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Halil Tözüm
Istanbul Medeniyet Univ.
Goztepe Education Hospital,
Thoracic Surgery Department,
Turkey

Murat Demiroğlu
Istanbul Medeniyet Univ.
Goztepe Education Hospital,
Orthopaedic Surgery
Department, Turkey

Kamil Kaynak
Istanbul Univ. Cerrahpasa
Medicine Faculty, Thoracic
Surgery Department, Turkey

A different application of nuss procedure in a difficult case of pectus excavatum

Halil Tözüm, Murat Demiroğlu and Kamil Kaynak

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Abstract

A 17 year-old male patient who had a history of Nuss procedure 8 months ago with a diagnosis of pectus excavatum, the bar had been removed with left anterior thoracotomy due to complications such as bar dislocation, hemothorax and infection. Minimally invasive reoperation was performed on the patient who had an asymmetrical collapse distinctive on the right side. Classical Nuss operation was not possible due to strong adhesions that developed after past procedures. At this point, instead of open surgery, we entered the thoracic cavity with two new incisions performed on the two peak points of the collapse. A tunnel was formed beneath the sternum with obtuse and sharp opposing dissections through the newly formed holes. Subsequently, subcutaneous tunnels were opened up to the new entry holes through the initial incisions that were formed left and right previously. The bar was swiped under the sternum and rotated by using the subsequent holes as entry and exit holes for the bar. It was immobilized with a stabilizer. No complications occurred in the postoperative period. Pleural adhesions are accepted as one of the most important contraindications of thoracoscopic surgery. Nevertheless, with the help of two incisions in addition to the main procedure we present our case of re-operated pectus excavatum with a minimally invasive procedure and a successful outcome.

Keywords: Pectus excavatum, classical Nuss operation, subcutaneous tunnels

Introduction

Pectus excavatum (PE) is an anterior thoracic wall deformity that occurs as a result of depression of sternum and costal cartilages in varying degrees. It is the most common anomaly of the thoracic wall [1]. This anomaly, generally does not present with functional pathology, is corrected due to reasons such as esthetics and psychosocial factors. Despite the use of open sternoplasty technique (Ravitch procedure) for many years, Nuss procedure, termed a minimally invasive procedure, has become the most commonly used technique in the last 15 years. This procedure, which can be described as shaping a metal bar in a convex form according to the concavity of the deformity, then swiping it between sternum and pericardium with the help of thoracoscopy, rotating it and immobilizing it on the thoracic wall with varying ways, gained popularity due to high patient satisfaction and low complication rates [2]. However, in cases of deep deformity with a wide angle, prominent asymmetry, increased rigidity in the elderly and fibrous adhesions prevent thoracoscopy, this procedure is difficult to perform with a rate of high complication and low success. In such cases open surgical interventions should be preferred or Nuss procedure should be modified properly for the patient [3].

Case

A 17 year-old male patient with PE applied to our clinic for the correction of the deformity. It was found out that the patient had a history of operation with "Nuss procedure" in another center, however a chain of complications had occurred starting with the bar ripping through the intercostal space and collapsing in gaining high popularity due to high patient satisfaction and low complication rates to thoracic cavity and causing hemothorax and empyema. In that period, he was operated with an incision resembling "left anterior thoracotomy" a second time in order to remove the bar and repair the intercostal space (Picture 1). After recovery, the patient applied to several different centers and was offered open sternoplasty that he declined.

Correspondence
Murat Demiroğlu
Istanbul Medeniyet Univ.
Goztepe Education Hospital,
Orthopaedic Surgery
Department, Turkey

The patient, who had an asymmetrical PE more depressed on the right side as well as rotation to the right, was operated with minimally invasive procedure after signing the consent form to continue with surgery if necessary. Before the surgery, Haller index was calculated 4.8 in the CT scan of the thorax (Picture 2). Due to adhesions in each hemithorax, the classical Nuss procedure was impossible to perform. In addition to inadequate visualization of the thoracic cavities with optical camera, the separation of the adhesions in an already altered anatomical location was not possible. At this point, instead of continuing with open sternoplasty, a different procedure was performed. Thoracic cavity was reached with two new incisions of 1 cm performed on the two peak points of the collapse under the control of optical camera (Picture 3). Through these new holes, a tunnel was formed beneath the sternum with obtuse and sharp dissections. Despite the fact that dissections were performed without visualization, safety of the procedure was prioritized especially using finger dissections. Sharp dissections were used now and then in one hemithorax with the help of scissors, however controls with fingers from opposing hemithorax were performed in order to prevent myocardial and pericardial injury. After forming a tunnel beneath the sternum with this method, another tunnel was formed under the skin and muscles thorough the camera entry incisions to subsequently formed incisions. By using these subsequent incisions as entry and exit holes for the bar, which was previously optimized, was swiped under the sternum and rotated. Thus the deformity was corrected. A stabilizer was placed on the left and immobilized with a steel wire on the costa (Picture 4). PDS sutures, number 1, were used to attach to surrounding tissue on the right. The operation was completed in a time of 72 minutes by placing one thorax tube on each hemithorax and using underwater seal drainage.

