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Isolated Spinal Accessory Nerve Palsy from Volleyball Injury

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Abstract

Spinal accessory nerve (SAN) palsy is typically a result of posterior triangle surgery and can present with partial or complete paralysis of the trapezius muscle and severe shoulder dysfunction. We share an atypical case of a patient who presented with SAN palsy following an injury sustained playing competitive volleyball. A 19-year-old right hand dominant competitive volleyball player presented with right shoulder weakness, dyskinesia, and pain. She injured the right shoulder during a volleyball game 2 years prior when diving routinely for a ball. On physical examination she had weakness of shoulder shrug and a pronounced shift of the scapula when abducting or forward flexing her shoulder greater than 90 degrees. Manual stabilization of the scapula eliminated this shift, so we performed scapulopexy to stabilize the inferior angle of the scapula. At 6 months postoperative, she had full active range of motion of the shoulder. SAN palsy can occur following what would seem to be a routine volleyball maneuver. This could be due to a combination of muscle hypertrophy from intensive volleyball training and stretch sustained while diving for a ball. Despite delayed presentation and complete atrophy of the trapezius, a satisfactory outcome was achieved with scapulopexy.

Keywords
- accessory nerve injuries
- cranial nerve XI injury
- spinal accessory nerve injury
- spinal accessory nerve trauma

Spinal accessory nerve (SAN) palsy is typically a result of posterior triangle surgery and can present with partial or complete paralysis of the trapezius muscle and severe shoulder dysfunction. Several atypical causes of SAN palsy have been described in the literature, including stretch injury[1,2] and compression from muscle hypertrophy due to repetitive movements performed in manual labor and sports activities.[3–5] Herein, we share an atypical case of a patient who presented with SAN palsy following a closed injury sustained playing competitive volleyball.

Case Report

A 19-year-old right hand dominant competitive volleyball player presented with right shoulder weakness, dyskinesia, and pain. She injured the right shoulder during a volleyball game 2 years prior when diving routinely for a ball. Two months postinjury, at another institution, she underwent anterior and middle scalene partial resection and internal and external neurolysis of the long thoracic nerve, suprascapular nerve, and upper trunk of the brachial plexus. She reported no improvement. She also completed multiple courses of physical therapy without

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improvement. At the time of our evaluation, she had weakness of right shoulder shrug and required a pronounced and painful shift of the torso and scapula when forward flexing or abducting her shoulder greater than 70 degrees, presumably to provide mechanical advantage to the deltoid (►**Video 1**). Manual stabilization of the inferior angle of the scapula against the posterior thorax eliminated this shift and allowed her to abduct and forward flex fully and without discomfort (►**Video 2**). Our workup included electromyography, which showed the right brachial plexus to be fully intact (but did not evaluate the trapezius), and magnetic resonance imaging, which revealed complete atrophy and fatty replacement of the entire (upper, middle, and lower) trapezius muscle (►**Fig. 1**). Because the atrophic trapezius was no longer salvageable, we felt that further evaluation or exploration of the SAN would be fruitless, and instead recommended scapulopexy to permanently stabilize the inferior angle of the scapula against the thorax.

Video 1

Preoperatively, the patient was unable to abduct beyond 70 degrees without severe compensatory movements of the torso and scapula. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0042-1748660.

Video 2

Firm manual stabilization of the inferior angle of the scapula against the posterior thorax eliminated the scapular shift, enabling the patient to abduct fully and smoothly. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0042-1748660.

We performed the surgical procedure as an outpatient under general anesthesia. We marked the inferior angle of the scapula preoperatively with the patient standing, the arm adducted, and the scapula in a neutral (i.e., nonprotracted) position. With the patient in the left lateral decubitus position, we made a 9-cm incision along the preoperative marking, exposing the inferior angle of the scapula. We exposed the underlying rib and created a subperiosteal plane around the rib, taking great care to avoid pleural injury. We then passed #2 polyethylene/polyester braided suture (FiberWire, Arthrex, Naples, FL) around the rib (►**Fig. 2A and B**). We used a drill to create a hole at the inferior angle, preserving a 2-cm bridge of bone at the medial and lateral borders. We then passed two cadaveric gracilis tendons, reinforced with FiberTape (Arthrex), under the rib and through the hole in the scapula, cinching the construct to allow just a few millimeters of motion between the scapula and the rib (►**Fig. 3**). We secured the tendons together with a Pulvertaft weave. As is routine for chest wall surgery, a positive pressure Valsalva maneuver was used to verify the integrity of the pleura prior to closure. At the conclusion of the procedure we placed the patient in a shoulder harness to prevent scapular protraction.

