



Posterior Shoulder Pain and Arthroscopic Decompression of the Suprascapular Nerve at the Spinoglenoid Notch

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Suprascapular nerve compression is a disease entity not easily recognized or well understood by many surgeons. Posterior shoulder pain, muscle weakness, and muscle atrophy can result from compression of the nerve at either the transverse scapular ligament or the spinoglenoid ligament in many young adults. Compression at the spinoglenoid ligament, although thought to be rare, is often the result of repetitive overhead activities in either athletes or laborers and results in weakness and atrophy of the infraspinatus muscle. More recently, compression at this site occurs in patients with a massive rotator cuff tear. While this diagnosis is complex and other diagnoses must be considered and ruled out, early intervention is important to successfully manage this patient and return them to their desired activities to avoid permanent muscle atrophy. This paper will discuss the detailed physical examination, adjunct diagnostic procedures, and appropriate arthroscopic surgical treatment of this disease entity to provide the expected outcome with great satisfaction.

Oper Tech Sports Med 22:73-87 © 2014 Elsevier Inc. All rights reserved.

KEYWORDS posterior shoulder pain, suprascapular nerve, spinoglenoid notch, arthroscopic decompression, weakness, atrophy

Suprascapular nerve entrapment in the clinical setting has been a diagnosis to consider when presented with posterior shoulder pain.¹ Although posterior shoulder pain is often mistaken as rotator cuff or cervical disc disease, many authors, including ourselves, have looked at compression of the suprascapular nerve as a possible disease entity to consider in the diagnosis of posterior shoulder pain. Suprascapular nerve compression not only contributes to pain in the posterior shoulder girdle but also contributes to weakness and possible subtle or significant muscle wasting in the supraspinatus and infraspinatus fossas. A prolonged course of symptoms, whether ignored by the patient or a misdiagnosis, can contribute to a prolonged disease course and reversal of symptoms and function. Two possible sites of compression of the suprascapular nerve include the transverse scapular ligament and the spinoglenoid notch²⁻⁵ (Fig. 1). An improved understanding of the disease as well as advanced arthroscopic

techniques will hopefully improve expected outcomes and patient satisfaction in this population. This article focuses on compression of the suprascapular nerve at the spinoglenoid ligament. The readers are referred to our other article in this edition, "Posterior Shoulder Pain and Arthroscopic Decompression of the Suprascapular Nerve at the Transverse Scapular Ligament" for the etiology and treatment of suprascapular nerve compression at the transverse scapular ligament.

Anatomy of the Suprascapular Nerve

The suprascapular nerve has been classically thought to arise from the upper trunk of the brachial plexus (C5-C6) at Erb's point; however, in 25% of individuals, the C4 nerve root also contributes to the nerve's innervation^{6,7} (Fig. 2). As the nerve approaches the suprascapular notch, the artery and the nerve diverge.⁸ At this point, the suprascapular nerve travels under the transverse scapular ligament as it enters the suprascapular notch. The suprascapular artery traverses over the transverse scapular ligament; however, in rare instances, the artery travels with the nerve.⁹ As the nerve then travels laterally along the supraspinatus fossa, it approaches the posterior glenoid rim,

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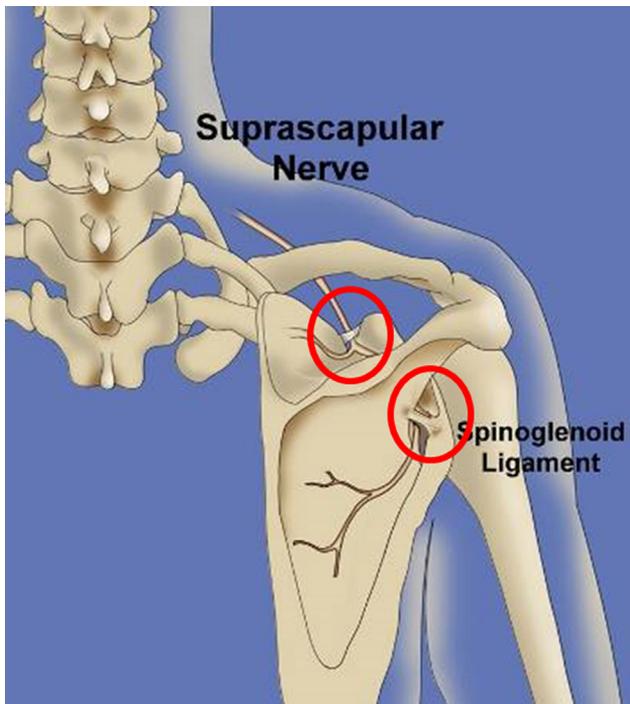


Figure 1 Right shoulder posterior view artwork demonstrating the 2 compression sites of the suprascapular nerve. (Copyright: K. Plancher.)

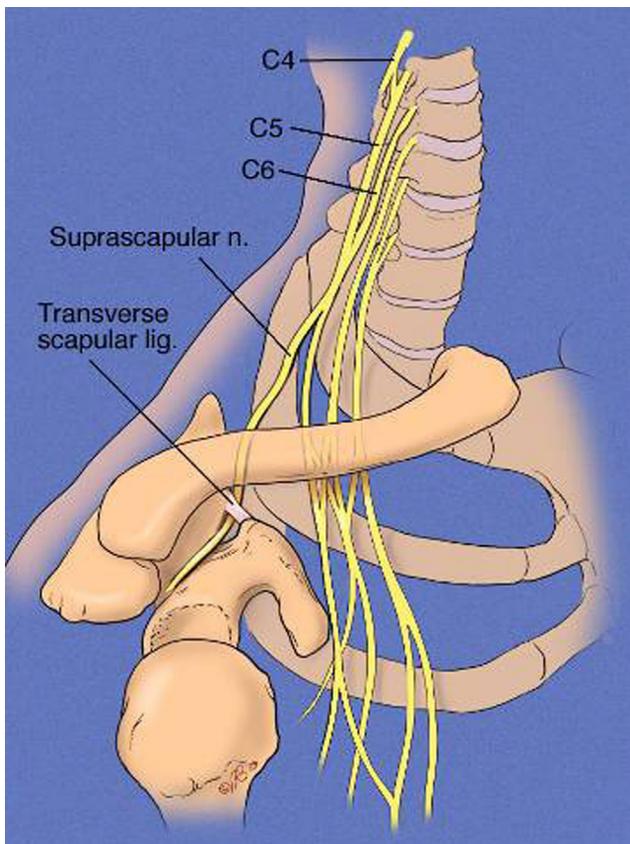


Figure 2 Right shoulder anterior view artwork of the suprascapular nerve arising from the upper trunk of the brachial plexus. (Copyright: K. Plancher.)

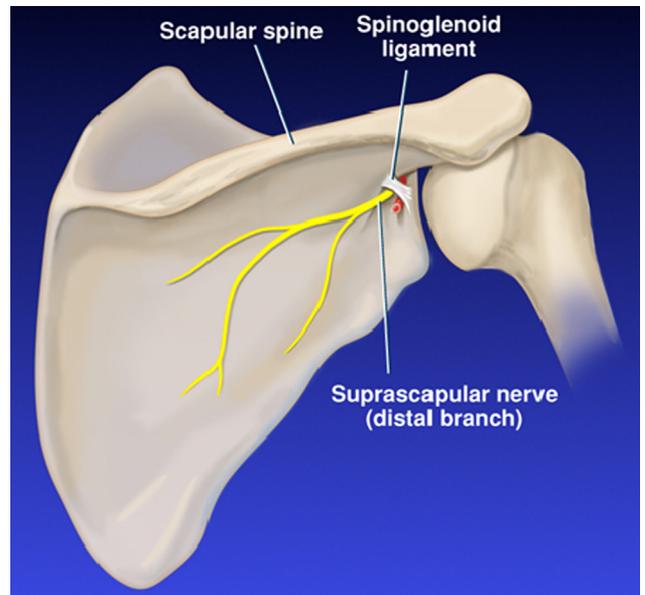


Figure 3 The suprascapular nerve descending into the infraspinatus fossa passing under the spinoglenoid ligament. (Copyright: K. Plancher.)

around the scapular spine, and descends into the infraspinatus fossa and passes under the spinoglenoid ligament (inferior transverse scapular ligament)¹⁰ (Fig. 3). The suprascapular nerve then gives rise to 2-4 branches in the infraspinatus muscle belly.

Some authors have described 2 types of ligaments: type I, which is a thin indistinct band of tissue, and type II, which is a well-formed ligament. We performed a cadaveric study and found that the spinoglenoid ligament was present in 100% of specimens.³ We also found that it has attachments to the glenohumeral joint, which contributes to compression of the suprascapular nerve at the spinoglenoid ligament on internal rotation of the shoulder. The nerve itself is approximately 2.5 cm away from the glenoid rim and located approximately

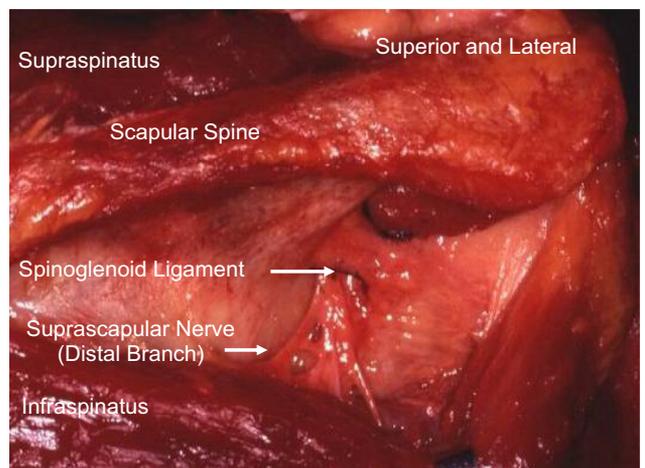


Figure 4 The spinoglenoid ligament, quadrangular in shape, demonstrated in the posterior view of a right shoulder dissection. Note the distal branch of the suprascapular nerve compressed. (Copyright: K. Plancher.)