Discussion

Correction with re-operation on recurrent PE cases is always difficult whichever previous procedure was used. Fibrosis and fibrous adhesions, developing after prior procedures, are the causes that make the second operation challenging. Especially surgical interventions such as Ravitch procedure performed on wide areas cause fibrosis and loss of chest wall elasticity. Ravitch procedure was not the initial operation in our patient, however during the second operation for complications, a surgery on the level of anterior thoracotomy was performed. During the operation, the fibrous adhesions were so strong that sharp dissections were used with the guide of fingers since finger dissections alone were not able to separate them. Surgical procedure is controversial in PE patients who are scheduled to have a second operation. While there are authors such as Antonof that think regardless of the first procedure the second operation should be open surgery [4]; there are also authors such as Redlinger who report 95% success rates when minimally invasive procedure is used as a second method regardless of the first [5]. Since the first operation resulted in complications causing high morbidity in our case, we preferred to perform minimally invasive procedure instead of open surgery. However; we also took into consideration the possible difficulties and obtained informed consent from legal guardians of the patient to perform open surgical sternoplasty when necessary.

In view of the minimally invasive techniques, the key point (basis) is how the adhesions behind the sternum are separated and how the introducer is pushed safely across the mediastinum to opposite side. At this point, in our case, we felt it was appropriate to open two new holes to the peak points of the deformity. We tried to relieve the sternum by carefully entering the thoracic cavity by using blunt finger dissections [6]. However, we still came across fibrous tissue that could not be separated. In this situation, with the guide of fingers from one hemithorax, we had to perform sharp dissections with the help of scissors. We feel it may cause severe morbidity to perform sharp dissections without the guide of fingers in such a place so blind and close to pericardium. Our modification was basically planned to overcome this difficulty.

In conclusion, we believe it is safe to perform a minimally invasive procedure in almost all patients for the treatment of PE. However, in cases with a high degree of difficulty, in recurrent cases that were operated twice or in cases of recurrence being operated twice or in cases of fibrous adhesions due to other causes, the technique may have to be modified to ensure the safety of the surgery.



Fig 1: Image of the thorax of the patient from the front and left lateral before the surgery.

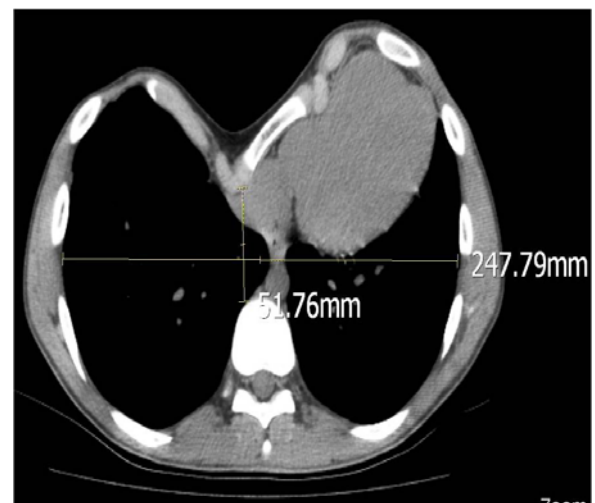


Fig 2: Axial CT scan of the patient and measurement of Haller index.



Fig 3: Image of new incisions added to standard Nuss procedure.



Fig 4: Corrected chest wall of the patient after the procedure.

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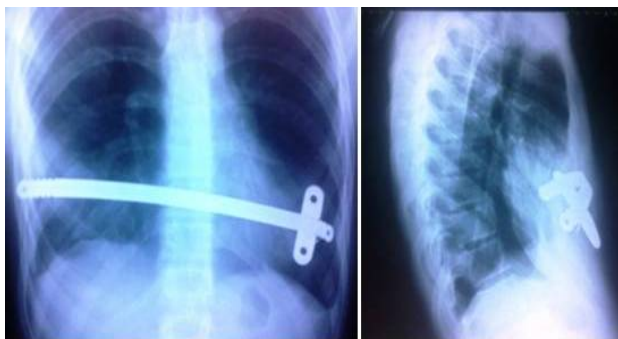


Fig 5: Posteroanterior and lateral chest roentgenogram of the patient 6 months after surgery.

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