Suprascapular Vascular Anomalies as a Cause of Suprascapular Nerve Compression

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Abstract: The vascular anatomy at the spinoglenoid and suprascapular notches appears to be more variable than previously thought. In patients presenting with signs of suprascapular nerve compression, vascular causes must be considered. Especially when considering percutaneous or arthroscopic treatment, awareness of these entities may help to guide treatment decisions, aid in identification of the anatomy, and prevent unwanted vascular insult.

The first report of compression of the suprascapular nerve was by Schilf in 1952. Since then, the understanding of this neuropathy and its possible etiologies has improved substantially. Those thought to be at highest risk include athletes engaging in repetitive overhead activity, especially tennis and volleyball players. Nerve compression has been attributed to a stenotic notch, an ossified transverse scapular ligament, soft tissue or bone tumors, cysts secondary to capsulolabral pathology, and fractures. Several authors have described suprascapular nerve palsy in patients with a massive rotator cuff tear associated with fatty infiltration or muscle atrophy. At times, anatomic variants of the neurovascular structures may lead to compression of the suprascapular nerve; however, this has been sparsely described in previous literature. The current article describes one such compressive etiology and reviews the literature on vascular anomalies at the suprascapular and spinoglenoid notches.

Case Report
A 52-year-old man who had undergone 2 previous failed shoulder surgeries for presumed rotator cuff tear presented with pain and progressive weakness of forward elevation, abduction, and external rotation of his left shoulder. No rotator cuff tear was seen during the previous surgeries, and a subacromial decompression with acromioplasty was performed. Although he initially reported being unable to play basketball and participate in weight lifting, his symptoms progressed to limiting his ability to work.

Electromyography and nerve conduction studies demonstrated mild denervation in the infraspinatus and supraspinatus muscles. The decision was made to proceed with suprascapular nerve decompression at the suprascapular notch.

With the patient in the beach-chair position, thorough arthroscopic examination was performed. Physical therapy failed to improve his weakness or discomfort, which localized to the posterior scapular region, and some atrophic changes were seen on inspection of the periscapular muscles. Magnetic resonance imaging demonstrated edema and moderate atrophy within the supraspinatus and infraspinatus muscles consistent with acute-on-chronic denervation, but no evidence of a tear. No lesion was identified within the suprascapular notch (Figure 1).

A second electromyogram and nerve conduction study obtained 12 weeks after the first studies showed dysfunction of the suprascapular nerve at or proximal to the suprascapular notch, with the supraspinatus and infraspinatus muscles demonstrating evidence of both acute and ongoing denervation and chronic changes. The decision was made to proceed with suprascapular nerve decompression at the suprascapular notch.
Evidence existed of a rotator cuff tear. A lateral viewing portal was established in the subacromial space. The coracoacromial ligament was identified and followed down to the base of the coracoid. A straight medial Nevasier portal was made under direct vision with a spinal needle, similar to the technique described by Lafosse et al. Just medial to the conoid ligament, the transverse scapular ligament was identified, and both the suprascapular artery and nerve were identified passing beneath the ligament. Two smaller branches of the suprascapular artery originating proximal to the ligament were traveling with the main trunk of the suprascapular artery under the ligament. These 3 arterial vessels were compressing the nerve within the notch (Figure 2).

A narrow arthroscopic biter was then used to divide and resect the transverse scapular ligament. However, the artery was still tethered medially by the smallest of the branches (Figure 3). This branch was cauterized using an arthroscopic cautery device and then divided. The artery then lifted superiorly off the nerve, leaving the nerve freely mobile in the notch (Figure 4).

Six months postoperatively, the patient had no pain, full range of motion, and 5/5 rotator cuff strength. Electromyography demonstrated significant interval improvement with no signs of active denervation, normal recruitment, and a full 100% interference pattern. At 1-year follow-up, the patient remained symptom free and had returned to manual labor.

**DISCUSSION**

The suprascapular nerve has contributions from C4-C6 via the upper trunk of the brachial plexus. It is a mixed nerve with sensory branches to the acromioclavicular joint, coracoacromial ligament, and glenohumeral joint capsule and has 2 motor branches that innervate the supraspinatus muscle. The nerve descends through the posterior triangle of the neck before passing beneath the suprascapular ligament in the suprascapular notch. The superior transverse scapular ligament is approximately 1.3 cm posterior to the posterior aspect of the clavicle, 2.9 cm medial to the acromioclavicular joint, and 4 cm deep to the skin surface. The nerve then courses approximately 3 cm medial to the supracle- noid tubercle and 1.8 cm medial from the posterior glenoid rim at the base of the scapular spine. The distance from the palpable posterolateral corner of the acromion to the base of the scapular spine is approximately 4.5 cm. It then travels beneath the inferior transverse scapular ligament in

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**Figure 1:** Sagittal magnetic resonance imaging anatomy sequence showing mild decreased muscle bulk and early fatty change of the supra- and infraspinatus consistent with acute-on-chronic changes (A). Fat-suppressed, fluid-sensitive sequence showing significant interstitial edema of muscles consistent with acute denervation changes (B).