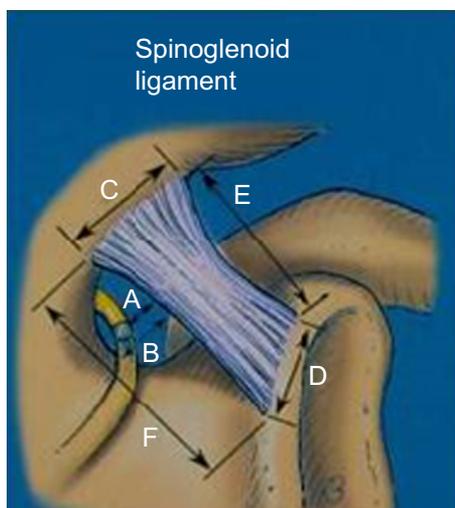


Figure 5 The relationship of the spinoglenoid ligament in a previously published study with investigation of space available between the suprascapular nerve and the spinoglenoid ligament. Note the attachment to the spine of the scapula. (Copyright: K. Plancher.)

4 cm from the posterior corner of the spine of the scapula.³ The spinoglenoid ligament is quadrangle in shape and extends from the posterior glenoid neck and glenohumeral capsule to insert a bilaminar ligament into the scapular spine (Fig. 4). Recent clinical studies, together with the rereading of the many articles with anatomic dissections, have convinced many of the larger amounts of sensory innervation of the shoulder by the suprascapular nerve. These sensory contributions may explain pain on traction or compression of the suprascapular nerve and perhaps after repair of a massive rotator cuff tear with advancement of the tissue.¹¹

Pathophysiology

Injury to the suprascapular nerve may occur at the spinoglenoid ligament (Fig. 5). Although the usual site of suprascapular entrapment neuropathy is at the transverse scapular ligament in the suprascapular foramen, clinical presentation and diagnosis of compression at the most distal site have been well recorded (Fig. 6). Several mechanisms have been proposed and have been previously discussed. Most commonly thought of in overhead athletes, injury to this nerve may occur from repetitive traction and microtrauma.^{2,3,12-14} The spinoglenoid ligament has also been demonstrated to tighten when the shoulder is in a position for overhead throwing, resulting in increased pressure on the suprascapular nerve¹⁵ (Fig. 7). Early literature speculated that injury to this nerve occurred by intimal damage from microemboli in the vasa nervorum.¹⁶ A stenotic notch, ossified spinoglenoid ligament, or even superiorly oriented fibers of the subscapularis muscle may cause suprascapular neuropathy.^{8,17} Compression of the nerve at the spinoglenoid ligament location has been noted by many authors to be caused by a soft tissue mass or ganglion cyst as a result of some form of a labral or capsule injury. Unlike others, we decompress the ganglion from the posterior aspect

of the shoulder and do not repair the labrum and have achieved excellent results^{18,19} (Fig. 8). Compression by a ganglion cyst or soft tissue mass has known to occur because of the relatively fixed position of the suprascapular nerve combined with the close proximity of the infraspinatus muscle to the glenohumeral joint. These ganglia may form when the capsule or labrum tears and synovial fluid is forced into the tissues as a 1-way valve, similar to meniscal cysts that occur in the knee.²⁰

Although rare, a patient may have a neuropathy due to Parsonage-Turner syndrome; however, this viral neuritis more commonly attacks other nerves. Irrespective of the mechanism, compression or injury to the suprascapular nerve at the spinoglenoid ligament results in weakness and, if long term, atrophy of the infraspinatus muscle, with little, if any, probability of return to normal muscle strength.

Patient Profile

History

Patients with compression of the suprascapular nerve at the spinoglenoid notch constitute a special group of individuals, more commonly overhead athletes and laborers, who perform all their tasks above the shoulder. These individuals are young, usually well developed, and complain of a diffuse ache around the shoulder region. Their pain is more localized to 4 cm medial to the posterolateral corner of the acromion as well as near the posterior aspect of the glenohumeral joint.

A patient may complain of weakness on attempts of shoulder external rotation and abduction. This may confuse the examiner who may suspect rotator cuff disease or even cervical disc disease, as symptoms are often similar to compression at the transverse scapular ligament. A patient with compression of the suprascapular nerve at the spinoglenoid ligament has a more profound weakness on external

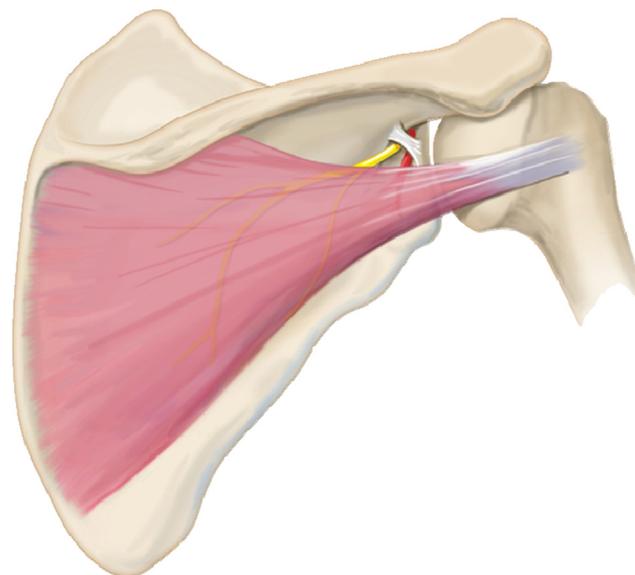


Figure 6 Suprascapular nerve entrapment at the spinoglenoid ligament. Note the medial course of the nerve as it wraps around the spinoglenoid notch. (Copyright: K. Plancher.)

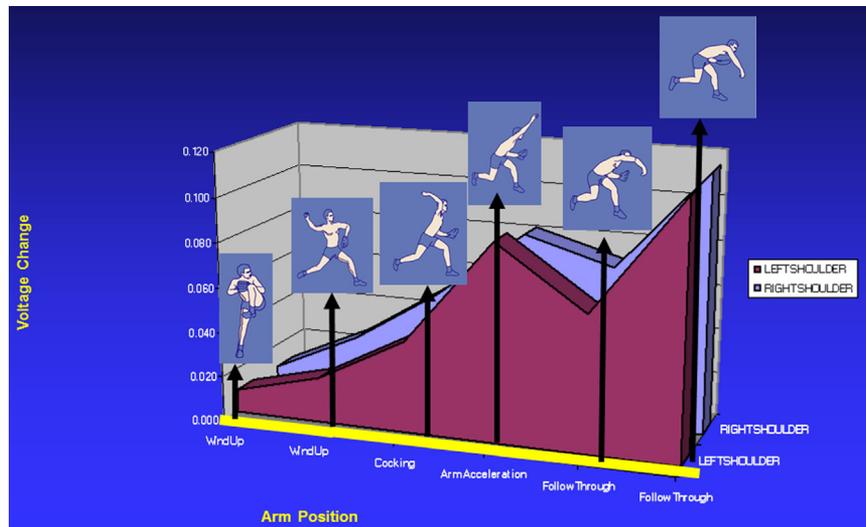


Figure 7 The voltage change that occurs with throwing motion with intact spinoglenoid ligament. Note that the follow through or crossed-arm adduction yields the highest pressure change at the spinoglenoid ligament. (Copyright: K. Plancher.) (Previously published as Figure 4 in Plancher et al.²)

rotation and often has a longer recurrent history of missed diagnoses and chronicity of systems.

There are exceptions; compression can occur because of an acute trauma, as in a forced external rotation of the upper extremity required in many racquet sports. This activity could produce a stretch on the suprascapular nerve and contribute to irritation at the compression point. Activities across the body are often difficult, and follow-through motions, whether throwing a baseball or spiking a volleyball, can be quite painful, leading the athlete to avoid such movements. This position of follow-through or adduction in an extended position has been shown by our group to increase the tension and pressure within the spinoglenoid notch.² Common sports played by these patients include repetitive sports such as golf, volleyball, basketball, tennis, weightlifting, and swimming.

Heavy laborers may also be plagued with suprascapular neuropathy as a result of the repetitive overhead work duties required, similar to laborers with compression of the suprascapular nerve at the transverse scapular ligament. Compression at the spinoglenoid ligament is often insidious in onset. A delayed diagnosis is the single biggest problem that prevents full restoration of muscle strength and alleviation of pain, decreasing the hope for atrophy to be eradicated.

