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Case Report

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Paralysis of the Upper Extremity Due to Acute Thoracic Outlet Syndrome Caused by the Subclavius Posticus Muscle: A Case Report With Literature Review

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Conflict of Interest
The authors have no financial conflicts of interest.

ABSTRACT

The subclavius posticus muscle is a rare aberrant muscle that traverses from the costal cartilage of the first rib posterolaterally to the superior border of the scapula. We report a patient having persistent paralysis of shoulder abduction with wrist and finger extension after a humeral neck fracture. Electromyography (EMG) examination revealed injuries to several upper extremity peripheral nerves, including the radial, axillary, and musculocutaneous nerves. Magnetic resonance imaging (MRI) performed at 10 months post-injury showed severe entrapment of the left brachial plexus by the subclavius posticus muscle at the thoracic outlet. The diagnosis of brachial plexus injury due to a rare abnormal subclavius posticus muscle was typically delayed until the MRI was performed for unexplained multiple peripheral nerve palsy. Resection of the aberrant muscle and brachial plexus decompression did not yield significant improvement in the patient's radial nerve palsy until 6 months after surgery. Entrapment of the brachial plexus caused by the subclavius posticus muscle can cause symptoms of acute thoracic outlet syndrome following trauma to the upper extremity. In a case of inexplicable multiple peripheral nerve injuries in the upper extremity that are not proportional to the degree of trauma, MRI imaging along with EMG is required.

Keywords: Radial nerve; Subclavius posticus muscle; Thoracic outlet syndrome

INTRODUCTION

The subclavius posticus muscle is an aberrant muscle originating from the cranial surface of the sternal end of the first rib, running laterodorsally beneath the clavicle and inserting into the superior border of the scapular (**FIGURE 1**).[1,5,6,8,11,13,14,16,18,19] Because of its unique location in the costoclavicular space and close relationships with the brachial plexus and subclavian vessels, the subclavius posticus muscle has been reported sporadically as a rare cause of thoracic outlet syndrome.[1,5,6,8,11,13,14,16,18,19] The prevalence of subclavian muscle is 8.3%–8.9%, with bilateral presence rate of 0.8%–1.7%.[1,18] Although the prevalence of aberrant muscle is rather high, only 8 cases have shown clinical symptoms so far based on our literature review (**TABLE 1**). Most of them manifested symptoms of neurogenic and vascular thoracic outlet syndrome.

TABLE 1. Reports on clinical relevance of the subclavius posticus muscle

Year	Authors	Number	Age/Sex	Side	Onset	Clinical manifestations and remarks
2009	Kolpattil et al.[11]	1	51/F	Left	Incidental	Incidental finding in screening mammogram. MRI confirmation
2010	Özcakar et al.[14]	1	30/M	Bilateral	Gradual	Bilateral (left>right), occurrence after traction type upper extremity injury, operation (left side), neurogenic TOS.
2014	Smayra et al.[16]	1	30/F	Left	Gradual	Chronic numbness in left upper extremity, neurovascular TOS, symptom relieved after operation.
2015	Muellner et al.[13]	1	32/M	Left	Gradual	Hand weakness (radial nerve), neurogenic TOS, dynamic compression, macrodactyly and carpal tunnel syndrome in left hand, physical therapy.
2015	Cogar et al.[6]	1	49/M	Left	Gradual	Shoulder weakness (suprascapular nerve palsy), athlete, prior clavicle fracture (healed), complete recovery after operation.
2017	Ciampi et al.[5]	2	23 and 25/M	Right	Gradual	Pain and paresthesia, functional disability, swelling, warmth in dominant upper extremity, DVT (subclavian vein), neurovascular TOS, complete recovery following surgery.
2018	Yum et al.[19]	1	56/M	Right	Gradual	Pain on arm hyperabduction, contralateral congenital absence of subclavius muscle, neurogenic TOS, improved with medicine.
2021	Duncan et al.[8]	1	33/F	Left	Gradual	Left upper extremity pain on exercise, hand weakness (ulnar nerve involvement), neurogenic TOS, improved after surgery.
2022	Current report	1	71/M	Left	Sudden	Left arm weakness and sensory change after a fall.

