New ideas - Thoracic non-oncologic

Modified Nuss repair for pectus carinatum

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Abstract

A minimally-invasive modified Nuss technique is described for pectus carinatum which has reduced risk of cardiac perforation compared to a standard Nuss procedure, and avoids performing the Ravitch procedure. © 2010 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Nuss repair; Pectus carinatum

1. Introduction

The Nuss procedure is increasing in popularity due to reduced wound size [1]. The Ravitch procedure, however, still remains the gold standard with regard to pectus excavatum or carinatum correction [2]. The mechanics of the Nuss procedure mean it is not adaptable for carinatum corrections [3]. We describe a modification of the Nuss for carinatum correction. The procedure has the added advantage of reducing the risk of cardiac injury associated with the Nuss procedure [4].

2. Technique

A small midline vertical incision is performed at the xiphisternal level, together with bilateral thoracoscopy port incisions (Fig. 1). Blunt dissection develops a subxiphoid plane. The patient is ventilated on the right lung to allow the safe passage of a Roberts clamp from the subxiphoid plane to the left thoracoscopy port incision using finger guidance. A tape is passed between the two. This is repeated on the right-hand side. The tape allows safe passage of the bar from one side to the other as the bar follows the tunnel created by the tape. A flat metal spatula one inch wide is introduced behind the sternum, to protect the heart, and to allow the passage of a sternal wire through the sternum, around the bar and back up through the sternum. The pectus bar is secured to the ribs at each thoracoscopy port. Pressure is then applied to the sternum to depress it backwards onto the bar. The sternal loop wire is then tightened so the back table of the sternum abuts the pectus bar.

The thoracoscopy wounds are closed and local anaesthetic is again applied. No pleural drainage is necessary.

2.1. Modifications

2.1.1. Excess cartilage

Excess cartilage is frequently encountered at the lower end of the sternum in carinatum cases. This can be shaved off to help create a lower profile anterior chest wall.

2.1.2. Rigid chest walls

For rigid chests not suited for the Nuss procedure two additional modifications can be utilised, both of which involve extension superiorly of the original midline incision. First, if the sternum is very rigid then the incision needs to be extended up to the level that a transverse osteotomy is required to correct the sternum angulation. Second, a ‘lateral release’ of the costal cartilages may be needed on one or both sides. To do this, the periostium is elevated superiorly and inferiorly and the cartilage is divided to allow free movement of the sternum, no cartilage is removed. This may have to be done on multiple cartilages unilaterally or bilaterally. We virtually always leave the lowest cartilage intact to maintain chest wall stability.

2.1.3. Pleural adhesions

Pleural adhesions are occasionally encountered. These can usually be broken down with simple digital dissection, however, a thoracoscope may need to be inserted to aid dissection of difficult/dense adhesions. The thoracoscope can be inserted either via the thoracoscopy port or via the midline subxiphoid dissected space. In these cases, we insert a pleural drain at the end of the procedure. The drain can be brought out either laterally or below the midline incision.

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Fig. 1. Demonstrates the small midline and lateral port incisions. A metal spatula is passed behind the sternum to protect the heart during placement of the restraining sternal wire (top). Coronal and sagittal views of the procedure. Osteotomy and lateral cartilage release requires extension of the midline incision superiority (bottom).

3. Comment

This procedure can easily be done as a day case, however, osteotomy and lateral costal cartilage release tends to be painful requiring overnight stay for analgesia.

Preoperative assessment is crucial to planning this procedure. Simple manual compression of the patients chest in an anterior-posterior direction will easily allow the assessment of sternal and costal cartilage rigidity necessitating the addition of an osteotomy and costal cartilage release. Costal cartilage rigidity is always associated with sternal rigidity, but not necessarily the other way around. Excessive postoperative pain can be prevented by the appropriate use of the horizontal osteotomy and lateral costal cartilage release in the more rigid chest walls.

Anterior chest asymmetry can cause problems with spinal curvature postoperatively. This technique flattens out the front of the chest, without correcting the underlying chest wall geometry asymmetry, potentially causing a secondary scoliosis of the spine as an anatomical correction.

In carinatum patients who have costal recession this technique helps elevate the chest wall laterally, due to the forces created by the bar flattening it anteriorly making for a good cosmetic result.

We would recommend this technique for all but the most severe carinatum corrections.

References