A ganglion cyst can also cause compression of the suprascapular nerve at the spinoglenoid notch. The nerve is relatively immobile as it traverses the lateral edge of the scapular spine and is in close proximity of the posterior glenohumeral joint contributing to possible compression.

Diagnosis by evaluation of history can be difficult because the findings significantly overlap with those of rotator cuff and labral pathology; however, certain findings such as a description of weakness on external rotation activities can help the clinician. The patient may also indicate a difference in the appearance of the infraspinatus fossa when compared with the other side. Range of motion does not often decrease despite chronicity of symptoms; however, the chronic ache or pain

often increases, becomes constant, and can even affect or interrupt sleeping patterns. It is more common for patients to complain of catching, locking, or clicking with spinoglenoid compression than with compression at the transverse scapular ligament because of the frequent association of a labral tear. Lastly, men present more often with this condition, however, with increased participation in sports by women, the ratio of male to female athletes with compression of the suprascapular nerve at the spinoglenoid ligament has an equal distribution.

Physical Examination

In the early evolution of this disease entity, findings on clinical examination are often nonspecific. Symptoms are typically less severe, with suprascapular neuropathy at the spinoglenoid notch. Athletes can present with painless wasting of the infraspinatus in isolation. Surprisingly, palpation at the spinoglenoid notch can be very painful. Some patients may describe microinstability as a part of their complaints, although confirmatory physical findings are not found.

An examination of the cervical spine and both shoulders including a full neurologic examination, similar to that for compression of the suprascapular nerve at the transverse scapular ligament, must be completed. In a shoulder gown with the complete scapula in full view, the examiner must thoroughly inspect the peri-scapular musculature. The patient may exhibit no atrophy or severe atrophy of the infraspinatus, in the infraspinatus fossa (Fig. 9). Atrophy can be overlooked in a well-developed individual who participates in a weight training program owing to the overlying trapezius and the large bulk of the deltoid muscles.

Range of motion must also be tested. Subtle decreases in external rotation and abduction strength can be seen in these young throwers. In patients with long-standing diseases, we

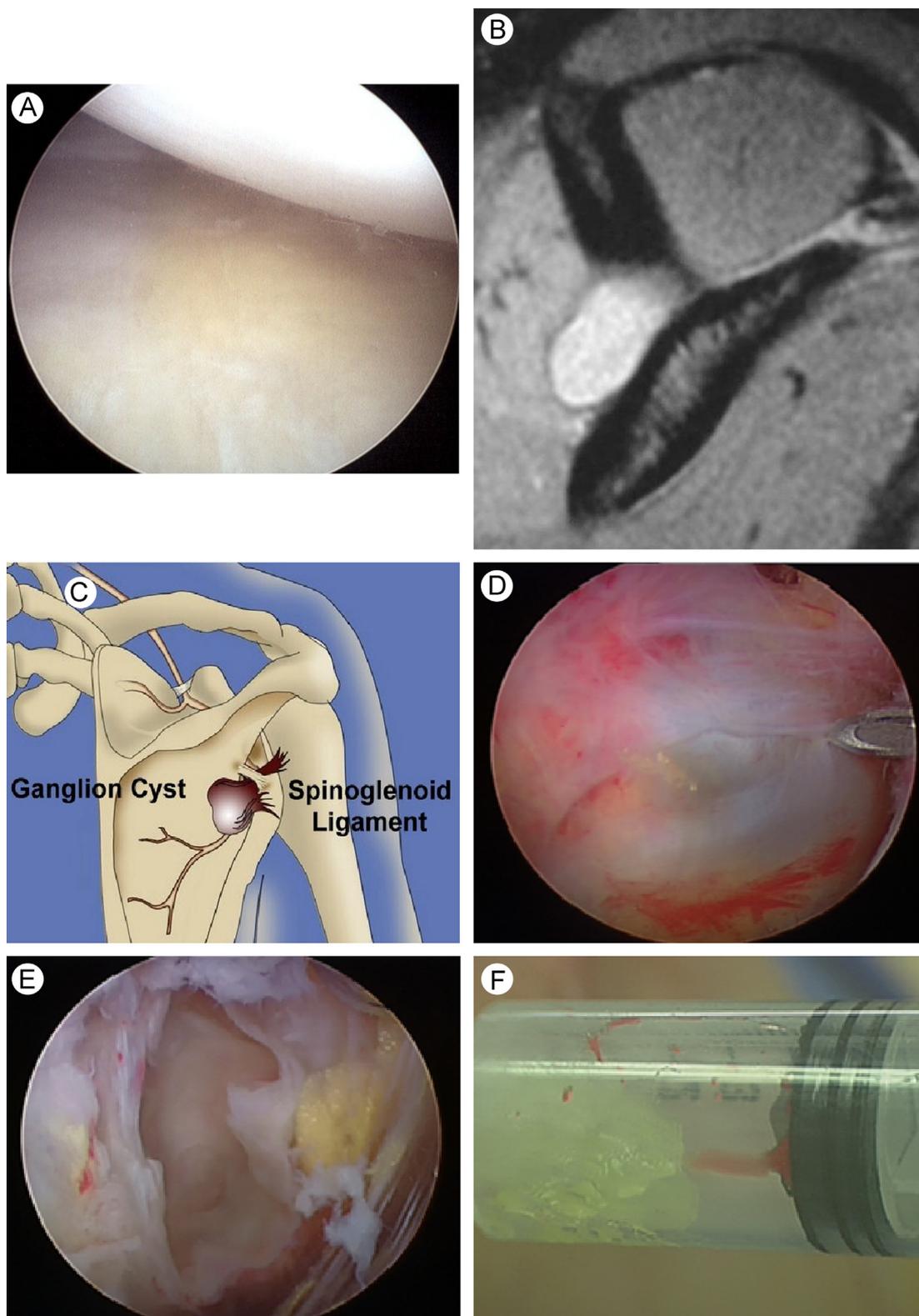


Figure 8 (A) Arthroscopic view of a ganglion cyst decompressed from the outside emitting its contents intra-articularly through a posterior inferior perforation in the labrum. (B) Sagittal oblique magnetic resonance image (MRI) demonstrating a ganglion cyst compressing the suprascapular nerve at the spinoglenoid notch. (C) Artwork of the posterior view of right shoulder demonstrating a classic ganglion cyst compressing the spinoglenoid ligament at its notch. (D) Posterior view of a bulging ganglion cyst located at the spinoglenoid notch (Courtesy John Ticker, MD). (E) Decompressed ganglion cyst at the spinoglenoid notch before complete excision of its root (Courtesy John Ticker, MD). (F) Syringe containing the contents of the ganglion cyst commonly seen on MRI compressing the suprascapular nerve at the spinoglenoid ligament (Courtesy John Ticker, MD). (Copyright: K. Plancher.)



Figure 9 Clinical photograph of the right shoulder (posterior view) demonstrating severe atrophy in a 21-year-old female tennis player with chronic wasting of the infraspinatus muscle since the age of 9 years with no apparent diagnosis. (Copyright: K. Plancher.)

have also found that the teres minor and serratus anterior muscles compensate for infraspinatus weakness to obtain near-normal strength. External rotation should be tested with the arm at the side and marked weakness will be present on testing without any significant pain. The painless finding is because the sensory portion of the suprascapular nerve may be unaffected in the spinoglenoid notch.

Provocative tests for any labral pathology must be performed, as labral tears may be found in conjunction with a suprascapular neuropathy, common at the spinoglenoid ligament. A cross-arm adduction test, as described earlier, must be performed and recorded and correlated with findings on a Zanca view x-ray image (Fig. 10). Cross-body adduction may reproduce the patient's symptoms with the arm extended or internally rotated. The pain may be felt in the posterior aspect of the shoulder as well, but it is important to distinguish whether this pain is from the acromioclavicular joint or from some other source.²¹

Therefore, the differential diagnosis for suprascapular neuropathy at the spinoglenoid notch includes the same diseases as for compression of the nerve at the transverse scapular ligament (ie, cervical disc disease, a brachial neuritis like Parsonage-Turner Syndrome, rotator cuff tendinopathy, labral pathology with or without a ganglion cyst, a mild form of adhesive capsulitis, osteoarthritis of the glenohumeral joint, bursitis of the subacromial space with or without impingement syndrome, acromioclavicular joint degenerative disease, posterior instability, quadrilateral space syndrome, triangular space and interval disease or thoracic outlet syndrome, and the rare Pancoast tumor). The astute clinician realizes that with the lack of reproducible signs on physical examination and the overlapping symptoms with other shoulder problems, compression of the suprascapular nerve at the spinoglenoid ligament may be easily overlooked.