Subclavius posticus muscles found in cadaveric studies were excluded.
DVT: deep vein thrombosis, F: female, M: male, TOS: thoracic outlet syndrome.

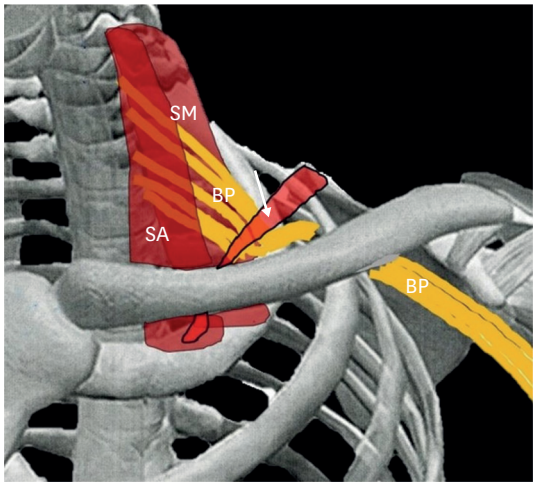

FIGURE 1. The subclavius posticus muscle, an aberrant muscle in the thoracic outlet space.
The subclavius posticus muscle (white arrow) connects the first rib and the scapula in the left infraclavicular space. It attaches at a right angle to the brachial plexus. It may compress the brachial plexus.
BP: brachial plexus, SA: scalene anterior muscle, SM: scalene medius muscle.

Here, we report a case of the subclavian muscle causing paralysis of the upper extremity after a fall. In the present case, the diagnosis of acute thoracic outlet syndrome due to the subclavian muscle was delayed because humerus fracture occurred at the same time.

CASE REPORT

A 71-year-old right-handed male patient presented with a wrist drop on the left wrist and inability to extend left fingers (**FIGURE 2**). The patient was healthy. However, about a year ago, he slipped and fell to the ground with his left arm. He developed severe pain and limited movement in his left upper arm. He was diagnosed with a fracture of the left humerus neck. He underwent an open reduction surgery at five days after the injury. After the surgery, his left arm was in brace immobilization for 6 weeks. With the brace on, his left wrist and fingers were initially completely motionless.

