IV. PEDIATRIC SURGERY

MINIMALLY INVASIVE REPAIR OF PECTUS EXCAVATUM – CASE REPORT

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Abstract

The Nuss procedure is a minimally invasive technique using a retrosternal bar to repair pectus excavatum. Although its technical simplicity and cosmetic advantages are remarkable, early applications have been limited to children with symmetrical pectus excavatum. We report a 13 year old boy presented with pectus excavatum to witch we applied operative treatment, using principles of minimal-access surgery and thoracoscopy combined with placement of a Lorenz bar. The surgical intervention was accoplishied in the colaboration with our colleagues from Department of Thoracical Surgery Emergency Clinical City Hospital Timisoara witch provides us the logistical support.
Key words: Pectus excavatum, Nuss procedure, MIRPE

Introduction

Pectus excavatum is a congenital chest wall deformity in which several ribs and the sternum grow abnormally, producing a concave appearance in the anterior chest wall.

Pectus excavatum is the most common type of congenital chest wall abnormality (90%), followed by pectus carinatum (5-7%), cleft sternum, pentalogy of Cantrell, asphyxiating thoracic dystrophy, and spondylothoracic dysplasia. Pectus excavatum occurs in an estimated 1 in 300-400 births, with male predominance (male-to-female ratio of 3:1) [1,2]. The condition is typically noticed at birth, and more than 90% of cases are diagnosed within the first year of life. Worsening of the chest's appearance and the onset of symptoms are usually reported during rapid bone growth in the early teenage years. Many patients are not brought to the attention of a pediatric surgeon until the patient and the family notice such changes. Most patients are asymptomatic and present for esthetic correction[3]. Cardiac function is usually normal, but mitral valve prolapse has been reported in 20-60% of cases. Echocardiography reveals an improved cardiac index upon exertion after operative repair of the deformity[4]. The long-term health risks of patients who are managed without surgery are not known[5,6].

The standard operative treatment of pectus excavatum has been the Ravitch's technique that requires the exposition of the thorax's anterior region with resection of the costal cartilages affected bilaterally, the performance of a cross sternal osteotomy with the placing of a stabiliser, and the development of muscular flaps[7,8]. The Nuss Technique, also known as the "Minimally Invasive Repair of Pectus Excavatum" (MIRPE), uses principles of minimal-access surgery and thoracoscopy combined with the proper placement of a Lorenz Pectus Bar to achieve correction of Pectus Excavatum. The MIRPE procedure was developed by Dr Nuss in the 1980's and was initially performed for children and adolescents[9]. This is a minimally invasive technique which places one or two curved steel bars - Lorenz pectus bar - behind the sternum and forces it back into a more normal shape. With this minimally invasive technique, 2 small incisions are made on the lateral chest wall, and a convex steel bar, contoured to the patient's chest, is inserted under the sternum, with the convex surface facing posteriorly. The bar is rotated 180^o so that the convex surface elevates the sternum and corrects the pectus deformity. The bar is removed after 2 years, when permanent remolding has occurred[10,11]. The results have been good to excellent. The procedure offers several advantages over pectus repair in which cartilage is removed, with or without strut support. It is easier to perform, avoids having to make an anterior chest incision, returns the patient to full activity sooner, preserves elasticity of the chest, and does not retard chest wall growth. Currently, the ease of the Nuss technique makes it the procedure of choice for surgical repair of pectus excavatum[12]. Furthermore, its long-term benefits may be even greater. By preserving the costal cartilages, the Nuss procedure maintains chest elasticity and chest wall growth and it avoids the restrictive effects associated with costochondrectomy and has the potential to improve both cardiac and pulmonary functions[10,13,14].

The operation for correction starts with general anesthesia and the placement of an epidural catheter for the management of pain after the operation. Two lateral incisions are made on either side of the chest for insertion of a curved steel bar under the sternum. A separate, small lateral incision is made to allow for a thorascope for direct visualization as the bar is passed under the sternum[11,15,16,17].

The bar is individually curved for each patient. The bar is used to pop out the depression. It is then fixed to the ribs on either side and the incisions are closed and dressed. A small steel, grooved plate may be used at the end of the bar to help stabilize and fix the bar to the rib. The bar is not visible from the outside and stays in place for a minimum of two years. When it is time, the bar is removed as an outpatient procedure[18,19].

Case Report

A 13 year old boy presented with an abnormal chest wall deformity in which several ribs and the sternum grow abnormally, producing a concave, or caved-in, appearance in the anterior chest wall. The deformity had been increasing for the past two year. The patient posture it was with significant anterior curvature of the thoracic spine with the shoulders slumped forward. Clinical aspect is shown on the following pictures [Figure 1,2].

Figure 1 - Clinical aspect.

Figure 2 - Clinical aspect.

There was no mediastinal shift clinically. There was no scoliosis or any other spinal deformity. Lateral view of the chest radiograph showed an abnormal protrusion of the second to eighth costal cartilages in the parasternal region. A CT scan of the chest confirmed that the deformity was involving the costal cartilages as well as the costochondral junctions and with anterior indentation of the right ventricle. [Figure – 3,4,5].

