

*How to do it? / Nasıl yapılır?*

## Nuss procedure without videothoracoscopy

### *Videotorakoskopi kullanılmayan Nuss prosedürü*

Serdar Evman , Onur Derdiyok , Volkan Baysungur 

Department of Thoracic Surgery, University of Health Sciences, Süreyyapaşa Chest Diseases and Thoracic Surgery, Training and Research Hospital, Istanbul, Turkey

#### ABSTRACT

Minimally invasive repair of pectus excavatum (Nuss) operation is the current choice of surgical treatment for pectus excavatum deformities. Technical pitfalls arise in patients with previous thoracic and/or cardiac surgical interventions, due to severe intrathoracic fibrous adhesions. Herein, we describe an original modification technique in a patient with bilateral apical wedge resection and total pleurectomy due to recurrent spontaneous pneumothorax episodes within the past two years. Correction was performed by opening the pleura bilaterally and retrosternal release with digital palpation via a subxiphoid incision, to help to guide the introducer and the pectus bar, without a videothoracoscopy visualization.

**Keywords:** Chest wall, minimally invasive surgery, pectus excavatum.

Several technical modifications have been described for the minimally invasive surgical correction of pectus excavatum, the most common congenital chest wall deformity, since the Nuss procedure was first described by Dr. Donald Nuss<sup>[1]</sup> in 1987. The use of a subxiphoid incision with video assistance is also one of these modifications in patients with very profound deformities.<sup>[2]</sup> Herein, we describe a novel technique: a small additional subxiphoid incision and manual finger guidance for opening right and left parietal pleurae with retrosternal blunt dissection, which ensured safe passage of the introducer between the pericardium and sternum, without the routine use of videothoracoscopy guidance.

#### SURGICAL TECHNIQUE

A 29-year-old male patient presented with complaint of cosmetic deformity on his chest wall.

#### ÖZ

Minimal invaziv pektus ekskavatum onarımı (Nuss) ameliyatı, pektus ekskavatum deformitelerinin düzeltilmesinde günümüzde kullanılan en yaygın cerrahi tedavi seçeneğidir. Daha önce torasik ve/veya kardiyak cerrahi girişimleri olan hastalarda, ileri derece intratorasik fibröz adezyonlar nedeniyle, teknik tehlikeler ortaya çıkar. Bu yazıda, son iki yıl içinde tekrarlayan spontan pnömotoraks atakları nedeniyle iki taraflı apikal kama rezeksiyonu ve total plevrektomi uygulanmış bir hastada yeni bir modifikasyon tekniği sunuldu. İntrodüseri ve parmak barı yönlendirmeye yardımcı olmak için, bir subksifoid insizyon ile plevra iki taraflı olarak açılarak, retrosternal alan serbestlendi ve videotorakoskopik görüntüleme olmaksızın onarım gerçekleştirildi.

**Anahtar sözcükler:** Göğüs duvarı, minimal invaziv cerrahi, pektus ekskavatum.

No pathological finding was found, except for symmetrical mild pectus excavatum (Figure 1a). His medical history revealed seven pneumothorax episodes (right sided four times and left sided three times) over the last two years. He underwent bilateral apical wedge resection and total pleurectomy operations, by video-assisted thoracoscopy surgery (VATS) for right and by mini-thoracotomy for left hemithorax. His thoracic computed tomography revealed a Haller Index of 3.5 (Figure 1b). Based on these findings, we decided to perform Nuss procedure without directly entering the “hostile” thoracic cavity to prevent any parenchymal or cardiac damage. A written informed consent was obtained from the patient.