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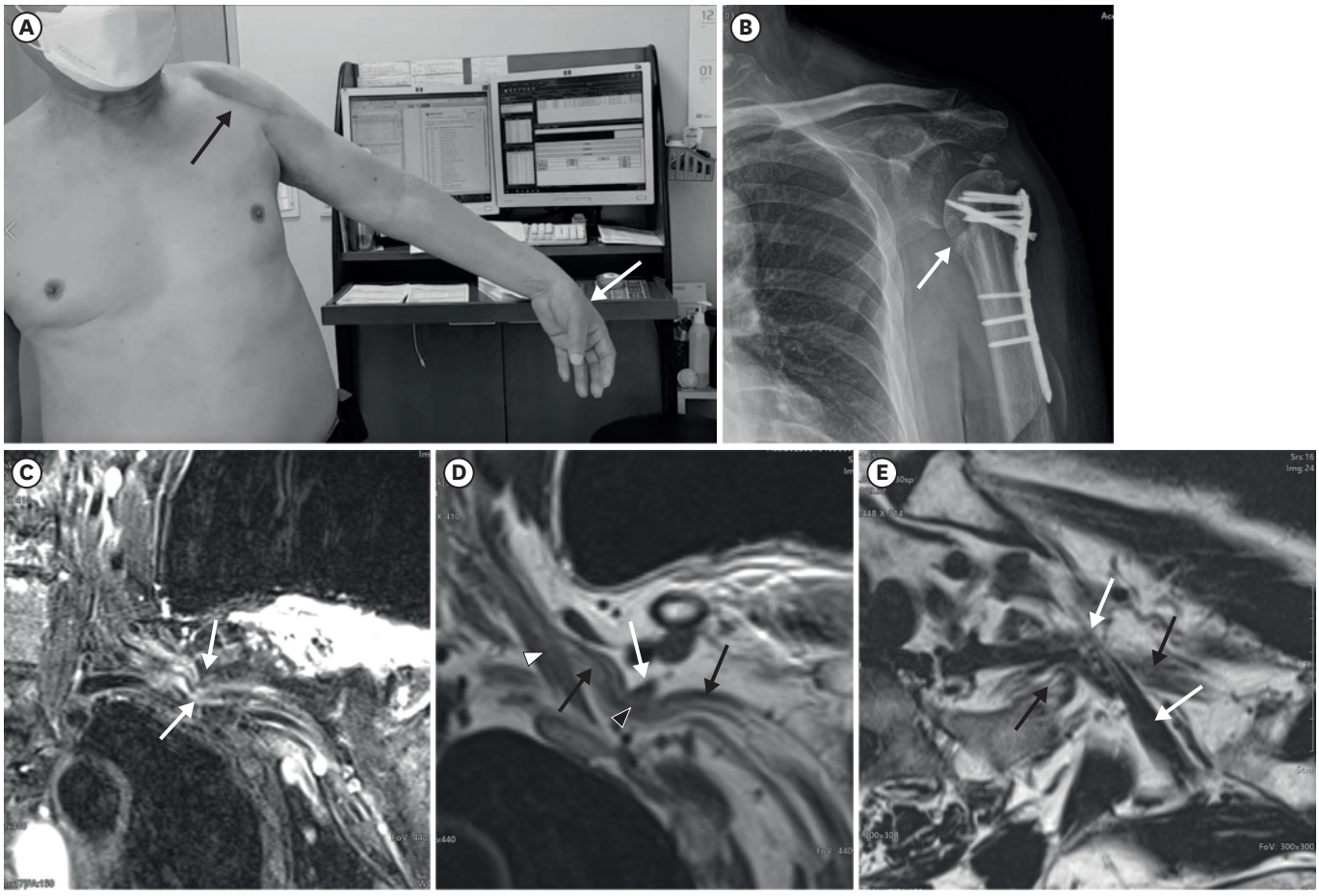

FIGURE 2. Weakness of left upper extremity and radiologic findings.
(A) A clinical photograph showing weakness of shoulder abduction and extension of left wrist and fingers (white arrow). An about 15-cm linear scar in the anterior shoulder (black arrow) showing the operation site for the fracture involving the left humerus neck. (B) An X-ray image showing postoperative state of open reduction and internal fixation for the fracture involving the neck of the humerus. The original fracture site of the humerus is indicated (white arrow). (C) A coronal T2-weighted image of left shoulder showing an acute angulation of the left brachial plexus (white arrows). (D) A coronal T1-weighted image of the left brachial plexus showing a muscular structure (white arrow) of an isointense signal intensity compressing the brachial plexus (black arrow). The black arrowhead indicates the position of maximum compression of the brachial plexus. The white arrowhead indicates the scalene medius muscle. (E) An axial T1-weighted image of the left brachial plexus showing that the subclavius posticus muscle (white arrows) connects the first rib and the scapula in the left infraclavicular space, attaches to the brachial plexus (black arrows) at a right angle and compresses it.

One month after the operation, flexion of the left wrist and fingers was gradually possible. However, extension did not occur. After the brace was removed, he found that he could not extend his left shoulder. In addition, he could barely use his left hand. His attending physician confirmed that there was no damage to the radial nerve at the fracture site at the time of surgery and requested an electromyography (EMG) and nerve conduction study. His attending physician confirmed that there was no damage to the radial nerve at the fracture site at the time of surgery and requested an electromyography. An EMG performed at three months after the injury revealed radial nerve palsy around the left humerus fracture site. He was prescribed rehabilitation physiotherapy.

Six months after the injury, the extension of his left arm improved only slightly. Extension of his left wrist and fingers was still impossible. Subsequent EMG examination revealed paralysis of the left axillary and musculocutaneous nerves as well as the left radial nerve. After that, he continued to receive rehabilitation treatment. However, he could not use his

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left hand because his left wrist and fingers could not extend. Ten months later, he visited our outpatient clinic for treatment of paralysis of wrist and finger extensor.

