Technical Note

Suprascapular Nerve Release: Technique Based on Anatomic Landmarks

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Abstract: Dysfunction of the suprascapular nerve (SSN) is closely related to rotator cuff pathology; nerve dysfunction can lead to cuff disease and vice versa. Owing to repetitive microtrauma during overhead sports or massive cuff tears with significant tendon retraction, the SSN may suffer compression or traction neuropathy at the suprascapular notch. The SSN release technique has already been described. However, on the basis of the many hands-on cadaveric laboratories in which we have participated in the past 20 years, only a few instructors and almost none of the attendants have shown the experience and skill set needed to release the SSN at the suprascapular notch. Therefore, a review of the surgical technique following the anatomic descriptions of an expert anatomist (P.G.) of the shoulder girdle is quite valuable.

After its origin in the C4 to C5 cervical spine roots, the suprascapular nerve (SSN) arises from the upper trunk of the brachial plexus. It runs posterior to the clavicle and arrives at the suprascapular notch by passing beneath the transverse scapular ligament. It provides 2 collateral motor branches to innervate the supraspinatus (SSP) and a few sensory branches to the shoulder region. Subsequently, the nerve reaches the spinoglenoid groove to innervate the infraspinatus (ISP).[1]

Primary SSN entrapment syndrome is an often-recognized cause of disability in overhead athletes. Overstretching of the SSN at the suprascapular notch can produce posterior shoulder pain with weakness and atrophy of the SSP and ISP muscles. The dysfunction is determined based on physical examination findings and hyperintense muscle denervation signals on magnetic resonance imaging with positive electromyography (EMG) and nerve conduction velocity test findings.[2-5]

In the setting of a chronic retracted cuff tear, the mechanism of nerve entrapment is different. The muscle atrophy and fatty infiltration may be produced by the tendon tear, the SSN neuropathy, or both. Anatomic studies have assessed the risk of SSN elongation by quantifying the tension on the nerve and the angle between the nerve and its motor branch at the scapular notch with medial SSP tendon retraction. With 3 cm of retraction of the SSP, the motor branch of the SSN was stretched.[6-10] The real incidence of this situation is undetermined, but it has been reported to be present in 8% to 27% of massive rotator cuff tears.[11-13] The reduction of the tendon to the original footprint during cuff repair may be advantageous to nerve function and lead to improvements in postoperative pain and strength. Nevertheless, the SSN native angle correction by tendon repair can be insufficient, and an SSN release may help to decrease pain and achieve better muscle recovery.[14,15]

The purposes of this article are (1) to discuss the SSN anatomy based on the anatomic dissections of one of the authors (P.G.) and (2) to describe the surgical technique of SSN release regarding the described landmarks.

Patient Evaluation and Imaging

In patients with massive cuff tears and SSN neuropathy, primary tendon failure leads to their symptoms and examination findings. Patients with SSN entrapment without cuff tears usually describe nonspecific, continuous posterior shoulder pain. Overhead

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throwing athletes describe a decrease in the ability to swing the arm during sports participation. A thorough physical examination is mandatory. SSP atrophy and ISP atrophy are the most frequent findings, with the addition of external rotation and abduction weakness. The cross-arm adduction test and the suprascapular stretch test described by Lafosse et al.,[16] turning the head to the opposite side and depressing the shoulder, can yield positive findings. Three-dimensional computed tomography reconstructions show the different shapes or narrowing of the suprascapular bony notch. The magnetic resonance images help to rule out paralabral cysts compressing the SSN. In addition, they often show the hyperintense muscle signals frequently found in denervated muscles. Because the SSN entrapment in sports is a dynamic condition, it is not always seen during the EMG assessment. EMG and nerve conduction velocity tests show between 70% and 90% sensitivity in confirming the diagnosis.

Surgical Indications

The primary treatment of SSN neuropathy is conservative. A trial of cortisone and anesthetic infiltration, guided by ultrasonography, may help to improve the patient's symptoms and confirm the diagnosis. When pain, weakness, and physical signs persist after 6 months, an SSN release is indicated.

The decision to add an SSN release in cases of massive cuff repair or cuff revision surgery is still controversial. Some surgeons base their indications on preoperative pain, the degree of tendon retraction, or the intraoperative finding of a thickened transverse ligament.