The patient was placed in the supine position. The planned entrance and exit points for the bar were preoperatively marked on the anterior chest wall. In addition to the standard two anterior axillary incisions and subcutaneous pockets, a small subxiphoid incision

Received: November 16, 2020 Accepted: December 17, 2020 Published online: October 20, 2021

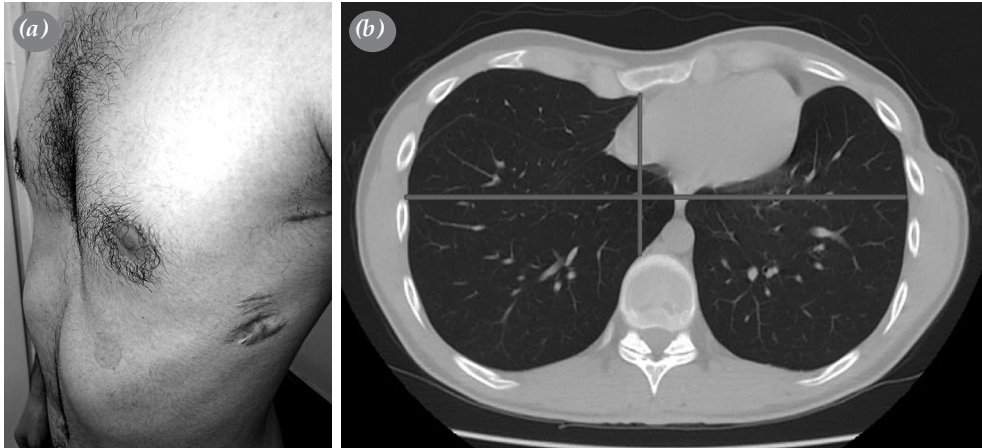
**Correspondence:** Serdar Evman, MD. SBÜ Süreyyapaşa Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesi, Göğüs Cerrahisi Kliniği, 34844 Maltepe, İstanbul, Türkiye. Tel: +90 216 - 421 42 00 e-mail: sevman13@yahoo.com

#### Cite this article as:

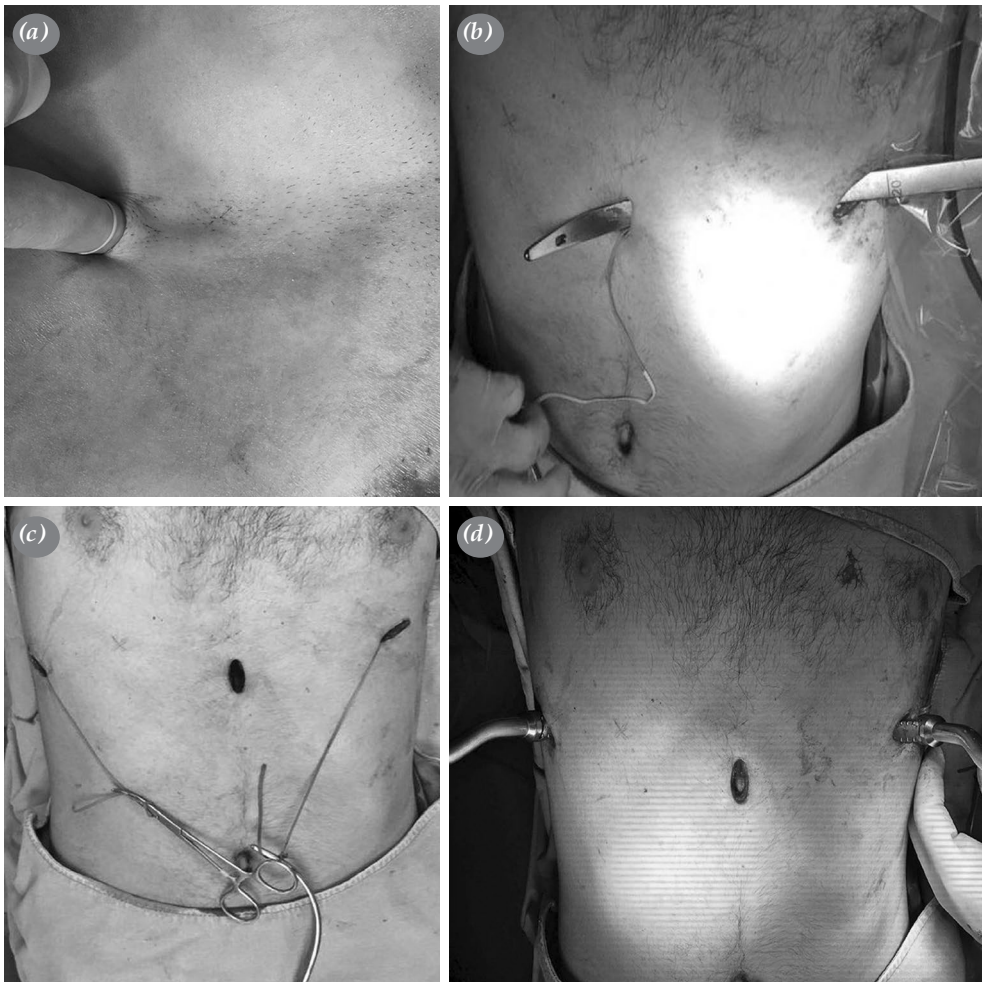
Evman S, Derdiyok O, Baysungur V. Nuss procedure without videothoracoscopy. Turk Gogus Kalp Dama 2021;29(4):559-561