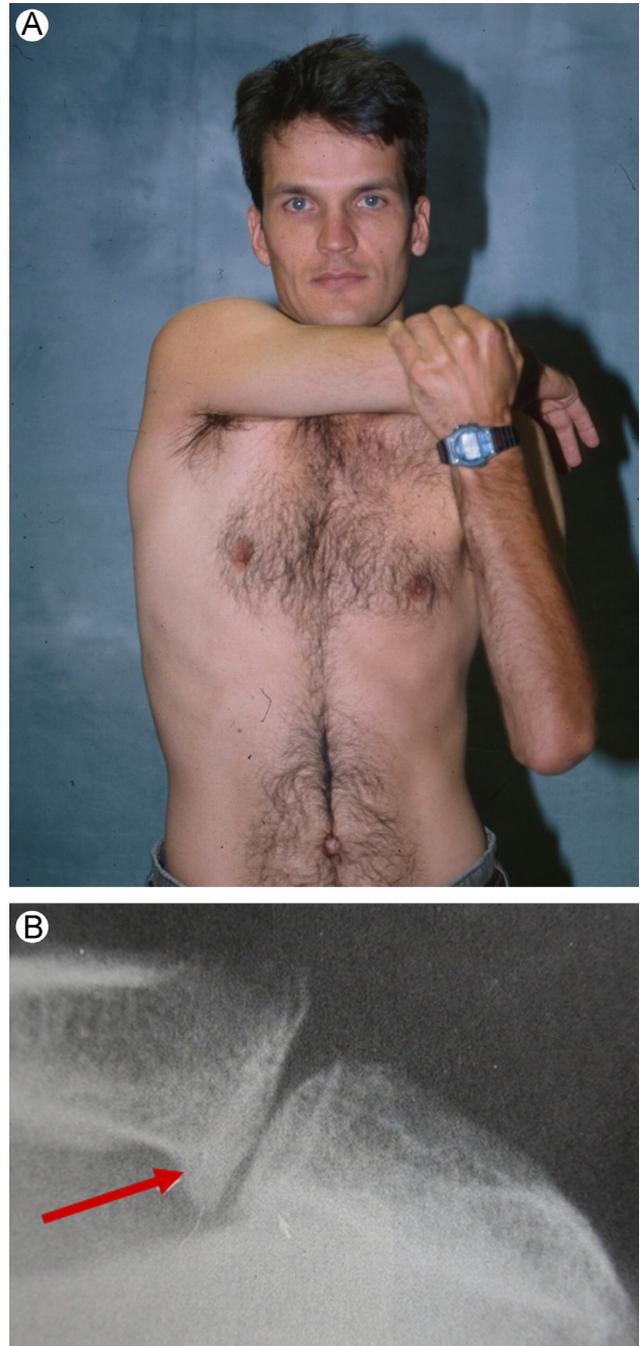


Figure 10 (A) Cross-arm adduction test. (B) Zanca view of a left shoulder showing classic osteoarthritis of the acromioclavicular joint with an osteophyte, which would preclude a diagnosis of suprascapular nerve entrapment. (Copyright: K. Plancher.)

Radiographic Examination

Plain radiographs, including an anteroposterior (AP), axillary lateral, and the Y or suprascapular outlet view, should always be obtained (Fig. 11). Special views, such as a Stryker notch view, can be ordered when necessary.⁴ The plain series identifies any fracture or minute trauma to the scapula, clavicle, coracoid, or glenoid neck.

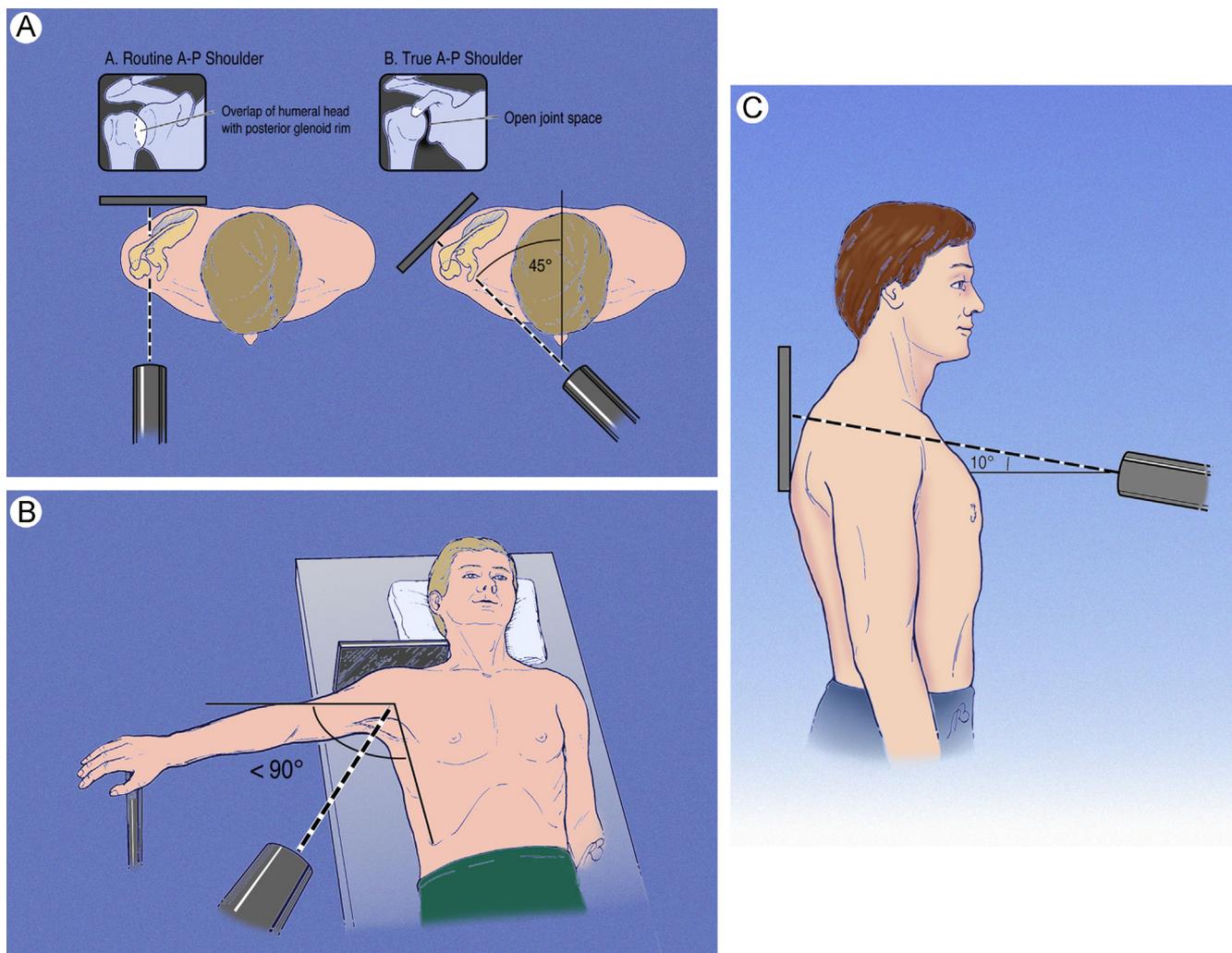


Figure 11 (A) The difference and correct way to obtain a true vs routine AP view of the shoulder. (B) Supine axillary view artwork demonstrated. (C) The direction of the x-ray beam to obtain an x-ray of the acromioclavicular joint with a Zanca view. AP, anteroposterior. (Copyright: K. Plancher.)

Magnetic resonance imaging (MRI) and identification of soft tissue masses, such as ganglion cysts, has become increasingly important when evaluating compression of the suprascapular nerve at the spinoglenoid ligament (Fig. 12). MRI can identify a ganglion with a homogenous signal, low T1 intensity, high T2 intensity, and rim enhancement if contrast is used.²² MRI also detects labral tears that may arise from the glenohumeral joint and with significance from the posterosuperior quadrant of the labrum with the ganglion cyst attached (Fig. 13). Controversy does exist with surgeons on whether the paralabral cyst is a secondary sign of a labral tear in patients. Those who believe that this is the case insist on treatment to the labrum to minimize recurrence, whereas, others may leave the labrum alone when the cyst has been excised or decompressed.

The presence of a soft tissue mass or ganglion cyst on MRI does not necessarily indicate suprascapular neuropathy. Abnormal signal intensity within the infraspinatus muscle can indicate suprascapular nerve compression at the spinoglenoid notch. Some patients demonstrate increased signal intensity on T2 fast spin echo imaging with fat saturation with

a normal muscle mass implying subacute denervation of the nerve caused by neurogenic edema. Chronic denervation seen best on T1 spin echo with increased signal intensity within the muscle mass demonstrates muscle atrophy with fatty infiltration (Fig. 14).

Newer modalities such as ultrasound may be helpful as well in identifying ganglion cysts. This operator-dependent test can be very helpful not only in making a diagnosis but also in assisting surgeons to complete an ultrasound-guided aspiration of the ganglion cyst. Compression sites can be easily seen and aid in making a definite diagnosis as in the case of compression of the suprascapular nerve at the transverse scapular ligament.

