

# Winged scapula caused by dorsal scapular neuropathy combined with suprascapular neuropathy

## A case report

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### Abstract

**Rationale:** Scapular winging is caused by neuromuscular dysfunction of shoulder stabilizer muscles. Clinically, a winged scapula can be easily diagnosed by typical physical findings. We report a case of atypical winged scapula caused by dorsal scapular neuropathy combined with suprascapular neuropathy, which has rarely been reported.

**Patient concerns:** A 25-year-old right-handed male was admitted to the clinic due to right arm weakness for 1 year. On physical examination, right winged scapula with medially rotated inferior angle was observed on flexion.

**Diagnoses:** Under the diagnostic impression of a winged scapula due to long thoracic nerve injury based on physical examination, electrodiagnostic study was performed. However, the results showed right dorsal scapular neuropathy combined with suprascapular neuropathy.

**Interventions:** Neck and right shoulder MRI were also performed to rule out other causes of winged scapula, but these showed only a partial thickness tear of the rotator cuff tendon. The patient received rehabilitation.

**Outcomes:** The symptoms have not improved.

**Lessons:** In this case, combined suprascapular neuropathy might contribute to scapular winging and can confuse the diagnosis of winged scapula based on physical findings. This is the first report that indicates suprascapular neuropathy as a contributing factor of scapular winging.

**Abbreviations:** CMAP = compound muscle action potential, MMT = manual muscle testing, MRI = magnetic resonance imaging, ROM = range of motion.

**Keywords:** dorsal scapular neuropathy, electrodiagnostic study, scapular winging, suprascapular neuropathy

## 1. Introduction

A winged scapula is a rare debilitating condition caused by neuromuscular dysfunction of shoulder stabilizer muscles. Scapular winging causes limited functional activity of the upper limbs. It has numerous causes involving traumatic, iatrogenic, and idiopathic processes that lead to injury of either the long thoracic, dorsal scapular, or spinal accessory nerve.<sup>[1]</sup> Most lesions associated with winged scapula are the result of blunt trauma

due to repetitive movements, as seen in athletics.<sup>[2]</sup> The most common cause of scapular winging is paralysis of the serratus anterior muscle due to the injury of the long thoracic nerve.<sup>[3,4]</sup>

Dorsal scapular neuropathy may result in abnormal motion of the shoulder joint with scapular winging.<sup>[3]</sup> Dorsal scapular neuropathy is rare and may mimic shoulder impingement or rotator cuff injury.<sup>[3]</sup> Therefore, it is difficult to discern the accurate diagnosis of scapular winging based on physical examination.

Suprascapular neuropathy is associated with upper extremity weakness and shoulder pain and usually, caused by trauma or strenuous activities.<sup>[5]</sup> It has not been generally regarded as the cause of scapular winging. The relationship between suprascapular neuropathy and scapular winging has not yet been reported.

Here, we report an unusual case of scapular winging caused by dorsal scapular nerve injury combined with suprascapular nerve injury, which has been rarely reported previously.

## 2. Method

Because this is a case report and a new intervention was not performed, ethics committee or institutional review board approval was not obtained. However, informed consent was obtained from the patient.

## 3. Case presentation

A 25-year-old right-handed male was admitted to the clinic due to right upper limb weakness. He had difficulty in lifting his right arm above the shoulder. His symptoms started gradually 1 year

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before his admission. He worked as a cook for 6 years and used his right arm strenuously to cook. Before the right upper limb weakness presented, he complained of right shoulder pain for 1 week. After the right shoulder pain spontaneously subsided, right arm weakness developed. There were no suspicious signs or symptoms of infection at that time. There was no remarkable muscle atrophy of the right shoulder. There was also no trauma history or family history of muscle weakness or atrophy.

On manual muscle testing (MMT), right shoulder flexion and abduction were grade 3+ on the medical research council scale. The result of MMT of right shoulder extension was grade 4. Active range of motion (ROM) in shoulder flexion was limited to 90°. Active ROM of shoulder abduction was limited to 80°. There were no sensory abnormalities or tenderness of the right shoulder region. Deep tendon reflexes were normal in both upper limbs.

On close inspection, the medial border of the right scapula was mildly prominent at rest but was not remarkable (Fig. 1A). Right winged scapula with medially rotated inferior angle was observed when the patient flexed his shoulder (Fig. 1B). However, when he abducted his shoulder, right winged scapula was not as prominent (Fig. 1C). Based on this physical examination, the diagnostic impression of scapular winging was thought to be due to paralysis of the serratus anterior muscle due to the injury of the long thoracic nerve.