On physical examination, extension of his wrist and all fingers did not occur. His left wrist was in ulnar deviation. The left deltoid, supraspinatus, biceps, triceps, and brachioradialis muscles showed mild atrophy. Extension and abduction of left shoulder were limited to 30°. Other movements of the left shoulder also showed limited motion due to shoulder surgery. Flexion of the left elbow was possible (medical research council [MRC] grade 4). Extension grade was 2. Flexion of the left wrist and finger was possible (MRC grade 4). Abduction of fingers was impossible. Adduction was barely possible. The radial side of the dorsum of the hand and the dorsal side of the first and second fingers had decreased sensation and slight numbness. There was a mild pain in the radial side of the left shoulder and the upper arm, although the sensation was preserved. On the front side of the left shoulder, a surgical scar of about 15 cm in size was observed for fracture of the humerus neck (FUGURE 2A). No tenderness at the surgical site was observed. No abnormalities were found in his laboratory findings. He complained that he lost the function of his left hand and arm because he could no longer use his left hand no matter how long he waited.

X-ray examination of the left shoulder showed an instrumented fixation of the left humerus head, heterotopic ossification, and osteoarthritic changes of the shoulder joint (**FIGURE 2B**). The orthopedic surgeon who operated for his humerus neck fracture was confident that the brachial plexus or radial nerve was not exposed in the surgical field of the anterior approach and that no damage occurred during the operation. In magnetic resonance imaging of the shoulder joint to confirm the change in the surgical site of the left humerus neck, no remarkable abnormalities were observed in the nerve pathway around the neck of the humerus. However, the left brachial plexus was found to be severely bent in that position after passing through the left interscalene triangle (**FIGURE 2C**). In addition, it showed increased signal intensity and swelling. This led to another request of magnetic resonance imaging (MRI) for the left brachial plexus. Severe kinking of the left brachial plexus was caused by a musculotendinous structure of the isointense signal in the left infraclavicular space (**FIGURE 2D**). This muscle was identified as an aberrant muscle called the subclavius posticus (**FIGURE 2E**).

Considering the persistent paralysis of the extensor muscles of the left wrist, fingers, and shoulder with severe compression of the left brachial plexus by the subclavian posticus muscle, it was judged to be a left brachial plexus injury. Decompression of the left brachial plexus was performed via a supraclavicular approach. After dissection and preservation of the supraclavicular nerve and the external jugular vein, the left brachial plexus located next to the scalene muscle was dissected and exposed (**FIGURE 3**). A thin fibrous musculotendinous structure crossing the brachial plexus pathway at a right angle was identified. It was enveloped with a thin fibrous sheath, carefully separated from the brachial plexus, and excised. Afterwards, external neurolysis of the left brachial plexus was performed.

The postoperative course was uneventful. MRI performed on the 4th day after the surgery confirmed that the path of the left brachial plexus was restored to normal without any bent (**FIGURE 3C**). The subclavius posticus muscle was not located around the brachial plexus. It showed retraction. At 1 month postoperatively, the range of abduction of his left shoulder was up to 45°. However, the radial nerve palsy did not show significant improvement until 6 months after brachial plexus decompression.