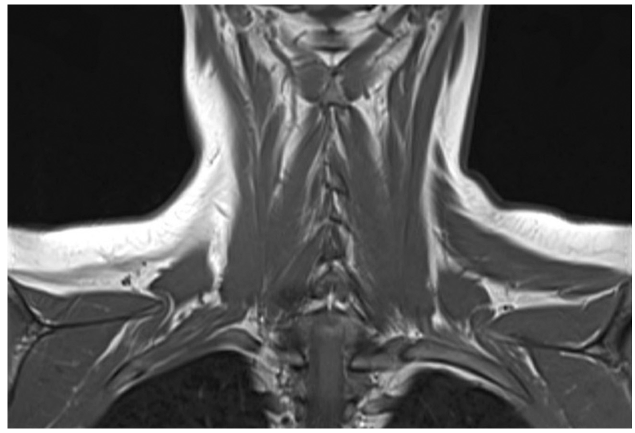

Fig. 1 Magnetic resonance image showing complete atrophy of the right trapezius.

The patient continued the shoulder harness for 12 weeks postoperatively, removing only for hygiene. We restricted her from shoulder motion for the first 8 weeks, then limited her to 90 degrees abduction and forward flexion for an additional 4 weeks. At 12 weeks we discontinued the harness and allowed full active motion at the glenohumeral joint, with a focus on active stabilization of the scapulae in a depressed and retracted position. We described this to the patient as moving the shoulder joint but keeping the shoulder blades *down and back*. At 6 months she had regained full active range of motion of the shoulder, with smooth, painless motion (►**Videos 3** and **4**). Informed consent for this study was obtained from the patient.

Video 3

Six months after scapulopexy, the patient was able to move the shoulder actively through a full range of motion smoothly and without pain—anterior view Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0042-1748660.

Video 4

Six months after scapulopexy, the patient was able to move the shoulder actively through a full range of motion smoothly and without pain—posterior view. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0042-1748660.

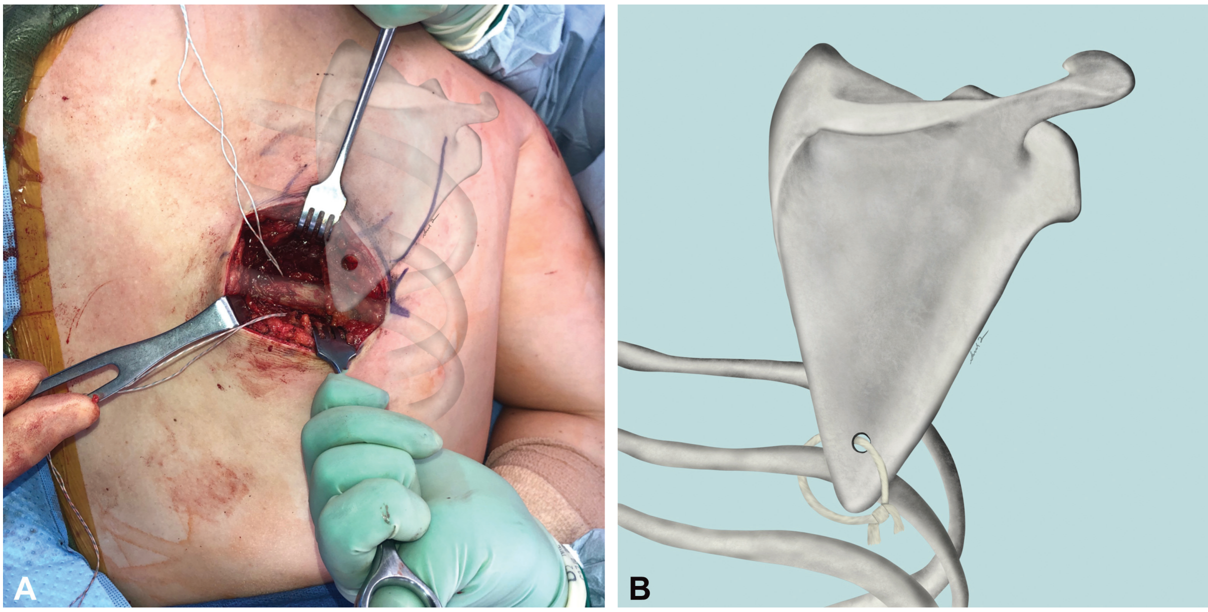

Fig. 2 (**A**) A FiberTape suture (Arthrex, Naples, FL) was passed in the subperiosteal plane around the rib that underlay the inferior angle of the scapula, and a hole was drilled in the inferior angle of the scapula, maintaining a 2-cm bridge of bone at the medial and lateral borders. (**B**) Schematic line diagram of scapulopexy procedure.