Electrodiagnostic study was performed to determine the cause of scapular winging. On nerve conduction study, the amplitude of the right dorsal scapular compound muscle action potential (CMAP) recorded at the rhomboid major muscle was reduced compared to the left side. The amplitudes of the right suprascapular CMAPs recorded at the supraspinatus and infraspinatus muscles were also reduced compared to the left side. The amplitude of the right long thoracic CMAP recorded at the serratus anterior muscle was similar to that of the left long thoracic CMAP. On needle electromyography, abnormal spontaneous activities were found in the right supraspinatus and infraspinatus muscles. On motor unit action potential during volitional activity, polyphasic patterns and reduced recruitment patterns were found in the right supraspinatus, infraspinatus, and rhomboid major muscles. There were no abnormalities in other muscles. In electrodiagnostic study, right dorsal scapular neuropathy combined with suprascapular neuropathy above a suprascapular notch lesion was diagnosed. The

results of the electrodiagnostic study were different from what we expected based on physical examination. The electrodiagnostic study was repeated after 3 weeks, and the result was similar to the previous study.

Plain radiograph and magnetic resonance imaging (MRI) of the cervical spine were performed to rule out other causes of scapular winging. However, the result of radiologic examination of the cervical spine showed no specific findings except straightening of the cervical spine curvature. Right shoulder MRI was performed and showed a partial thickness tear of the rotator cuff tendon, especially the supraspinatus and infraspinatus tendons.

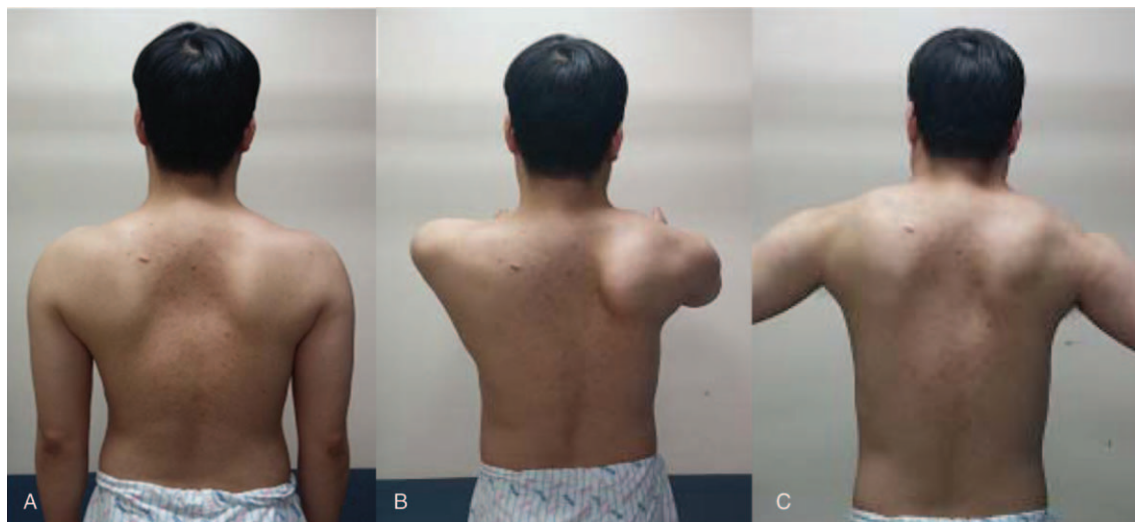
The patient received rehabilitation treatment for 5 months. Physical therapy and manual therapy were performed to stabilize and strengthen the right shoulder girdle. Treatment was conducted 3 times a week. However, the therapeutic effect was minimal, and the patient's symptoms remained.

#### 4. Discussion

In this case, the scapular winging observed was consistent with the typical physical findings of long thoracic neuropathy. However, the final diagnosis was dorsal scapular neuropathy combined with suprascapular neuropathy according to the electrodiagnostic study.

The long thoracic nerve innervates the serratus anterior muscle, has a rather long and twisting anatomic course, and is on average 24 cm in length.<sup>[1]</sup> The common cause of long thoracic nerve injury is strenuous activity, such as overuse, repetitive exercise, or heavy workloads.<sup>[1,2]</sup> Blunt trauma that results in sudden depression of the shoulder girdle can also induce long thoracic nerve injury.<sup>[1,2]</sup> The function of the serratus anterior muscle is to protract and stabilize the scapula. Paralysis of this muscle caused by long thoracic nerve injury can induce a particular type of scapular winging. At rest, the scapula as a whole is translocated medially with the inferior angle rotated medially. These abnormalities are accentuated when a patient flexes the shoulder forward or pushes on a wall in a push-up motion due to weak scapular protraction.<sup>[1]</sup>

The dorsal scapular nerve innervates the rhomboid major and minor muscles, which provide scapular retraction, elevation, and medial rotation of the inferior scapular angle. This nerve has been



**Figure 1.** Inspection of the patient's scapula at admission in neutral (A), shoulder flexion (B), and shoulder abduction (C) positions.

reported to be injured in strenuous weightlifting activities, shoulder dislocation, and entrapment between the scalene muscles.<sup>[6,7]</sup> Injury to this nerve can cause a distinct form of scapular winging different from an injury to the long thoracic nerve. The winged scapula caused by an injury of the dorsal scapular nerve appears as a prominence of the inferior angle with lateral rotation. The scapula is translocated laterally as a whole. These findings are accentuated when a patient elevates the affected arm overhead.<sup>[8]</sup>

