PECTUS EXCAVATUM REPAIR - NUSS PROCEDURE

Alexandru Nicodin1, Eugen S. Boia4, Gabriel Cozma1, Calin M. Popoiu4, Gabriela Nicodin3, Rodica Badeti4, Maria Trailescu5, Ovidiu Adam4, Vlad L. David4

REZUMAT


ABSTRACT

Introduction: Pectus excavatum (PE) is the most frequent anterior chest deformity. In 1998 Nuss et al reported a 10 years experience whit a minimal invasive technique for correction of PE. Material and methods: Between July 2007 and September 2008 five patients underwent minimal invasive surgical repair for pectus excavatum. The surgical interventions were performed by a joined team of thoracic and pediatric surgeons from the Municipal Hospital and “Louis Turcanu” Children Hospital in Timisoara. We present you the operative technique and the results for short and medium term. Results: No intraoperative incidences were recorded and the immediate postoperative course was good for all patients. Therapeutic and cosmetic results were considered good by all patients and their parents. Conclusions: Preliminary results indicate that Nuss procedure is safe with and have excellent outcomes. Key Words: pectus excavatum, minimal invasive surgery, Nuss technique

INTRODUCTION

Pectus excavatum (PE) is the most frequent anterior chest deformity occurring in approximately 1 in 1000 live births.1 Until the 20th century when endotracheal intubation was developed only limited operation could be performed on the chest. First successful repair was reported by Meyer and Sauerbruch in 1911 and 1913.2 M. Ravitch introduced his surgical technique for the correction of PE in the early 50’s. Ravitch technique consists in bilateral resection of the deformed costal cartilage, transverse sternotomy at the level of the last normal rib and placement of a substernal bone graft.3 Later, the bone graft was substituted with an internal metal support bar, passed through the sternum by Wallgren and Sulamaa and posterior to the sternum by Adkins.2 The overall success of Ravitch technique led to its wide adoption and over four decades no significant improvements were made to the surgical repair of PE. In 1998 Nuss et al reported a 10 years experience whit a minimal invasive technique for correction of PE.4 A convex steel bar is inserted under the sternum through small bilateral thoracic incisions. The steel bar is inserted with the convexity facing posterior, and when it is in position, the bar is turned over, thereby correcting the deformity.4 No cartilage resection and no sternotomy are needed. In the late decade a several improvements were added including the routine use of thoracoscopy and the development of a lateral stabilizer.

1 Department of Thoracic Surgery, 2 Department of Pediatric Surgery, Victor Babes University of Medicine and Pharmacy, Timisoara, 3 Department of Anesthesia and Intensive Care, Municipal Hospital, Timisoara, 4 Department of Pediatric Surgery, Louis Turcanu Children’s Hospital, Timisoara, 5 Department of Pediatric Surgery, County Hospital Arad

Correspondence to:
Dr. Alexandru Nicodin, Department of Thoracic Surgery, Victor Babes University of Medicine and Pharmacy, Timisoara, Tel: +40-722-232560. Email: acnicodin@gmail.com

The purpose of this study is to assess the short and medium time results after minimal invasive correction of pectus excavatum and to present our improvements to the original Nuss technique.

MATERIAL AND METHODS

Between July 2007 and September 2008 five patients underwent minimal invasive surgical repair for pectus excavatum. All patients were male with age of patients ranging between 12 and 18 years, mean 14.4.

Anamnestic the deformity was present at birth in all five patients and increased significantly during the past year in two cases. Clinical exam showed mild exertion dyspnoea in two cases. In all patients the deformity was severe with Haller index (HI) ranged between 3.62 and 5.98. The deformity was symmetric in 3 cases. Associated diseases were present in 3 cases: mitral valve prolapsed, myopia, isolated atrial extrasystole, dilated cardiopathy, scoliosis, pulmonary hypertension.

The surgical interventions were performed by a joined team of thoracic and pediatric surgeons from the Municipal Hospital and “Louis Turcanu” Children Hospital in Timisoara.

The Lorenz bar was bent to the desired shape one day before surgery in order to reduce the length of the intervention. The patient is put under general anesthesia with oro-tracheal intubation and an epidural catheter for postoperative pain management is inserted.

The incision for thoracoscope is made in 7th right intercostal space by the mid axillary line. Bilateral thoracic incisions are performed in the mid axillary line at the level of deepest point of the depression. In first 4 patients the incision was transverse while in the 5th case the incision was orientated vertical.

Skin tunnels are raised anterior from each incision to the top of the deformity where the thoracic cavity is entered. When the pleural cavity is opened an iatrogenic pneumothorax is made in order to form the work chamber.