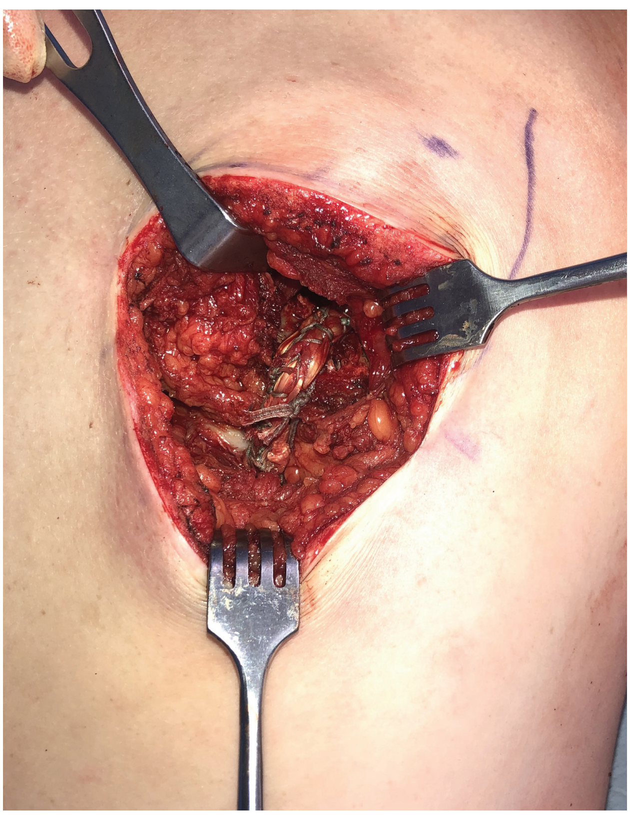

Fig. 3 Cadaveric gracilis tendons were woven with the FiberTape and passed through the scapular hole. This tendon/suture construct was cinched in a Pulvertaft weave to allow just a few millimeters of motion between the inferior angle of the scapula and the rib.

Discussion

The SAN is also known as the eleventh cranial nerve, as it contains some fibers that originate in the nucleus ambiguous of the medulla. However, the primary function of the nerve, motor input to the sternocleidomastoid (SCM) and trapezius muscles, comes from fibers originating in the ventral horn of the upper 4 to 6 cervical segments of the spinal cord. These spinal fibers ascend through the foramen magnum and join with the cranial component before exiting the skull through the jugular foramen. The SAN then passes downward to reach the SCM and trapezius.[1] Perhaps due to this circuitous route, as opposed to the direct route of the brachial plexus trunks, the SAN is almost always spared in the type of traction mechanisms that result in brachial plexus injuries. A clinician who frequently deals with brachial plexus injuries might therefore overlook the possibility of an SAN injury when evaluating a patient with neurologic shoulder dysfunction. The purpose of this article is to call attention to this unusual mechanism for SAN palsy.

The most common cause of SAN palsy is surgical damage from procedures such as cervical lymph node dissection, thyroidectomy, and carotid surgery.[2,6,7] Tumors are a less common cause of SAN palsy.[8] Some unusual causes of SAN palsy have been reported, such as whiplash injury,[9,10] carrying climbing gear or heavy rucksacks[11] that put pressure on the SAN, and manual labor jobs, which are thought to cause microtrauma and local inflammation through repetitive muscle use.[3,12,13] Sport-related injury to the SAN appears to be extremely uncommon, but has been described in the literature secondary to direct trauma (hockey stick striking the neck), forceful rotation of the head to the opposite shoulder (wrestling), and a combination of hypertrophy and extreme loading of the trapezius (weightlifting). Our case adds volleyball to the list of potentially injurious sports.

The most noticeable effect of SAN palsy is motor weakness of the trapezius muscle. As a result, the most common complaint is difficulty abducting the shoulder above 90 degrees.[12] This primary symptom of shoulder dysfunction may lead to diagnostic difficulty with extensive shoulder injury workup, brachial plexus workup, prolonged therapy, and ultimately a delay in treatment, as was the case for our patient. Unfortunately, paralysis of the trapezius is sometimes not responsive to therapy as the other muscles of the shoulder girdle cannot fully recapitulate the functions of the trapezius. To be fair, although it might be possible to explore and repair the nerve if the diagnosis were made immediately, it might also be possible, and perhaps probable, that inability to localize the lesion would preclude repair.

In our patient, some of her dysfunction and abnormality of scapular motion developed over years as a compensatory motion. Evaluation of the scapula is critical in the workup of unusual shoulder presentations, such as this case. Although the SAN does not contain sensory nerves, patients with SAN palsy still often report pain in the ipsilateral neck that radiates to the arm,[14] possibly caused by atrophy of the trapezius and resulting increased tension along the brachial plexus. This appeared to be an issue in our patient, who reported static, diffuse pain in the ipsilateral neck and shoulder, in addition to the dynamic pain and crepitus during shoulder motion. Interestingly, surgical stabilization of the inferior angle of the scapula completely eliminated both the static and dynamic pain in our patient.

Author Contributions

C.A.H. and S.L.H. contributed to the writing of this manuscript. B.M.E. and S.L.H. contributed to the conception and editing of this manuscript.

Patient Consent

Informed consent was obtained from all individual participants included in the study.

Conflict of Interest

None declared.

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