Surgical Technique

We usually perform the procedure with the patient in the beach-chair position under an interscalene block with or without the addition of general anesthesia. With the scope in the posterolateral portal in the subacromial space, the coracoacromial ligament, which arises from the coracoid tip, is easily identified. An anterolateral portal, used as a working portal, is located with a spinal needle by an outside-in technique. The angle of this anterolateral portal is essential to achieving adequate access to the coracoid body and its base. A radiofrequency device is used to clean the coracoid body from lateral to medial. Following the coracoid body, the coracoclavicular ligaments (trapezoid laterally and conoid medially) are found over the coracoid base. A shaver and a radiofrequency wand are used to clean the conoid ligament, which is medial and posterior to the trapezoid. Thereafter, we use a spinal needle to locate 2 retro-clavicular portals between the clavicle and the acromial spine. These portals, called "SSN portals," are placed posterior to the clavicle, around 7 to 9 cm from the acromial edge.[1,16] First, we establish the medial SSN portal using a trocar as a retractor; then, we locate the lateral SSN portal. The transverse ligament follows the conoid ligament medially and is just posterior to the posterior-lateral curve of the clavicle; these structures are approximately 3.5 cm from the acromioclavicular joint[1] (Fig 1). A switching stick is used to disperse and retract the fat tissue and to see the medial border of the conoid ligament. The conoid ends at the suprascapular notch and the transverse ligament (Fig 2).

After adequate blunt dissection with a trocar, the artery over the transverse ligament and the nerve under this ligament are clearly identified (Figs 3 and 4). The SSN lies at the suprascapular groove. The surgeon

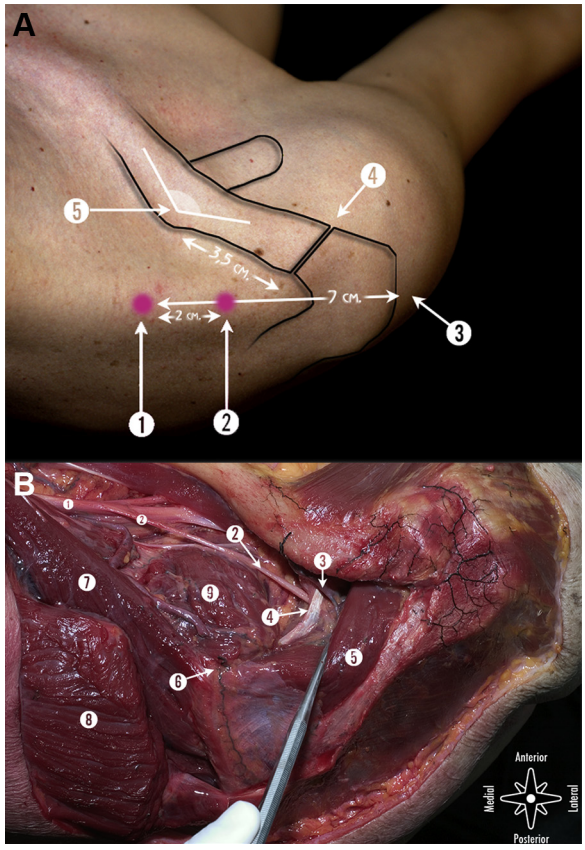

Fig 1. Anatomic specimen (right shoulder). (A) Outside view from above showing the suprascapular nerve portals 7 and 9 cm from the acromial edge (1, 2); acromial edge (3); acromioclavicular joint (4); and posterior-lateral curve of the clavicle (5), with its angle above the coracoid base and 3.5 cm from the acromioclavicular joint. (B) Outside view after dissection showing the upper trunk of the brachial plexus (1), suprascapular nerve arising from the plexus and running behind the clavicle (2), suprascapular artery above the transverse ligament (3), transverse ligament (4), supraspinatus muscle (5), superior angle of the scapula (6), levator scapulae muscle (7), trapezius muscle (sectioned) (8), and serratus anterior muscle (9) with insertions at the ribs.

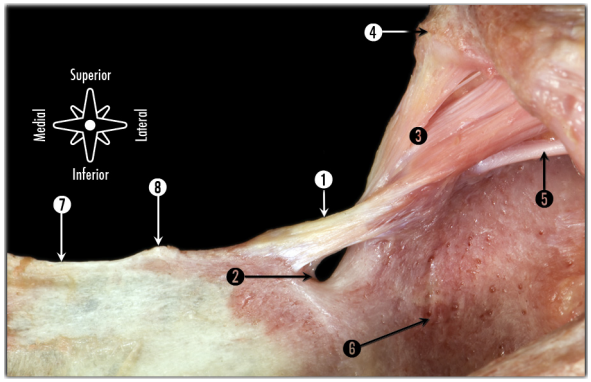

Fig 2. Anatomic specimen (right shoulder), suprascapular-notch posterior view, showing the transverse ligament following the conoid ligament (1), suprascapular groove (2), conoid ligament (3), clavicle and conoid tubercle (4), coracoclavicular ligament (5), supraspinatus fossa (6), superior border of the scapula (7), and omohyoid muscle insertion tubercle (8).

