



Case Report / Olgu Sunumu

## Brachial plexus palsy after Nuss procedure for pectus excavatum

### *Pektus ekskavatum için Nuss işleminden sonra brakial pleksus palsisi*

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#### ABSTRACT

Brachial plexus palsy rarely occurs after Nuss procedure for pectus excavatum. Brachial plexus palsy after surgery may be caused by nerve tension and compression related to surgical positioning. In this article, we report a 21-year-old male patient of brachial plexus palsy after Nuss procedure revealing a narrowing of the costoclavicular space from 7.60 mm to 2.83 mm and an increase to 4.51 mm after upper bar removal. Patient's symptoms were fully recovered. Our results showed that narrowing of the costoclavicular space after Nuss procedure might trigger brachial plexus palsy and that brachial plexus palsy may not be related to surgical positioning.

**Keywords:** Brachial plexus palsy, complication, minimally invasive surgery, pectus excavatum.

Brachial plexus palsy (BPP) refers to paralysis or weakness of the arm resulting from an injury to the plexus. Postoperative brachial plexus palsy, although rare, is increasing in frequency, and is attributed to two factors: nerve tension and compression, related to surgical positioning.<sup>[1]</sup> Nuss procedure is a minimally invasive surgery to repair pectus excavatum. Brachial plexus palsy has been reported rarely as a postoperative complication of the Nuss procedure.<sup>[2]</sup> Nuss procedure for pectus excavatum raises the sternum and ribs anterosuperiorly and causes narrowing of the costoclavicular space.<sup>[3]</sup> This additional factor may trigger nerve compression in BPP after Nuss procedure.

#### ÖZ

Pektus ekskavatum için Nuss işleminden sonra brakial pleksus palsisi nadiren gerçekleşir. Cerrahiden sonra brakial pleksus palsisine cerrahi konumlanma ile ilişkili sinir gerilimi ve kompresyonu neden olabilir. Bu yazıda, Nuss işleminden sonra kostoklaviküler boşlukta 7.60 mm'den 2.83 mm'ye daralma ve üst çubuğun kaldırılmasını takiben 4.51 mm'ye artış gösteren brakial pleksus palsisi olan 21 yaşında bir erkek hasta bildirildi. Hastanın semptomları tamamen iyileşti. Bulgularımız Nuss işleminden sonra kostoklaviküler boşlukta daralmanın brakial pleksus palsisini tetikleyebileceğini ve brakial pleksus palsisinin cerrahi konumlanma ile ilişkili olmayabileceğini gösterdi.

**Anahtar sözcükler:** Brakial pleksus palsisi, komplikasyon, minimal invazif cerrahi, pektus ekskavatum.

#### CASE REPORT

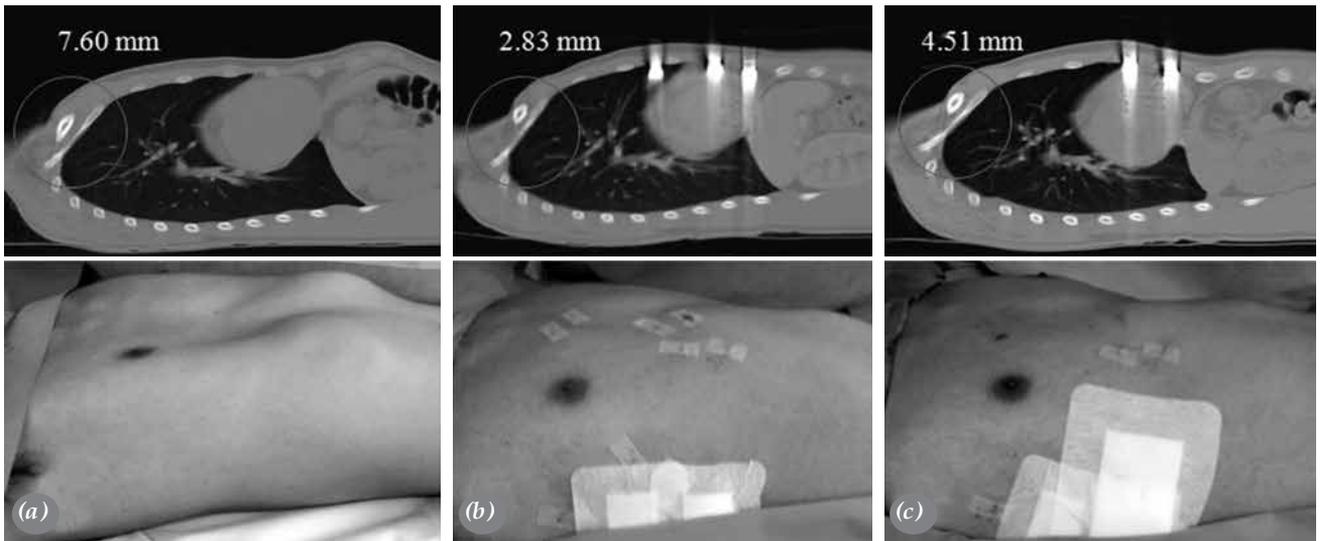
A 21-year-old male patient presented with diffuse depression of the anterior chest wall. Chest computed tomography (CT) showed asymmetric depression, more on the right side, with indentation on the heart. Haller index, the ratio of the maximal transverse diameter and narrowest anteroposterior length of chest, was 5.85. The patient underwent Nuss procedure entailing insertion of three bars for severe pectus excavatum with upper and lower depression. During the procedure, the patient was placed in the supine position with both arms abducted less than 90° to