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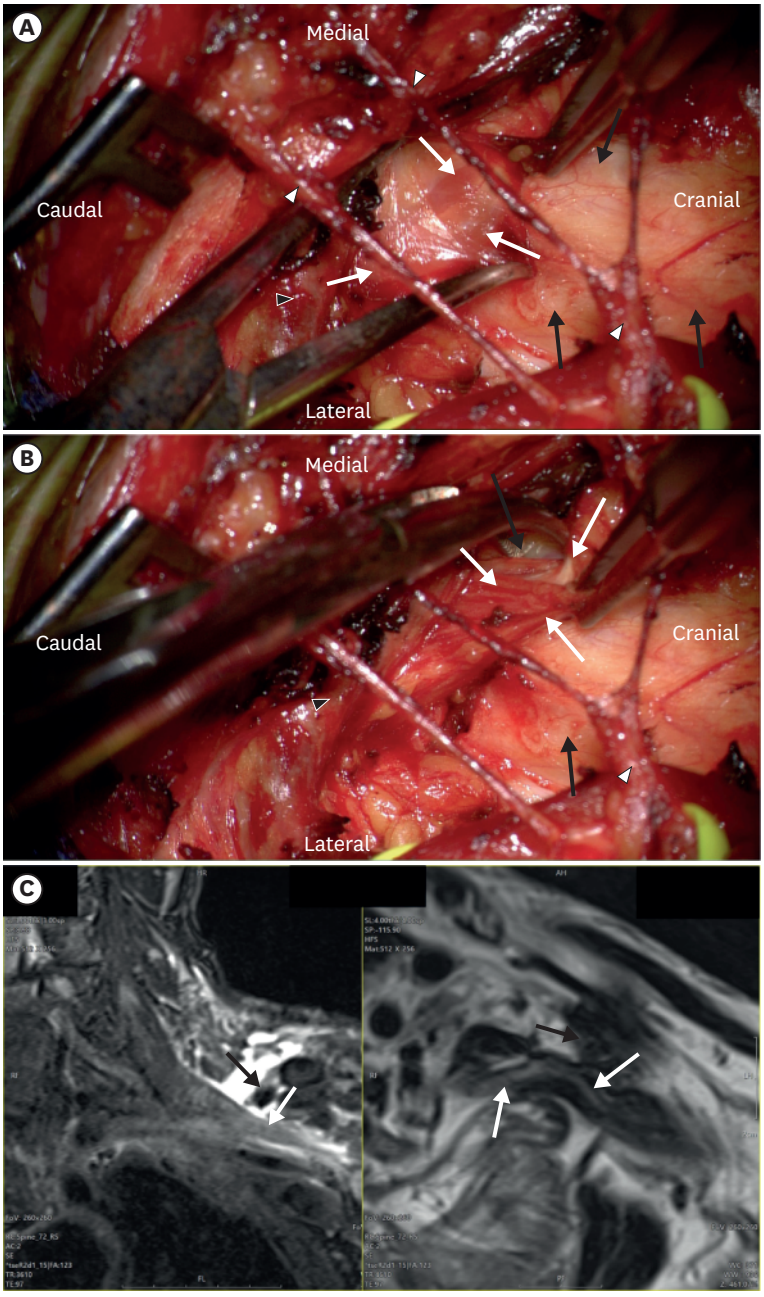

FIGURE 3. Surgical findings of subclavian muscle causing thoracic outlet syndrome.
(A) An intraoperative photograph showing the subclavian muscle (white arrows) compressing the brachial plexus (black arrows) through a supraclavicular approach. White arrowhead indicates the supraclavicular nerve and its branches. Black arrowhead indicates the external jugular vein. (B) An intraoperative photograph showing the thick tendinous portion of the subclavius posticus muscle (white arrows) dissected from the brachial plexus underneath (black arrows). The black arrowhead indicates the external jugular vein. (C) T1-weighted coronal (left) and axial (right) images of the left brachial plexus (white arrows) showing resolution of compression by the subclavius posticus muscle (black arrows).

DISCUSSION

Subclavius posticus muscle

A supernumerary muscle connecting the first rib to the scapula has been reported in

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the literature, with some suggesting that it might predispose towards the development of thoracic outlet syndrome due to its course over the brachial plexus and subclavian vessels.[1,2,9,12] Known to anatomists as the subclavius posticus muscle, this muscle was first described in the literature by Rosenmüller in 1800.[1] It is a supernumerary muscle originating from the first rib, passing over the brachial plexus and subclavian vessels and inserting into the superior margin of the scapular. It is known that wide variations of the subclavius muscle region and innervation can occur concomitantly with the development of the heart and lungs from an anlage of the hypobranchial musculature near the junctional region between the hypobranchial and the pectoral regions of the body trunk.[17] The inferior belly of the omohyoideus muscle and the subclavius muscle develop from the same matrix that divides into two portions, cranial and caudal portions becoming the inferior belly of the omohyoideus muscle and the subclavius muscle, respectively.[1] In case of an aberrant muscle, the common matrix is thought to divide into 3 portions instead of 2, forming 2 normal muscles and the anomalous subclavius posticus muscle that is located between them, bridging the two normal muscle groups.[12]