Selective Injections

A 1% lidocaine anesthetic may be injected into the spinoglenoid notch to confirm the diagnosis of suprascapular nerve entrapment (Fig. 15). The needle is placed 4 cm medial to the posterolateral corner of the acromion. The patient is then asked if there is any change in the chronic ache that may have been

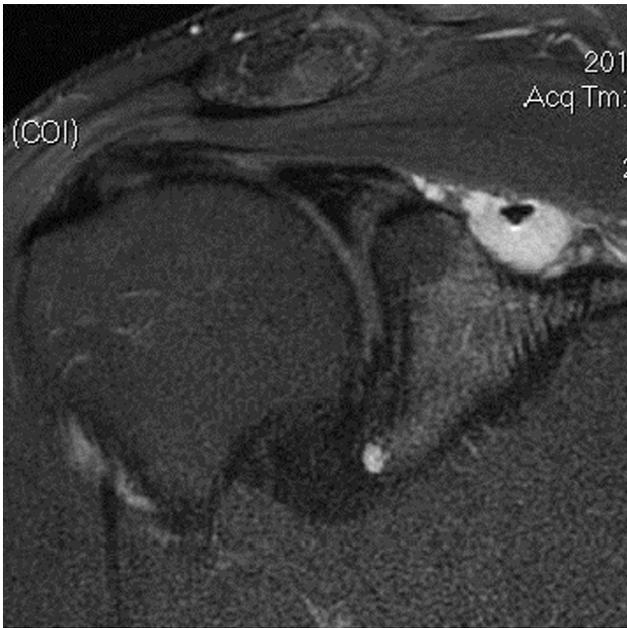


Figure 12 Coronal-view magnetic resonance image demonstrating a ganglion cyst displacing the suprascapular nerve at the spinoglenoid notch. (Copyright: K. Plancher.)

present previously. A cross-arm adduction test is then performed and, if the results were previously positive, it should now be a nonprovocative maneuver.

We have found pain relief to be dramatic and almost immediate. The ultrasound may be used as an adjunct to guide the needle to ensure accuracy. Unlike injecting in the transverse scapular ligament, this injection is simple because one feels the spine of the scapula and drops 1-



Figure 13 Axial-view magnetic resonance image demonstrating a labral tear and ganglion cyst compressing the suprascapular nerve at the spinoglenoid notch. (Copyright: K. Plancher.)

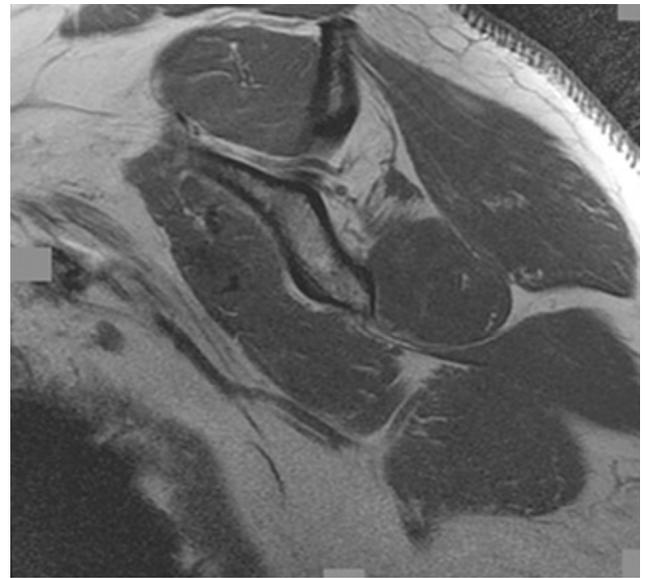


Figure 14 Oblique magnetic resonance image demonstrating isolated infraspinatus atrophy in a volleyball player. Note the course of the nerve in this T2-weighted image. (Copyright: K. Plancher.)

2 cm inferior and then aspirating and easily falling into the spinoglenoid notch. When there is no atrophy, no remarkable finding on electromyogram (EMG), and no evidence of a labral tear or ganglion cyst, and yet weakness and pain are present, we require a 6-month course of non-operative treatment before considering any type of operative intervention.

Electromyogram

Electrodiagnostic testing with myography and nerve conduction studies is the only valid objective assessment to confirm compression of the suprascapular nerve at the spinoglenoid notch. When the suprascapular nerve is compressed by a ganglion cyst or soft tissue mass at the spinoglenoid notch, the nerve shows decreased innervation of the infraspinatus muscle with normal innervation of the supraspinatus muscle. The



Figure 15 Lidocaine injection placed at the spinoglenoid ligament, 4 cm medial to the posterolateral corner of the acromion. (Copyright: K. Plancher.)

stimulation is typically performed at Erb's point. Motor distal latency and motor response amplitude at the supraspinatus and infraspinatus muscles are measured. An increased latency greater than 3.3 milliseconds (range: 2.4-4.2 milliseconds) confirms compression to the infraspinatus.²³

A classic positive result on electrodiagnostic study confirming compression at the spinoglenoid ligament is a dramatic motor loss to the infraspinatus if atrophy is present without changes in the supraspinatus muscle. Patients without visible atrophy present may still have compression of the nerve to the infraspinatus and hopefully demonstrate a delayed terminal latency to the inferior branch of the suprascapular nerve on EMG. Side-to-side measurement differences are important.²⁴ Evaluation of the sensory velocities is less useful as sensory innervation of this nerve is not well defined.

Other authors have felt that the only early finding may be increased nerve conduction time. This noted finding helps the physician to understand that the compression is not in the cervical spine and to be able to identify the compression point with selective injections to avoid chronic damage to the suprascapular nerve. The decreased amplitude, spontaneous activity, or marked polyphasicity of the evoked potentials is significant in confirming the presence of suprascapular entrapment for many when looking at compression at the transverse scapular ligament or at the spinoglenoid ligament.⁴

Suprascapular nerve dysfunction can be present with a normal nerve conduction. It has been shown that EMG and nerve conduction velocity are accurate 91% of the time in detecting nerve injury associated with muscle weakness.^{25,26} EMG testing of the infraspinatus is even more difficult as only 1 branch can be affected and the rest of the muscle may be unaffected, thus misleading the physician to think that suprascapular nerve entrapment is not present. Therefore, we encourage the clinician to test multiple locations. Stimulation of other periscapular muscles leads to volume interference, and perhaps needle recording is the only way of monitoring this disease in lieu of surface recordings. The suprascapular nerve, as mentioned previously, is a mixed motor and sensory nerve, which makes detection of a partial compression even more difficult. We encourage all clinicians to communicate with the neurologist before allowing the patient to undergo EMG and nerve conduction velocity testing so that the most accurate outcome is obtained.

Physical Therapy and Nonoperative Treatment

Most treating physicians believe that the initial treatment for an isolated suprascapular nerve compression is rest, activity modification, anti-inflammatory medications, physical therapy to maintain a normal range of motion, and strengthening of the shoulder girdle with return to sport after proprioceptive and plyometric exercises are completed. We require the therapist to enhance scapular stability and promote proper static and dynamic posture and resistive strengthening programs to the

trapezius, rhomboids, and the serratus musculature before any operative intervention. In the absence of a lesion causing a direct compression, most neuropathies resolve but the symptoms of pain and weakness may take more than a year to reach full resolution.

The natural history of suprascapular nerve entrapment at the spinoglenoid notch is not known, and therefore it is unclear how long to pursue a nonoperative course. If there is a space-occupying lesion, we do not recommend nonoperative treatment. Most of these lesions are ganglion cysts and are often associated with labral tears. Several studies have agreed with our philosophical approach to avoid a prolonged nonoperative regime. Hawkins and his group reported on 2 of 19 patients with a spinoglenoid cyst in whom the symptoms resolved with conservative treatment.²⁷ Hawkins surveyed patients and found patient satisfaction was much higher with surgical intervention. Specifically, they reported an 18% failure rate for aspiration of the cyst and 48% recurrence rate for those cysts that were aspirated successfully.

Ultrasound-guided aspiration of the ganglion cysts has been reported with adequate results at times; however, some authors have reported recurrence rates up to 75%. Although it is a safe technique, we have not recommended it to our patients as a disease-modifying procedure.^{27,28}

All patients who present with visible atrophy to the infraspinatus on physical examination should have a minimum time of nonoperative treatment. We have found, like many before us, that good results only come with early intervention to alleviate the pain with release of the suprascapular nerve because this atrophy that has developed is most of the time irreversible in our young patients.²⁹

Although many authors believe that a program of physical therapy that concentrates on scapular stabilization, shoulder motion, and strengthening is disease altering, we have realized that this theory is incorrect. This program only works to sustain a young athlete in their 20s because his or her serratus anterior or teres group of muscles support the shoulder. Unfortunately, when these same patients return 10 years later, as they have now done for the last 20 years in our practice, they have even more marked atrophy of either fossa and have irreversible muscle damage to the supraspinatus or infraspinatus. Therefore, we believe arthroscopic intervention is essential to arrest the disease process and allow the athlete or laborer to return to their sport or job in a very short period of "down" time.^{4,30}

In advanced and long-standing cases with spinati atrophy that almost never recover completely, we know that shoulder pain can improve with cessation of activity. On resumption of the activity, the pain profile commonly returns. Before the development of the arthroscopic approach, the surgeon not very familiar with the diagnosis of suprascapular neuropathy avoided open decompression because of the anatomy and limited return to sport. It is our hope that with this article and others writing on this topic, patients will afford the opportunity of an early diagnosis and intervention to make suprascapular compression a diagnosis that no longer only sees us, but we see it.

Endoscopic Release of the Spinoglenoid Ligament

Understanding Ganglion Cysts and Our Treatment Regime

The arthroscopic technique described later and other methods have opened the door for treatment of ganglion cysts in an atraumatic way. Avoiding musculature detachment offers a huge benefit to the patient.^{27,31} However, much debate exists on whether cyst decompression alone is sufficient or if it is more appropriate to perform cyst decompression and labral debridement or labral repair or both.³² Recently, some authors reported that they do not decompress the cyst but instead treat the labrum with a repair.³³ No randomized studies, including our technique, has been conducted to show the efficacy of any of these 4 treatment modalities. This section discusses the literature and our thoughts for effectively treating a patient with atrophy in the infraspinatus fossa, pain, weakness, and evidence of a ganglion cyst in the spinoglenoid notch and a labral tear on MRI.