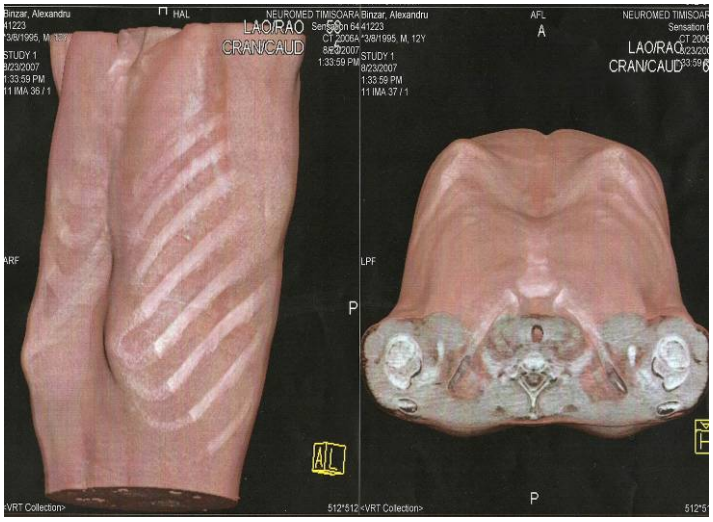

Figure 3 - CT scan of the chest confirmed the deformity.

Figure 4 - CT scan of the chest.

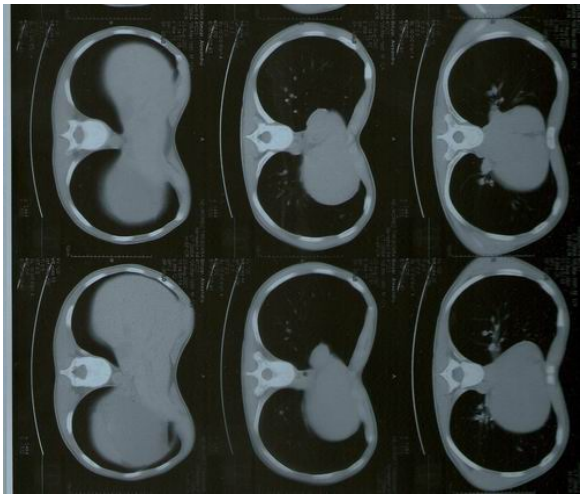

Figure 5-CT scan - anterior indentation of the right ventricle.

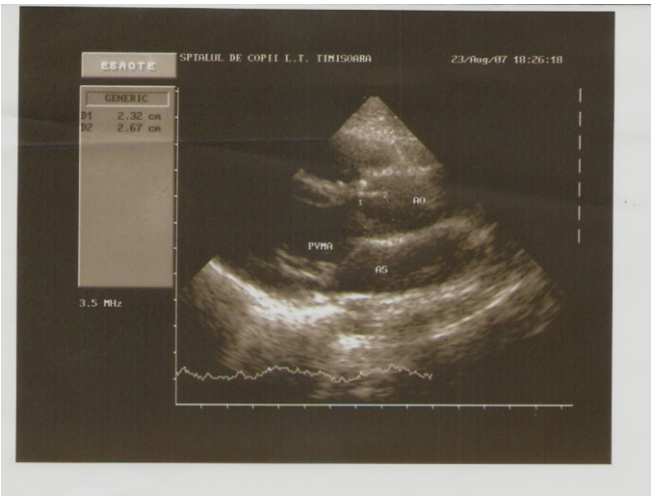

Figure 6 - Echographicaly aspect of mitral valve prolapse.

He has been diagnosticated echographicaly with mitral valve prolapse [figure 6] and isolated atrial extrasistholics. He did not have any shortness of breath or recurrent respiratory tract infections.

After these completed investigations, included blood analyses and ventilatory evaluations we decided that this pacient fullfield conditions for MIRPE. Prior to surgery, the chest is measured from the midaxillary line to midaxillary line to determine the approximate length of the bar require. The surgical procedure was made under general endotracheal anesthesia.

Lorenz pectus introducer was advanced such that the tunnel space created is enlarged. The bar was inserted with the convexity facing posteriorly. In the next time the bar was turned over so that the concave part now faces posteriorly to the mediastinum [figur 7,8]. The ends of the bars was placed in the subcutaneous tissue and it was fixed with two dispositives for stabilization and limitation rotation of the pectus bar. Stabilizers were sutured around the bar and to the muscle.

Because the residual pneumothorax was signifiant drenage of chest was necessary. The subcutaneous tissue and skin was closed with absorbable sutures.

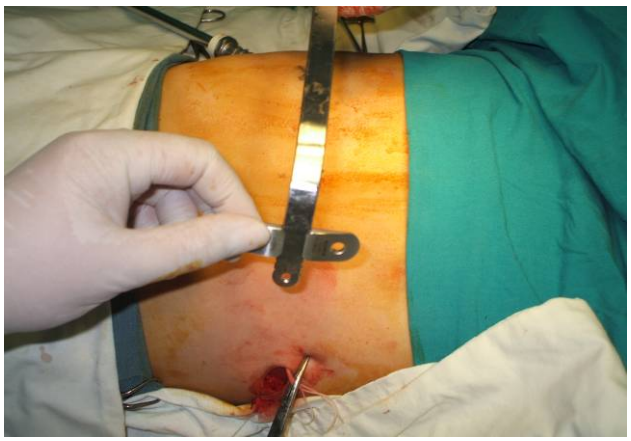

Figure 7 - Intraoperator details.

Figure 8 - Intraoperator details.

Follow-up postoperative repair of pectus excavatum involves outpatient visits with the pediatric surgeon 2-3 weeks after surgery and at regular intervals after that for the next 2 years. We recommend monitoring patient at least every 3-6 months to ensure that he is not developing an anterior protrusion of the chest due to too much pressure from the pectus bar.

Conclusions

Advantages of the Nuss procedure in comparison with the open approach are decreased operative times, minimal blood loss, and improved cosmetics results. The Nuss procedure has already been shown to have a positive impact on both the physical and psychosocial well-being of

children who are suffering from pectus excavatum deformity.

The minimally invasive repair of pectus excavatum procedure is a safe and effective method of pectus excavatum repair.

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