According to Sato et al.,[15] the aberrant muscles that runs between the first costal cartilage and the upper margin of the scapula can be classified into 2 categories according to its innervations. If it is innervated by a branch from the nerve to the subclavius muscle, it can be classified as the subclavius posticus muscle. If it is innervated by the branch of the ansa cervicalis innervating the omohyoid muscle, it considered as a duplication of the inferior belly of the omohyoid muscle.[1,15]

The subclavius posticus muscle is located in the narrow costoclavicular space. It is located closely to some important structures such as the brachial plexus and subclavian vessels. The subclavius posticus muscle was first discovered in cadaveric studies. Its association with thoracic outlet syndrome has been pointed out several times in anatomical studies of cadavers.[1,2,9,18] However, very few studies have reported its clinical symptoms in actual humans. In fact, the first clinical report of the subclavian muscle in a living person was a neck mass discovered incidentally on mammography in 2009 without clinical symptoms.[1] According to our literature review, clinical symptoms caused by this muscle have so far been reported in only 8 cases (**TABLE 1**). Considering the frequency of presence of the subclavius muscle using MRI study is about 8%–9%,[1,18] it is judged that it rarely causes clinical symptoms. So far, the subclavius posticus muscle caused gradual onset of thoracic outlet syndrome.[5,6,8,11,13,14,16,19] However, in the current case, it was very unusual that acute paralysis of the involved upper extremity was induced due to a fall without any preceding symptoms or signs. Unfortunately, because the fracture of the humerus neck coincided with trauma to the arm, the medical staff interpreted the paralysis of the upper extremity as axillary and radial nerve palsy associated with fracture.

Relationship between the subclavius posticus muscle and thoracic outlet syndrome

Thoracic outlet syndrome is a constellation of clinical manifestations caused by compression of neurovascular structures in the thoracic outlet region.[3,10] Three different compartments in the thoracic outlet region are related to the genesis of neurovascular compression syndrome: the interscalene triangle, the costoclavicular space, and the pectoralis minor region.[3,9,10] The diagnosis of thoracic outlet syndrome is based on findings of clinical evaluation, particularly if symptoms can be reproduced when various dynamic maneuvers, including elevation of the arm, are undertaken. However, clinical diagnosis is often difficult. Therefore, imaging tests

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such as computed tomography (CT) and MRI that can confirm anatomical structures of the thoracic outlet are essential along with electromyography.

Thoracic outlet syndrome occurs in young and middle-aged adults and occurs in women 3 times more frequently in men.[4,7] The clinical presentation of idiopathic thoracic outlet syndrome is highly variable, depending on what parts of the brachial plexus are involved and to what extent the circulatory system is involved.[7] The purely vascular forms of thoracic outlet syndrome are diagnosed easily, but are uncommon.[4] Neurogenic thoracic outlet syndrome is much more common than arterial or venous type of thoracic outlet syndrome, accounting for upwards of 98% of cases.[4,7] Symptoms caused by pure venous compression occur in 1.5% of patients and usually present as axillary vein thrombosis.[4] Physicians who diagnosis only the vascular forms of thoracic outlet syndrome are misdiagnosing the vast majority of patients they see who have this neurologic condition.[4]

In the present case, damage to the brachial plexus by the presence of the subclavius posticus muscle was confirmed by MRI findings of the brachial plexus due to incomprehensible paralysis of the upper extremity. In the current case, there were no symptoms or signs to suspect thoracic outlet syndrome before acute paralysis of the left arm after a fall. Therefore, it has similarities with the report of Muellner et al,[13] in which the subclavius posticus muscle induced dynamic brachial plexus compression (**TABLE 1**). In their case, on electromyography, only mild carpal tunnel syndrome was reported.[5] Involvement of the subclavius muscle was confirmed by MRI.