Advocates for treating intra-articular lesions such as the labral tear believe that if you correct the 1-way valve mechanism the cyst will never recur.³⁴ These authors at times just treat the superior labrum anterior to posterior (SLAP) tear and ignore the cyst, as they believe it will decompress itself after correction of all intra-articular pathology. Other authors investigate the type of labral tear present and arthroscopically decompress the cyst and debride the frayed labrum and repair and stabilize a type 2 SLAP in this young population.³⁵ If the labrum is intact, these authors have in the past incised the capsule above the labrum just posterior to the biceps to decompress the ganglion cyst. Other authors who used the subacromial method to decompress the ganglion cyst find the raphe between the supraspinatus and infraspinatus muscles, which is lateral to the spinoglenoid notch, and incise the capsule in this spot and then proceed with a decompression of the ganglion cyst with an accessory posterolateral portal.³¹ It appears from the literature that debridement or repair of the glenoid labrum in most patients with a spinoglenoid ganglion cyst has the best outcome with the lowest recurrence rate.^{19,21,36}

We feel direct decompression with a posterior approach is more efficacious. We have performed this method in more than 30 patients with follow-up and have had only 1 patient where the pain did not resolve in a multiply operated worker's compensation case. No recurrence of any cyst occurred in this group. It is acknowledged that every patient in this group has an investigation of any intra-articular pathology but no one with an intact labrum undergoes a capsulotomy posterior and superior to the glenoid rim to decompress the stalk of the ganglion cyst. Those authors who proceed with this type of decompression understand that no dissection should proceed beyond 1 cm medial to the superior capsule attachment to the glenoid to avoid the nerve as it courses through the spinoglenoid notch. We caution surgeons who attempt to decompress a ganglion cyst at the spinoglenoid notch to be wary of this technique to avoid its complications and consider a more

direct approach. Complications to the suprascapular nerve can occur. It is important to understand the average distance to the suprascapular nerve from the posterior glenoid rim is 1.8 cm and that the distance to the motor branches is approximately 2.0 cm. We have encouraged patients with a complication of a suprascapular nerve injury and profound external rotation weakness to consider a latissimus dorsi transfer.

The last controversy that exists is with the patient treated with labral repair and no cyst decompression. These authors believe that spinoglenoid cyst excision is unnecessary and avoids undue risk of injury to the suprascapular nerve during surgery. Although good results were reported in patients without pain, we cannot agree, as many patients still presented with a cyst on repeat MRI. The presence of a cyst will continue to erode nerve conduction and ultimately cause irreversible muscular atrophy in the infraspinatus fossa with permanent external rotation weakness.

Recurrence of ganglion cysts with other approaches other than a posterior approach to the spinoglenoid notch has been reported. Hawkins and his group have shown nonoperative techniques with aspiration lead to an unacceptable recurrence rate with continued compression of the suprascapular nerve.²⁷ Reports of recurrence of the cyst due to failure of the SLAP repair to heal or inadequate initial resection of the cyst give credence in our minds for a different approach.¹⁹ Debridement may not be adequate off the glenoid neck for fear, and appropriately so, of injury to the suprascapular nerve as visualization is so difficult. Understanding the appropriate depth of resection when working with such an oblique angle and tight space seems difficult even for the most skilled surgeon. When working to decompress with an intra-articular method, although the cyst is known to be located adjacent to the posterior and superior quadrant of the glenoid at the 10:30 to 11-o'clock position on a right shoulder and at 2:00-2:30 position on a left shoulder, identification of its exact location by this method is not as simple as it may appear. Blame on the lack of healing power of the patient is also avoided with our posterior approach as described later, although identification of the recurrence and understanding how to proceed with a road map is essential with the aid of a new MRI if the labrum fails to heal after repair has been performed.

Rehabilitation is affected with the intra-articular technique as opposed to a posterior approach with no labrum repair. If a concomitant SLAP repair is performed, then the patient must remain in a sling for 3-4 weeks. If no SLAP repair is performed, then 7 days in a sling is used with the patient commencing progressive range of motion exercises and strengthening with return to full overhead activities by 6 weeks. Although understanding if labral repair is necessary or if isolated cyst decompression will resolve all symptoms for the patient with suprascapular nerve compression, only time will tell with future studies and meticulous follow-up.

Technique

Arthroscopic release of the suprascapular nerve at the spinoglenoid notch should be approached from the posterior

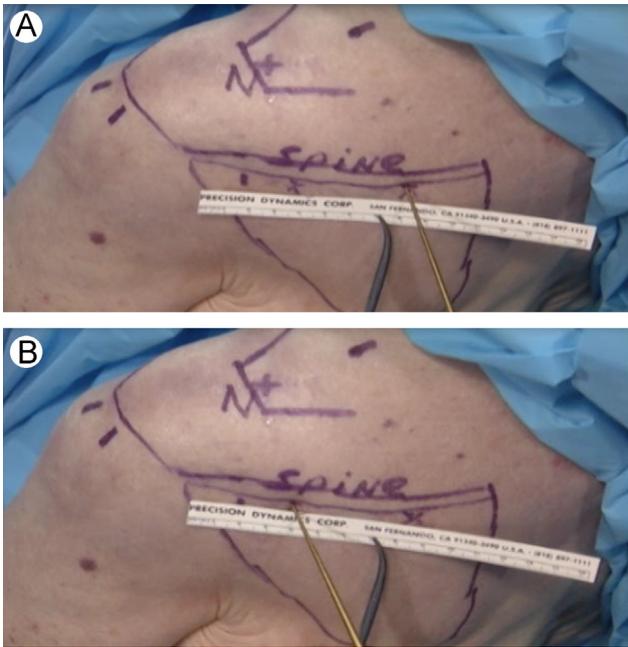


Figure 16 (A) Left shoulder, posterior view. The gold probe is pointing 8 cm medial to the posterolateral corner of the acromion. This portal is the viewing portal for release of the spinoglenoid ligament compressing the suprascapular nerve at the spinoglenoid notch. (B) Clinical photograph of a left shoulder posterior view. The gold probe is pointing 4 cm medial to the posterolateral corner of the acromion. This portal is the working portal for release of the spinoglenoid ligament compressing suprascapular nerve at the spinoglenoid notch. (Copyright: K. Plancher.)

shoulder. We use a posteromedial and posterolateral portal in the infraspinatus fossa (Fig. 16). Others have used a different approach when releasing the spinoglenoid ligament as they prefer the subacromial approach.³⁷ The ability to visualize anatomy and return to sport or activity of daily living is much faster and simpler than proceeding with the open technique in



Figure 17 Left shoulder, posterior view. The trochar is introduced in the following fashion. The tip of the blunt trochar palpates the spine of the scapula. The trochar is then moved inferiorly and gently swept to clear a space with the infraspinatus posterior muscle and the tip of the trochar on the infraspinatus fossa. The tip of the trochar is then moved laterally toward the working portal 4 cm medial to the posterolateral corner of the acromion. The trochar as it is moved laterally sweeps the infraspinatus muscle under the arch of its fossa to create a path for the arthroscope to allow visualization of the spinoglenoid ligament. (Copyright: K. Plancher.)

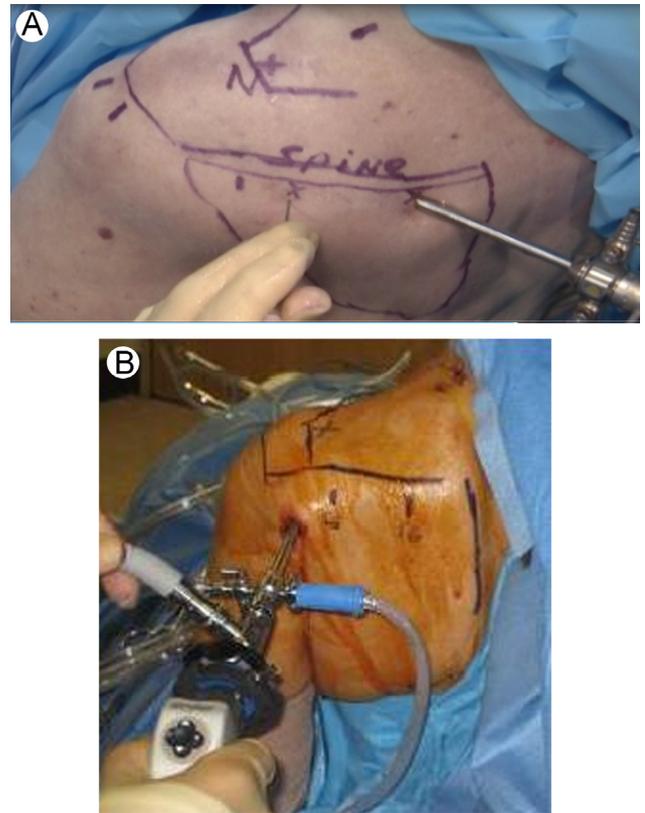


Figure 18 (A) Left shoulder, posterior view. The 30° arthroscope is introduced into the viewing portal located 8 cm medial to the posterolateral corner of the acromion. Note that the anesthesiologist should be instructed to maintain systolic blood pressure no higher than 100 mm Hg; be mindful of the patient's health if this is not possible. We have always released the spinoglenoid ligament before proceeding with any intra-articular work or if needed any release of the transverse scapular ligament to avoid any undue swelling that will make this procedure more difficult. (B) Left shoulder, posterior view with the spinoglenoid portals marked out (SG). The arthroscope is in the standard posterior portal for intra-articular glenohumeral joint inspection. Note the relationship of the normal posterior portal to the spinoglenoid ligament portals. 'X' represents Neviaser portal. (Copyright: K. Plancher.)

our opinion. The morbidity and postoperative recovery is much simpler and more pleasant for the patient as well.