The introducer is inserted facing upwards in the right pleural cavity. Oriented closely to the back of the sternum we slowly passed the introducer through...
the anterior mediastinum to the left pleural cavity. The assistant with his finger introduced in the pleural cavity elevates the sternum when the introducer is passed through the mediastinum increasing the distance between sternum and heart. The assistant expects and guides out the introducer. The introducer is then elevated and pressure applied above the sternum in order to correct the deformity. We attached an umbilical tape to the left end of the introducer and pulled through the tunnel by withdrawing the introducer from the right side. The Lorenz bar with the concavity facing anterior is pulled to the left side using the umbilical tape is for guidance. After the insertion, the bar is turned over with concavity facing posterior. Lateral stabilizer are fitted at each end and sutured to the rib cage.

![Figure 5](image1.png)
Figure 5. By applying pressure on sternum and ribs the deformity is corrected.

![Figure 6](image2.png)
Figure 6. The bar is inserted with the concavity facing anterior.

![Figure 7](image3.png)
Figure 7. Turning over the bar with the concavity facing posterior.

The skin is closed using non-resorbable sutures. Bilateral pleural drainage was necessary in 3 cases and unilateral in 2 cases. Postoperative management includes intravenous antibiotics, anti-inflammatory and analgesic drugs.

![Figure 8](image4.png)
Figure 8. Attaching the lateral stabilizer.

![Figure 9](image5.png)
Figure 9. Postoperative aspect.

**RESULTS**

Time of operation was between 60 and 90 minutes and no intraoperative complications were recorded. Postoperative course was good for all patients and no complication occurred in 4 of the 5 cases. In one patient right pleural effusion developed 14 days from the intervention and was immediately resolved by pleural puncture with no further complication. Postoperative pain and blood loss was minor. Therapeutic and cosmetic results were considered good by all patients and their parents.

**DISCUSSIONS**

Nuss technique for PE correction has become widely popular in the last decade. The lack of cartilage resection and midline incision led to its adoption by
a growing number of surgeons all over the world. The indication for surgical correction is made based on morphological, clinical and psychological criteria. Often clinical findings reveal mild or no symptoms so the only two factors remaining for consideration are the psychological and the morphological one. Previous studies have established that a HI greater than 3.1 surgery for PE should be considered. Indication for surgery was established in all our five cases based on objective criteria (HI>3.1), clinical and psychological criteria.

Age of the patient was also a key factor in the decision for surgery. The goal to obtain a balance between a good malleability of the chest wall and a small recurrence rate made puberty the ideal age for PE correction. Four of our patients are in pre- and puberty.

Nuss technique avoids the anterior thoracic incision, which is used in the open technique, leading in many cases to big, unaesthetic keloids. For further aesthetic benefits we improved the initial technique by performing a longitudinal instead of transversal incision.

Previous studies found that the most frequent complication after Nuss procedure are: pneumothorax (6.9%), wound infection (4.5%), pericarditis (2.4%), bar displacement (1.2%). In our cases complications occurred in one patient whom developed a pleural effusion 14 days from surgery.

In the technique proposed initially by Nuss, CO2 was insufflated in the pleura in order to create the necessary work chamber. We succeeded to perform the operation through the pneumothorax formed spontaneously when the pleural cavity is opened, without CO2 insufflation.

We consider thoracoscopy necessary in order to avoid heart or lung lesions. Thoracoscopy was particularly useful for the two cases where the sternum was in direct contact with the heart. The assistant introduced his finger in the left pleural cavity to expect and guide out the introducer. This adaptation of the initial technique offered a better control for introducer. An additional adaptation used by us is to elevate the sternum when the introducer passed through mediastinum increasing the space between the back of the sternum and the heart. This maneuver is achieved by introducing a finger inside the left pleural cavity through the site prepared for the left side exit of the introducer. In this way Rockitansky’s subxiphoid incision becomes unnecessary.

The most highly invoked inconvenience for Nuss operation is greater postoperative pain. For our patients the pain level was lower than that cited before and pain management was done mainly by intravenous drugs and was need only for a short time. The epidural catheter was necessary only in 2 cases and for 3 days only.

CONCLUSIONS

Nuss operation for PE correction is a safe surgical technique with low level of complication and low postoperative pain. Hospital stay is short. Blood loss and patients discomfort is minimal. Cosmetic outcomes are good with an almost invisible scar. Overall, the minimal invasive correction of PE has excellent outcomes.

REFERENCES