It is well known that the presence of a congenital anatomical anomaly predisposes individuals to the compression of the brachial plexus and subclavian artery and vein.[3,10] However, inferring the presence of congenital anomaly of the thoracic outlet in acute trauma is difficult. In fact, the doctors who treated the patient received electromyography reports revealing the radial and axillary nerve palsy after humerus fracture surgery. However, they did not get any information about the brachial plexus involvement. Although trauma to the brachial plexus by congenital anomaly such as the subclavius posticus muscle is very rare, if paralysis of the entire upper extremity nerve rather than isolated radial and axillary nerve palsy is caused by a simple humerus neck fracture, involvement of the brachial plexus should be suspected. In the report by Muellner et al,[13] symptoms of thoracic outlet syndrome were induced only by abduction of the involved arm.

Surgical decompression is necessary when neurogenic thoracic outlet syndrome does not improve with conservative treatment or causes neurological signs such as weakness. The goal of a surgical treatment is straightfoward to decompress the thoracic outlet through external neurolysis of the brachial plexus with resection of the subclavius posticus muscle. This is possible with a supraclavicular or transaxillary approach.[5,6,8,11,13,14,16,19] We decompressed the left brachial plexus through a supraclavicular approach considering the location of the subclavius muscle. As seen in the present case, the supraclavicular approach is very effective in excising the subclavius posticus muscle pressing the brachial plexus. Unfortunately, the patient's wrist and finger extension did not improve despite the brachial plexus decompression.

It was confirmed that chronic asymptomatic entrapment of the brachial plexus by the subclavius posticus muscle resulted in an abrupt onset of severe symptoms of neurogenic thoracic outlet syndrome after acute trauma. However, it was considered that left arm and hand weakness were overlooked due to limitation of motion caused by fracture of the neck

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of the humerus, surgery, and brace immobilization. In addition, the EMG performed three months after the injury showed only radial nerve palsy. Since radial nerve palsy can also be caused by a fracture involving the shaft of the humerus, observation was continued. EMG performed at six months after injury indicated additional impairment of the axillary and musculocutaneous nerves as well as the radial nerve. As this case shows, EMG for traumatic peripheral neuropathy is not perfect. It can sometimes cloud the therapist's judgment. Acute brachial plexopathy caused by the subclavius posticus muscle is a very rare traumatic peripheral neuropathy that the authors could not foresee. EMG and nerve conduction studies are important when multiple peripheral nerve palsies, which are difficult to explain, occur after upper extremity trauma and fractures. However, confirmation through imaging tests using MRI is also very important.

CONCLUSION

Paralysis of the upper extremity due to acute thoracic outlet syndrome caused by the subclavius posticus muscle, which was asymptomatic before trauma, was reported. A traumatic fracture of the neck of the humerus delayed the evaluation of upper extremity paralysis. Since acute thoracic outlet syndrome due to the subclavius posticus muscle is very rare, it is difficult to diagnose it clinically. In case of inexplicable multiple peripheral nerve injury in the upper extremity that is not proportional to the degree of trauma, MRI imaging along with EMG is required.