Received: March 10, 2018 Accepted: October 06, 2018 Published online: April 24, 2019

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#### Cite this article as:

Kim MW, Jeong JY, Ha G, Park SS. Brachial plexus palsy after Nuss procedure for pectus excavatum. Turk Gogus Kalp Dama 2019;27(2):245-247



**Figure 1.** Chest computed tomography findings (a) before Nuss procedure, (b) after procedure, and (c) after reoperation.

prevent excessive stretching and compression of the brachial plexus. After the procedure, he complained of severe weakness of the left arm. The left deltoid, biceps, and brachioradialis muscles had strengths of Medical Research Council (MRC) grade 1/5. Electrodiagnostic study revealed reduced recruitment at the deltoid, biceps, brachioradialis, and triceps muscles. The conduction studies were normal. Chest CT demonstrated narrowing of the shortest costoclavicular distance after Nuss procedure from 7.60 mm to 2.83 mm (Figure 1a, b). We removed the upper bar on post-procedure day four. After reoperation, the shortest costoclavicular distance was increased to 4.51 mm (Figure 1c) and the weakness of the arm was slightly improved. On post-reoperation day two, the interference patterns of the deltoid, biceps, and brachioradialis were increased with normal conduction studies. On post-reoperation day 23, the strength of left deltoid, biceps, and brachialis was above MRC grade 3/5. Full recovery from motor and sensory symptoms was achieved at three-month follow-up. A written informed consent was obtained from the patient.

## DISCUSSION

Nuss procedure is a minimally invasive surgery, in which metal bars are inserted with tiny skin incisions to repair pectus excavatum. Brachial plexus palsy has rarely been reported as a complication after Nuss procedure for pectus excavatum.<sup>[2]</sup> Early detection of BPP and understanding the mechanisms are important, and prompt treatment can improve BPP symptoms.

Postoperative BPP is attributed to two mechanisms: nerve tension and compression, related to surgical positioning. A fresh-cadaver study showed that the tension of the brachial plexus increased with the degree of arm abduction and that 90° abduction of the arm with 30° extension caused maximal tension of the nerve.<sup>[1]</sup> Another fresh-cadaver study reported compression of the brachial plexus in the costoclavicular space with maximal shoulder abduction and external rotation position.<sup>[4]</sup> Avoiding >90° shoulder flexion or abduction was suggested to prevent excessive stretching and compression of the brachial plexus.<sup>[5]</sup>

Additional mechanisms may mediate BPP after Nuss procedure. A study measuring the distance between the clavicle and the first rib on the chest CT before and after Nuss procedure demonstrated significant changes in the costoclavicular space.<sup>[3]</sup> Our case study also showed narrowing of the costoclavicular distance after Nuss procedure and an increase after a rearrangement operation. This mechanism, resembling a pump handle action in respiration, might be related to BPP after Nuss procedure. In our case, the neurologic symptoms of the patient began to improve immediately after removal of the upper bar and we thought that BPP was due to the narrowing of the costoclavicular space.

In this article, we described a rare case of brachial plexus palsy caused by compression of the costoclavicular space after Nuss procedure. Our results showing not only the mechanism related to surgical positioning, but also the postoperative changes in the costoclavicular space after Nuss procedure suggest the importance of early reoperation to relieve brachial

plexus palsy symptoms. Further large-scale studies investigating the effect of Nuss procedure on the costoclavicular space are needed to confirm the clinical significance of our findings.

#### **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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