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**Figure 1.** (a) Previous operative scars and pectus excavatum deformity, (b) with a Haller Index of 3.



**Figure 2.** (a) Opening of pleurae and substernal-pericardial release by blunt dissection via subxiphoid incision. (b) Introducer passed through the hemithorax and pushed out of the subxiphoid incision under tactile guidance. (c) The ligature tied to the pinhole of the introducer and pulled back through the lateral incisions. (d) Bar flipped with bilateral rotators.

was made, allowing passing a finger underneath the retrosternal area (Figure 2a). Initially, both pleurae were opened bilaterally, and caudal half of the sternum was released from the pericardium with blunt finger dissection. Subsequently, dense adhesions were freed between the parenchyma and the anterior chest wall until the marked exit points. The introducer was passed through the right subcutaneous tunnel and entered the hemithorax with the surgeon's fingertip right under the planned intercostal level, to avoid any parenchymal damage. With finger guidance, it was pushed out of the subxiphoid incision. A ligature was tied to the pinhole of the introducer and pulled back through the right incision (Figure 2b). The same procedure was repeated for the left side, and free end of the ligature was pulled out from the left incision (Figure 2c).

A bar was shaped and tied to the ligature on the right side. It was passed through the pre-created tunnel, entering the right hemithorax, passing between the sternum and the pericardium, and pulling out from the left hemithorax. All were performed under digital palpation through the subxiphoid incision. The bar was, then, flipped 180° with rotators (Figure 2d) and fixed with bilateral stabilizers. No exsufflation was performed. The incisions were closed and the patient was extubated in the operation room. Postoperative course was uneventful.

## DISCUSSION

Minimally invasive pectus repair was first performed by Dr. Nuss<sup>[1]</sup> in 1987, and became the worldwide procedure of choice for correction, after successful clinical 10-year-outcomes were published in 1998.<sup>[2]</sup>

Limited surgical trauma and small scars are certain advantages of the Nuss procedure. However, serious complications or even mortality have been reported; and the risk is high, particularly in complicated patients with very profound deformities, previous cardiothoracic surgical interventions, and advanced intrathoracic adhesions.<sup>[3-5]</sup>

Several technical modifications were recommended to prevent these injuries. The use of left-sided thoracoscopic visualization or an additional subxiphoid incision was advocated, while other surgeons preferred the use of right-sided thoracoscopy

with the impression that the mediastinal dissection of the substernal pericardial tissue was achieved with superior vision.<sup>[2,3]</sup> Additionally, the use of bilateral thoracoscopy has been described, both in children and adults, to ensure that the bar between the sternum and mediastinum is passed and placed safely.<sup>[4,5]</sup> To the best of our knowledge, our non-thoracoscopic modification of the Nuss procedure with the subxiphoid access has not been previously reported.

In conclusion, compared to the open Ravitch or standard Nuss procedure, our non-thoracoscopic modification can be considered safer and still a minimally invasive cosmetic procedure, with an additional 1.5 cm subxiphoid incision. This novel approach can be preferred, particularly in very young patients with an undersized and insufficient hemithoracic cavity for videothoroscope installation, or in patients having a previous thoracic surgery, and those in whom severe intrathoracic adhesions are expected.

### Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

### Funding

The authors received no financial support for the research and/or authorship of this article.

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