REFERENCES

1. Akita K, Ibukuro K, Yamaguchi K, Heima S, Sato T. The subclavius posticus muscle: a factor in arterial, venous or brachial plexus compression? **Surg Radiol Anat 22**:111-115, 2000
PUBMED | CROSSREF
2. Akita K, Tsuboi Y, Sakamoto H, Sato T. A case of muscle subclavius posticus with special reference to its innervation. **Surg Radiol Anat 18**:335-337, 1996
PUBMED | CROSSREF
3. Atasoy E. Thoracic outlet syndrome: anatomy. **Hand Clin 20**:7-14, 2004
PUBMED | CROSSREF
4. Brantigan CO, Roos DB. Diagnosing thoracic outlet syndrome. **Hand Clin 20**:27-36, 2004
PUBMED | CROSSREF
5. Ciampi P, Agnoletto M, Scotti C, Ballis R, Gerevini S, Peretti GM, et al. Thoracic outlet syndrome in the overhead athlete: a report of 2 cases of subclavius posticus muscle. **Clin J Sport Med 27**:e29-e31, 2017
PUBMED | CROSSREF
6. Cogar AC, Johnsen PH, Potter HG, Wolfe SW. Subclavius posticus: an anomalous muscle in association with suprascapular nerve compression in an athlete. **Hand (N Y) 10**:76-79, 2015
PUBMED | CROSSREF
7. Colbert SH. Thoracic outlet syndrome in Mackinnon SE (ed): Nerve surgery. New York, NY: Thieme Medical Publishers, pp 310-337, 2015
8. Demondion X, Herbinet P, Van Sint Jan S, Boutry N, Chantelot C, Cotten A. Imaging assessment of thoracic outlet syndrome. **Radiographics 26**:1735-1750, 2006
PUBMED | CROSSREF
9. Dukan R, Petroni G, Muller GP, Silvera J, Masmejean EH. Rare case of dynamic thoracic outlet syndrome resolved by an isolated subclavius posticus muscle resection: a case report. **JBJS Case Connect 11**: e20.00668, 2021
PUBMED | CROSSREF
10. Forcada P, Rodríguez-Niedenführ M, Llusá M, Carrera A. Subclavius posticus muscle: supernumerary muscle as a potential cause for thoracic outlet syndrome. **Clin Anat 14**:55-57, 2001
PUBMED | CROSSREF

https://doi.org/10.13004/kjnt.2022.18.e58

11. Juvonen T, Satta J, Laitala P, Luukkonen K, Nissinen J. Anomalies at the thoracic outlet are frequent in the general population. **Am J Surg 170**:33-37, 1995
PUBMED | CROSSREF

12. Kolpattil S, Harland R, Temperley D. Case report: a case of subclavius posticus muscle mimicking a mass on mammogram. **Clin Radiol 64**:738-740, 2009
PUBMED | CROSSREF

13. Martin RM, Vyas NM, Sedlmayr JC, Wisco JJ. Bilateral variation of subclavius muscle resembling subclavius posticus. **Surg Radiol Anat 30**:171-174, 2008
PUBMED | CROSSREF

14. Muellner J, Kaelin-Lang A, Pfeiffer O, El-Koussy MM. Neurogenic thoracic outlet syndrome due to subclavius posticus muscle with dynamic brachial plexus compression: a case report. **BMC Res Notes 8**:351, 2015
PUBMED | CROSSREF

15. Ozçakar L, Güney MS, Ozdağ F, Alay S, Kiralp MZ, Görür R, et al. A sledgehammer on the brachial plexus: thoracic outlet syndrome, subclavius posticus muscle, and traction in aggregate. **Arch Phys Med Rehabil 91**:656-658, 2010
PUBMED | CROSSREF

16. Sato Y, Oota U, Yokota A. La anomalio de M. omohyoideus ce Japanok. **Nichidai Igaku Zasshi 28**:431-444, 1969

17. Smayra T, Nabhane L, Tabet G, Menassa-Moussa L, Hachem K, Haddad-Zebouni S. The subclavius posticus muscle: an unusual cause of thoracic outlet syndrome. **Surg Radiol Anat 36**:725-728, 2014
PUBMED | CROSSREF

18. Tanaka S, Zukeran C, Nakagawa S. A macroscopical study of the subclavius muscle of the rat. **Anat Anz 165**:417-424, 1988
PUBMED

19. Ulusoy OL, Alis D, Oz A, Barlas SB, Sokmen BK, Sever S, et al. The prevalence and characteristics of the subclavius posticus muscle in the adult population on MRI. **Surg Radiol Anat 40**:1141-1145, 2018
PUBMED | CROSSREF

20. Yun S, Park S, Kim CS. Absence of the subclavius muscle with contralateral subclavius posticus muscle: first imaging report. **Clin Imaging 49**:54-57, 2018
PUBMED | CROSSREF

https://doi.org/10.13004/kjnt.2022.18.e58