The patient is in the beach-chair position with arm placed at the side. It is essential to prepare and drape from the midsternum to the midposterior spine with the complete scapula included. We encourage the anesthesiologist to maintain a systolic blood pressure slightly below 100 mm Hg. Our pump pressure is kept low at 45 mm Hg to avoid unnecessary swelling.

The portals selected include 2 portals: (1) the viewing portal, which is placed 8 cm medial to the posterolateral corner of the acromion just inferior to the scapula spine and (2) the working portal, which is placed 4 cm medial to the posterolateral corner of the acromion just inferior to the scapula spine (Fig. 16).

Release of the spinoglenoid ligament precedes any work done within the glenohumeral joint. We recommend that this part of the procedure should take no more than 5 minutes to ensure a limited amount of swelling to occur in the limb.

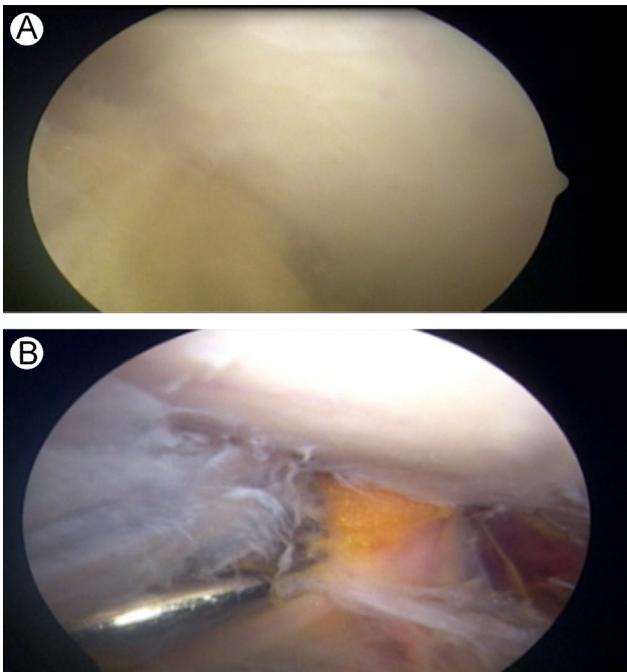


Figure 19 (A) Arthroscopic picture of the same left shoulder after initial sweeping of the soft tissue away to expose the adipose around the spinoglenoid ligament. Clarity of the pictures occurs once the water is turned on. (B) Intraoperative photograph of the same left shoulder showing perineural fat with the trochar teasing the spinoglenoid ligament off the suprascapular nerve. The white above represents the spine of the scapula. The glenohumeral joint is off to the left. (Copyright: K. Plancher.)

The blunt trocar is introduced into the viewing portal and directed straight toward the infraspinatus fossa (Fig. 17). The tissue under the spine of the scapula is swept away and the trocar is directed to the working portal passing the suprascapular nerve heading and falling into the spinoglenoid notch. The key to this step, which allows for visualization, is to ensure that the trocar sweeps under the roof of the infraspinatus spine feeling the curvature.

The arthroscope replaces the trocar and our first view of the spinoglenoid ligament is visualized (Fig. 18). Identification of the various landmarks is completed. Success with this procedure is achieved with visualization of the spine of the scapula to be maintained throughout the release of the ligament and decompression of the nerve.

The trocar is now introduced into the working portal and the soft tissue is teased away laterally as the course of the nerve can always be located in the medial side of the spinoglenoid notch (Fig. 19). A radiofrequency wand of small-radius non-aggressive shaver with the suction turned off can be used at this point to clear the tissue and more specifically the spinoglenoid ligament (Fig. 20). The ligament can be resected by staying on the spine of the scapula to avoid any bleeding. The ligament can be followed to the glenohumeral joint at its insertion to understand and visualize the complete resection of the ligament.

The blunt tip trocar is used now to assess the mobility and adequate release of the suprascapular nerve (Fig. 21). We then

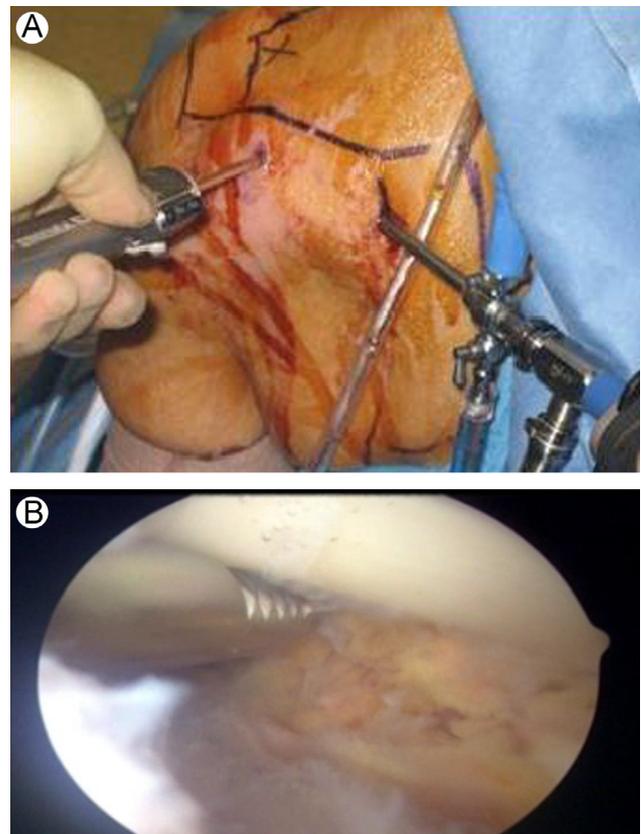


Figure 20 (A) The arthroscope and shaver are now moved into the appropriate spinoglenoid portals for decompression of the suprascapular nerve at the spinoglenoid notch. (B) Intraoperative photograph of the same left shoulder, posterior view. The spine of the scapula is above. The shaver is taking the spinoglenoid ligament directly off the spine of the scapula. All work is being completed lateral to the suprascapular nerve. Similar to resecting the ligamentum mucosa/infrapatellar plica in a knee, all work is done on the bone or the notch (the knee), thereby safely avoiding injury to the nerve anterior and medially. (Copyright: K. Plancher.)

head into the spinoglenoid notch to note any aberrations in anatomy such as a ganglion cyst or a bifid nerve that may now be compressing the suprascapular nerve (Fig. 22). Decompression of the ganglion and excision of the stalk can now be easily completed. It is important to understand that the ganglion root may be heading toward the posterior inferior quadrant of the glenohumeral joint. The released suprascapular nerve with the artery can now be seen hugging tightly as it wraps around the notch and heads medially giving its 2-4 muscular branches to the infraspinatus (Fig. 23). On completion and full inspection, the equipment is removed from the body and the portals are closed in routine fashion. The patient should wear a sling for 7 days to achieve comfort. Thereafter, all activities can be resumed, depending on whether any other work may have been performed to the same shoulder.

Our experience with this technique has been exceptionally successful in a patient in whom conservative treatment has failed, who has EMG-proven compression, and who has visual atrophy in the infraspinatus fossa. The patient's pain profile the