The suprascapular nerve innervates the supraspinatus and infraspinatus muscles through fibro-osseous foramina. This nerve is susceptible to entrapment or traction injury because it traverses various scapular recesses.<sup>[9,10]</sup> Acute injury of the suprascapular nerve is often caused by direct trauma, such as fracture or dislocation of the shoulder. However, chronic lesions of this nerve result from repetitive microtrauma associated with forceful occupational and sports activities.<sup>[9]</sup> The supraspinatus and infraspinatus muscles assist in the abduction and external rotation of the shoulder, as well as stabilization of the shoulder girdle. Weakness of these muscles is manifested as altered ability to externally rotate the shoulder, which might lead to abnormal scapular motion. Altered scapular motion can further aggravate supraspinatus and infraspinatus weakness and result in shoulder dysfunction.<sup>[11]</sup>

Mild medial border prominence of the right scapula at rest, which is not compatible with dorsal scapular neuropathy, was presumably due to combined suprascapular neuropathy in this patient. Medial rotation of the inferior angle when scapular winging was observed might also be due to combined suprascapular neuropathy. Paralysis of the supraspinatus and infraspinatus muscles might have led to these unusual findings. Considering the direction of the force originating from supraspinatus and infraspinatus muscles, winged scapula with medially rotated inferior angle could be observed even in cases of dorsal scapular neuropathy. In this case, suprascapular neuropathy might have had a greater influence on dorsal scapular neuropathy, which has a tendency to laterally translocate the scapula with a laterally rotated inferior angle. The combined suprascapular neuropathy might have contributed to scapular winging.

A previous case study reported two patients with dorsal scapular neuropathy combined with suprascapular neuropathy.<sup>[12]</sup> Winged scapula was also observed in two sibling volleyball players. The previous study only suggested a familial tendency, indicating structural vulnerability or anatomical variance, for more extensive lesions in the region of the suprascapular nerve.<sup>[12]</sup> However, detailed findings of scapular winging in those patients were not described. Thus, we do not know whether combined suprascapular neuropathy affected scapular winging in the previous study.

Mallon et al reported a case of suprascapular neuropathy combined with massive rotator cuff tear with a nonfunctional infraspinatus muscle.<sup>[13]</sup> This might adversely affect shoulder girdle stabilization and result in abnormal scapula motion. Merolla et al reported that altered scapular motion leads to weakened rotator cuff muscles.<sup>[11]</sup> According to these previous studies, clinical symptoms might worsen due to a double-crush effect on shoulder biomechanics in cases of suprascapular neuropathy combined with rotator cuff injury.<sup>[13]</sup> There was also a rotator cuff injury in this patient, which might have added to the adverse effect on shoulder girdle stabilization with combined suprascapular neuropathy.

There are a few limitations to consider in this case. When performing an electrodiagnostic study on the dorsal scapular,

suprascapular, and long thoracic nerves, there were no well-documented electrophysiologic techniques using a surface electrode. Instead, electrodiagnostic study for these nerves is performed using a needle electrode inserted into the rhomboid, supraspinatus, infraspinatus, and serratus anterior muscles. CMAP amplitude has little value for assessing conduction abnormalities because of needle electrode recording.<sup>[8]</sup> CMAP latency can be used to verify a nerve injury. The most valuable method for detecting injuries of these nerves is needle electromyography.<sup>[8]</sup> In this case, latencies of the right dorsal scapular and suprascapular CMAPs were delayed compared with the left side but were within normal range. With only these findings, we could not conclude right dorsal scapular neuropathy combined with suprascapular neuropathy. However, evidence of injury to the dorsal scapular and suprascapular nerves was revealed by needle electromyography findings.

This is the first report that indicates combined suprascapular neuropathy as a contributing factor of scapular winging. We also found that scapular winging is not always seen as a typical pattern if it is accompanied by suprascapular neuropathy. These findings may be helpful to reveal the exact cause of scapular winging in clinical settings.

## 5. Conclusions

Scapular winging is a clinical diagnosis. Characteristic physical examination findings are helpful to determine the cause of a winged scapula. However, a detailed investigation including electrodiagnostic and radiologic evaluations should be performed to disclose any possible combined condition. This case implies that combined suprascapular neuropathy might contribute to scapular winging. Combined suprascapular neuropathy can confuse the cause of scapular winging based on physical examination because the winged scapula may appear different from typical physical findings.

## Author contributions

**Investigation:** Sung Young Lee, Hyeok Dong Lee, Young-Shin Cho, and Seung Hoon Han.

**Supervision:** Seung Hoon Han.

**Writing – original draft:** Sung Young Lee.

**Writing – review and editing:** Sung Young Lee, Hyeok Dong Lee, Young-Shin Cho, and Seung Hoon Han.

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