**Figure 2:** Arthroscopic image of the suprascapular artery passing under the transverse scapular ligament.

**Figure 3:** Arthroscopic image after release of the ligament showing the pulsatile artery in the notch, tethered by a small medial branch.

**Figure 4:** Arthroscopic image of ligation of the smallest branch allowing the artery to lift superiority out of the notch, exposing the nerve.
the spinoglenoid notch before innervating the infraspinatus muscle via 2 or more motor branches. Suprascapular nerve injuries are common in repetitive overhead athletes, such as tennis, volleyball, and throwing athletes, for 2 main reasons. First, this nerve is vulnerable to stretch injuries because it takes a circuitous course and can become tethered in several places, such as the suprascapular and spinoglenoid notches. Second, those sports are often associated with labral pathology, which can lead to nerve compression from paralabral cysts. The resultant loss of rotator cuff strength can cause decreased performance, and the pain can lead to the inability to participate.

Suprascapular nerve compression causing posterior shoulder pain can be attributed to previous cadaveric findings of sensory branches to the glenohumeral joint, acromioclavicular joint, coracoacromial ligament, and skin. Some evidence indicates that the nerve may supply up to 70% of the sensation of the shoulder. Vorster et al demonstrated a glenohumeral sensory branch in 87% of 31 cadavers and an acromial sensory branch in 74%.

The suprascapular artery is a branch of the thyrocervical trunk of the subclavian artery. It passes downward and laterally across the scalenus anterior muscle and phrenic nerve before running behind and parallel to the clavicle and subclavian muscle. It then crosses the suprascapular notch above the superior transverse scapular ligament, after which it typically gives off branches that supply the supraspinatus muscle. The artery then continues distally, traveling beneath the inferior transverse scapular ligament before forming an anastomosis with the scapular circumflex artery and descending branch of the transverse cervical artery.

The most common anatomic arrangement at the suprascapular notch is that the nerve travels superior to the transverse scapular ligament while the nerve travels under it. This spawned the classic teaching pneumatic that when faced with an obstacle, “the Army [artery] goes over and the Navy [nerve] goes under the bridge.” However, previous cadaveric work showed that the suprascapular artery has a subligamentous course in up to 2.5% of dissections.

In the first clinical report on the subject, Reineck and Krishnan reported finding a subligamentous artery with evidence of suprascapular nerve compression in 3 of 100 patients undergoing arthroscopic suprascapular nerve release. They reported that the ligament was released but offered no follow-up results. They did not trace the artery back to its origin and therefore may have been visualizing a branch of the suprascapular artery proper as opposed to the main artery itself; they suggested that an anterior approach, rather than a lateral approach, may be preferable for better visualization of the suprascapular notch to avoid placing the artery at risk.

Recently, Yang et al dissected 103 cadaveric shoulders and found a single suprascapular artery that passed under the superior transverse suprascapular ligament in 26.2% of the shoulder specimens. They noted that the venous anatomy was more variable, with 21.3% having multiple veins, and all of the vessels passing superior to the ligament only 59.4% of the time. The same vascular arrangement described in the current case (with the suprascapular vein crossing over the transverse scapular ligament and the artery running under) occurred in 10.9% of their cadaveric specimens.

Although venous compression at the suprascapular notch has not been reported, venous compression at the spinoglenoid notch has been reported. Carroll et al were the first to report enlarged spinoglenoid notch veins as a cause of compression leading to pain and infraspinatus weakness. They identified 6 patients, 3 of whom underwent surgery, and all showed clinical improvement. The inferior transverse scapular ligament was divided in all patients, and 1 also had a varicosity ligated. Not all fluid signal seen in the notch on magnetic resonance imaging is a ganglion, and they stressed the importance of recognizing this entity when considering percutaneous aspiration. This has also been described in a patient with varicose veins in the lower extremity who developed a large varix in the spinoglenoid notch resulting in nerve compression. The patient underwent an open vessel ligation and resection with good clinical improvement. They noted that the addition of intravenous contrast when performing magnetic resonance imaging may help to differentiate this from the more common ganglion cyst.

The vascular anatomy at the spinoglenoid and suprascapular notches appears to be more variable than previously thought. In patients presenting with signs of suprascapular nerve compression, vascular causes must be considered. Especially when considering percutaneous or arthroscopic treatment, awareness of these entities may help to guide treatment decisions, aid in identification of the anatomy, and prevent unwanted vascular insult.

**REFERENCES**