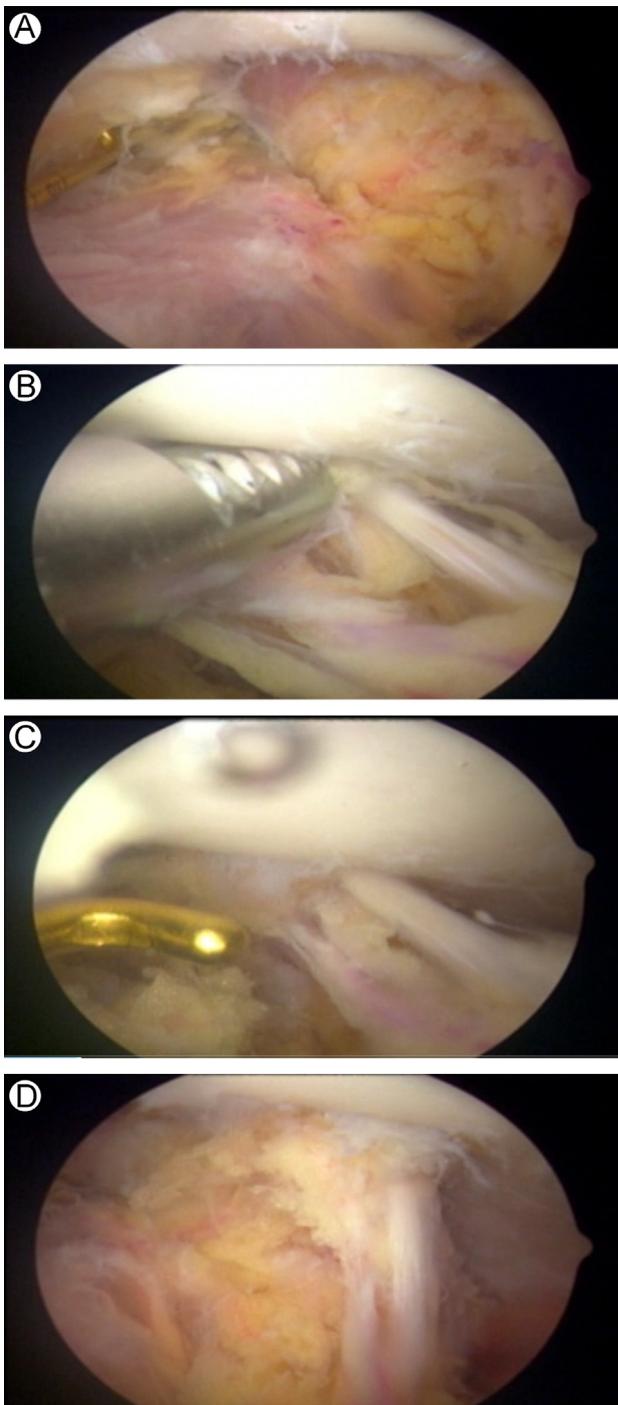


Figure 21 Intraoperative photograph of the same left shoulder, posterior view. The spine of the scapula is above (white). (A) The probe is teasing the spinoglenoid ligament off of the glenohumeral attachment laterally. The suprascapular nerve reveals itself in the perineural fat with blunt dissection. (B) The dull trochar has been used to tease the tissue and expose the suprascapular nerve seen at the tip of the shaver moving obliquely to the right. (C) In this arthroscopic view, the suprascapular nerve is clearly seen off to the right and the slightly anterior to the nerve is the suprascapular artery. The gold probe on the left is being used to tease any remaining remnants of the spinoglenoid ligament or the tissues compressing the suprascapular nerve. (D) The suprascapular nerve is now freed and fully mobile as it exits the spinoglenoid notch to move medially now that it has been decompressed. (Copyright: K. Plancher.)

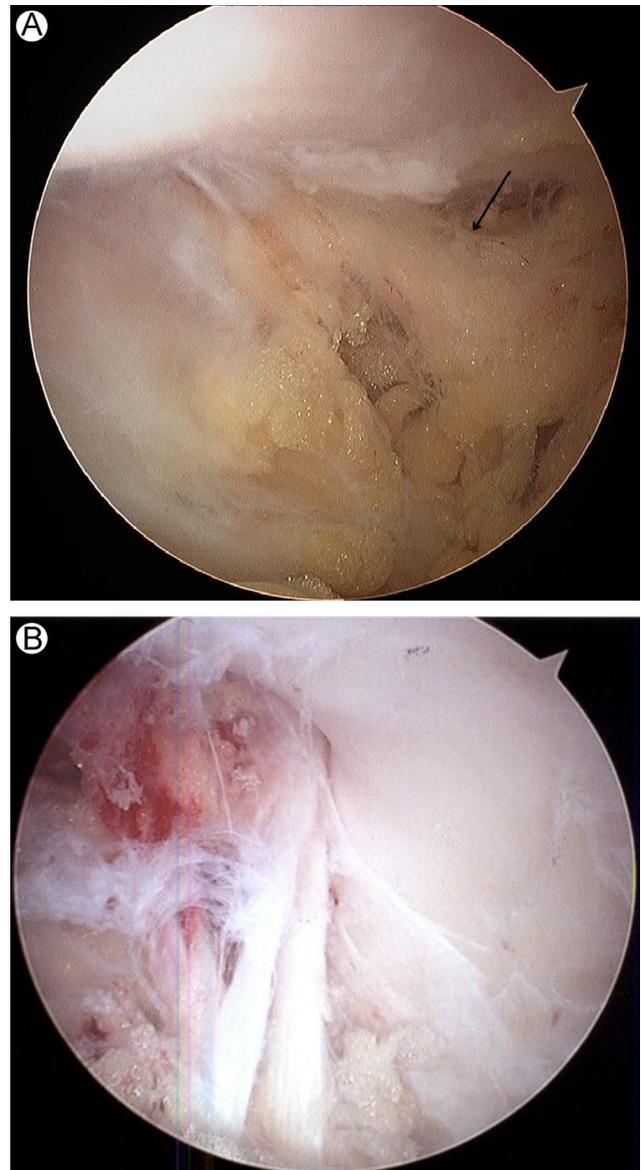


Figure 22 (A) Arthroscopic view of the left shoulder, posterior view, with the arrow pointing to the suprascapular nerve heading medially. Note the bulging tissue to the left, representing a ganglion cyst not yet decompressed. The spine of the scapula (white) is above. (B) Arthroscopic view of a left shoulder, posterior view. Note the relationship of the suprascapular nerve as it always tightly hugs the spinoglenoid notch. This suprascapular nerve represents an anomaly that is yet to be described because of its bifid nature. The nerve branches head medially toward the right. Arthroscopic decompression of the spinoglenoid ligament can be safely performed by staying lateral to the nerve that is fixed in position in the spinoglenoid notch. (Copyright: K. Plancher.)

next day after release is verbalized as completely gone, and although we have not been successful in reinsufflating the muscle belly, in those whose disease has not been present for more than 2 years, we have restored some measurable strength to external rotation. This technique, we believe, is safe and effective as it approaches the anatomy directly without taking any nonessential or essential muscular planes. We have also used this approach successfully in the last 20 patients who did

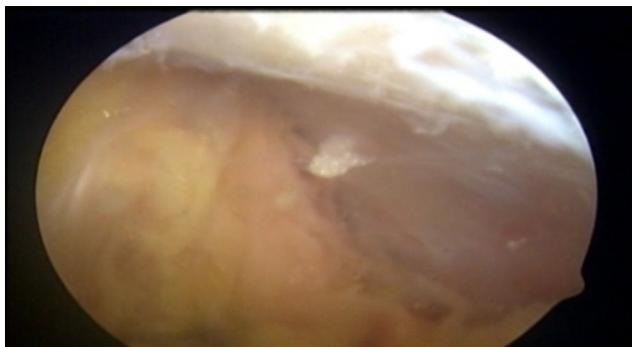


Figure 23 Intraoperative photograph of the same left shoulder demonstrating the most medial aspect of the spinoglenoid notch. This is the danger zone as the suprascapular nerve will always hug the most medial aspect of the notch as it heads midline, giving off 2-4 muscular branches to the infraspinatus. Note the spine of the scapula up above (white). Note the curvature of the infraspinatus fossa seen to the right of the perineural fat surrounding the suprascapular nerve. (Copyright: K. Plancher.)

not exhibit any infraspinatus wasting but had a chronic ache and a positive result on adduction test on physical examination with immediate success and return to overhead sport and activities of daily living.

Outcomes

Literature on this topic is not plentiful. There are very few series with long-term follow-up including our series. We have waited for at least a 3-year average follow-up before reporting to ensure accuracy that the ganglion cyst has not returned and that the athlete or laborer has in fact returned to all activities without pain. Understanding what to do with chronic atrophy is a difficult issue, which at this time there is no perfect answer.

As discussed earlier, Warren et al reviewed their results with nonoperative treatment.³⁸ They recommended that if no ganglion cyst or soft tissue mass was present and no compression of the suprascapular nerve was detected, then no intervention should proceed. This article does not focus though on the spinoglenoid notch solely.³⁸ Post reported on open surgical decompression without evaluation of the labrum and reporting excellent or good results in 88% of the patients.²⁶ In a small series, Fehrman et al²¹ reported great success after nonoperative treatment, with complete pain relief with intervention in the intra-articular lesion combined with an open resection of the ganglion. Chen et al³⁹ in one report and Lichtenberg et al⁴⁰ in another reported on a small series with repair of a SLAP and excision of the ganglia using an arthroscopic approach. All patients in both series had complete pain relief and improvement in strength and excellent function at their reported follow-up.

The last group of labral repair alone without decompression of the cyst is discussed earlier in the study by Schroder et al.³³ Curiously, there is a case report of a debridement of a labrum tear with radiographic evidence of resolution of a spinoglenoid notch cyst and reinnervation shown by EMG after this

procedure.³⁶ The most recent reports are yet to come from our group with direct posterior decompression and others with nerve decompression performed arthroscopically with limited follow-up data, although as presented in many meetings across the globe, the results are very promising.

Summary

Compression of the suprascapular nerve at the spinoglenoid ligament is a disease of a young overhead laborer or avid athlete. This article will hopefully make the reader aware of its existence as this disease entity has seen us but we have not seen it readily because of its less frequent appearance. The patients complaints can often be confused with rotator cuff disease but by following the aforementioned guidelines, we hope all physicians will identify the disease and perhaps consider after practicing in a learning environment how to endoscopically release the ligament and decompress the suprascapular nerve to enable the patient to return to all activities in a short period of time.

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