. Brachial plexus nerve can be injured by wide separation of the upper sternum (left). The Figure A-Shape Sternal Retractor we developed can solve this problem by minimizing separation of the upper sternum (right).

This retractor has been used in 10 patients who underwent OPCAB in Kanazawa University Hospital. After median sternotomy, we routinely use this sternal retractor to harvest LITA. The handle of the chest-opening device is

Figure 2. The figure A-shape Sternal Retractor consists of 3 essential parts: a chest-opening device, a blade which has several notches for deep pericardial stitches, and a retractor rake with the screw attachment.

Received March 30, 2005; accepted April 1, 2005.

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Figure 3. The exposure of LITA is enhanced by the rake with the screw attachment.

Figure 4. The retractor is moved upside down after LITA harvesting. It is considered to be atraumatic, because we do not have to open the upper sternum widely for exposure.

located in the caudal position, and the exposure of LITA is enhanced by the rake, the angle of which is changeable by the screw attachment (Figure 3). After LITA is harvested, the retractor is moved upside down (Figure 4). Because of this unique figure-A shape, we have never seen the patients who complained about pain or paresthesia of the upper extremities after surgery. First, we usually anastomose LITA onto left anterior descending artery using deep pericardial stitches which are held on the suture holder that the blade has (Figure 4). Next, the rake is located in the right side of the patient, so we can drop the heart into right pleural cavity easily by elevating the rake. It is considered to be very important, because rotation of the heart toward right pleural cavity can enhance the exposure of circumflex artery. In addition, deep pericardial stitches can be held by this unique retractor for circumflex artery.

DISCUSSION

OPCAB has been gaining the popularity for the recent years. OPCAB may decrease the mortality and morbidity related to cardiopulmonary bypass in heart surgery. Although some devices including heart stabilizer or heart positioner have evolved in order to obtain a motionless surgical field, one of the concerns regarding OPCAB is the exposure of circumflex artery without deterioration of homodynamic status [Mathison 2000]. The retractor we are now using enables us to enhance the exposure of the back wall of the heart, and we seldom see hemodynamic deterioration, because we can elevate the rake and drop the heart into a right pleural cavity by the screw attachment, which can prevent the heart from compression of the right ventricle.

Brachial plexus nerve injury is one of the annoying problems to the patients who underwent OPCAB with median sternotomy [Vahl 1991]. Unlike arrested hearts, it is sometimes difficult to lift the beating heart in the narrow surgical field without hemodynamic deterioration. To be on the safer side, we occasionally open the sternum relatively widely in order to obtain a good exposure of circumflex artery and avoid hemodynamic deterioration caused by compression of the right ventricle. In that sense, this unique figure A-shape retractor is important to avoid brachial plexus nerve injury, because we can avoid wide upper sternal separation.

This retractor also has several notches to hold deep pericardial stitches. They can facilitate exposure of circumflex or posterior interventricular artery. In OPCAB, it is imperative to make a good surgical field, because the heart is beating during operation.

This novel retractor enables us to harvest LITA without difficulty, make a good surgical field, and avoid brachial plexus nerve injury because of that unique A-shape. We believe that more and more surgeons are going to get interested in the chest-opening instrument to facilitate OPCAB procedure.

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