must be aware of the shape of the notch, as well as the location of the suprascapular artery, which may vary.[17-19] Through the medial SSN portal, a blunt trocar is used as a retractor, and the nerve is released by sectioning the transverse ligament with an arthroscopic punch from the lateral SSN portal (Fig 5). Thereafter, we must see the nerve moving freely out of the groove (Fig 6, Video 1).

The rehabilitation program is tailored according to the status of the rotator cuff. When the cuff tendons are intact, full range of motion and progressive strengthening are immediately recommended. In the setting of massive cuff tears, the rehabilitation program is usually harmonized to the repaired cuff.

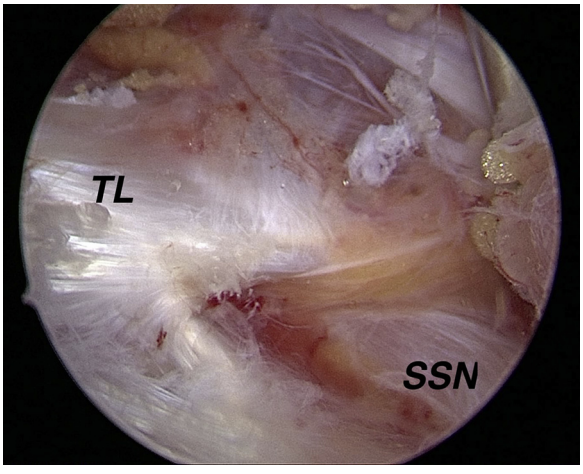

Fig 3. Arthroscopic view from posterolateral portal (left shoulder) showing transverse ligament (TL) and suprascapular nerve (SSN) under TL.

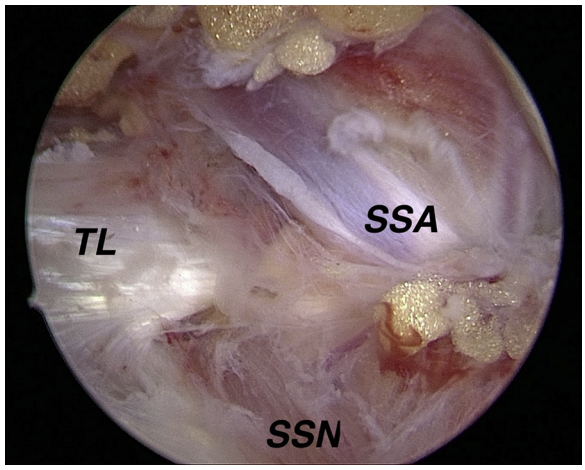

Fig 4. Arthroscopic view from posterolateral portal (left shoulder) showing transverse ligament (TL), suprascapular nerve (SSN), and suprascapular artery (SSA) over TL.

Discussion

Dramis and Pimpalnerkar,[2] as well as Sandow and Ilic,[3] described SSN neuropathy in volleyball players, and the benefits of releasing the SSN were tackled. More recently, Tsikouris et al.[4] compared athletes with cuff or labral tears treated by arthroscopic repair with or without SSN release and concluded that the release of the nerve improves outcomes and the return to sports.[5] Early in 2020, Gereli et al.[20] described the influence of the SSN injury as an underlying factor leading to compromise of the rotator cuff enthesis structure and neuropathy with an impact on healing after repair.

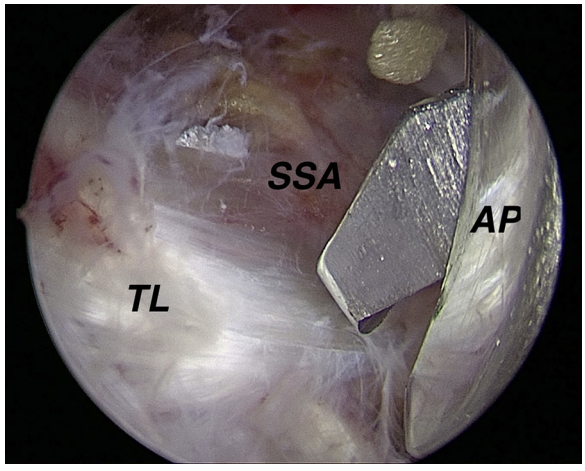

Fig 5. Arthroscopic view from posterolateral portal (left shoulder). A blunt trocar through the medial suprascapular nerve portal retracts the nerve and the artery medially. (AP, arthroscopic punch through lateral suprascapular nerve portal for cutting TL; SSA, suprascapular artery; TL, transverse ligament.)

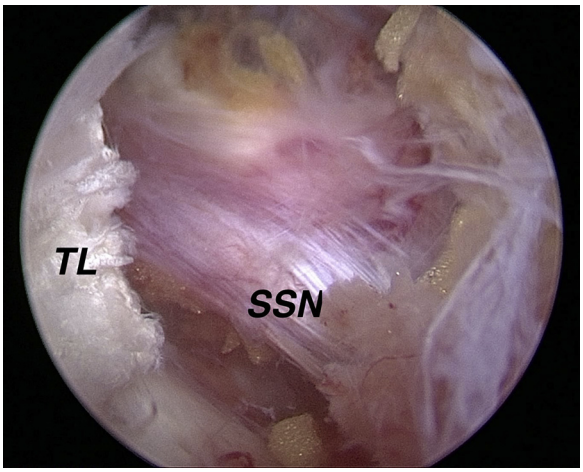

Fig 6. Arthroscopic view from posterolateral portal (left shoulder) showing sectioned transverse ligament (TL) and released suprascapular nerve (SSN).

The current indications for SSN release in massive cuff tears and revision cuff surgery are a matter of debate. Many researchers have reported significant differences comparing postoperative clinical improvements after rotator cuff repairs with versus without SSN release.[6,8,9] Zunkiewicz et al.[21] and Savoie et al.[22] are the only researchers who reported the results of patients undergoing revision cuff repair and compared the results in 2 groups: patients with SSN release and those without SSN release. They concluded that the patients with nerve release presented with better functional recovery and less pain at the final follow-up.[21,22] However, Gerber et al.,[23] in a prospective randomized trial of a small number of patients (N = 19), did not find any difference between the release and non-release groups.

Recently, current concepts and state-of-the-art articles have reviewed the indications and technique for SSN release.[24,25] The SSN release technique was reported by Bhatia et al.[17] and was first described by Lo et al.[18] in 2006. Laurent Lafosse mastered the procedure in 2011.[16] Developing the surgical skills needed to perform this procedure is quite challenging. Every article describing the technique adds some pearls, tips, and pitfalls (Table 1). The strength of this presentation is that it is based on the dissections of a master anatomist (P.G.). The advantages of the technique described in this article and shown in Video 1 are that (1) the surgeon is introduced to the shoulder extra-articular anatomy; (2) the procedure is performed with the scope always in the posterolateral portal; (3) the surgeon follows the bony landmarks which are easily identified; and (4) blunt dissection and a bloodless field avoid neurovascular complications. We hope that the anatomic landmarks included in this article, as well as Video 1 and the figures, will help the reader to make this demanding procedure much more straightforward.

In conclusion, performing SSN release is always a surgical challenge. Surgeons must review reported techniques with figures and videos and must attend hands-on cadaveric laboratories to achieve the skills needed to perform the procedures safely.

Table 1. Pearls and Drawbacks

	Pearls	Drawbacks
Diagnosis	The diagnosis is established based on posterior shoulder pain with SSP and ISP weakness without a cuff tear.	EMG and NCV test findings may be negative.
Arthroscopic surgery	The coracoid tip and CA ligament should be identified.	There is a need to learn the extra-articular shoulder anatomy.
	The surgeon should stay oriented following the coracoid body and its base.	The bursa behind the coracoid body and over its base must be resected without bleeding.
	An outside-in technique should be used to adequately locate the SSN portals.	The fat over the coracoid base posterior to the CC ligaments must be retracted medially.
	Blunt dissection and retraction should be performed with a trocar through the medial SSN portal.	The SSN portals are close to each other and parallel.
	The surgeon should identify the SS artery above the TL and the SSN below it.	Anatomic variations are common.
	The surgeon should resect the TL with a punch and remove a piece to avoid recurrence.	The surgeon should be aware that the SSN comes from anterior and is on the other side of the TL.

CA, coracoacromial; CC, coracoclavicular; EMG, electromyography; ISP, infraspinatus; NCV, nerve conduction velocity; SSN, suprascapular nerve; SSP, supraspinatus; TL, transverse ligament.

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