Arthroscopic Suprascapular Nerve Neurolysis With Spinoglenoid Ligament Release for Distal Suprascapular Nerve Entrapment

Running title: Arthroscopic Spinoglenoid Notch Suprascapular Nerve Release

Authors: Lorenz Fritsch, MD[a,b]; Trey Rogers, BS[a]; Michael Nocek, BA[a]; Brendon C. Mitchell, MD[a,c]; Shane Korber, MD[a,c]; Katelyn L. Kirwood, BA[a]; Marilee P. Horan, MPH[a]; Peter J. Millett MD MSc[a,c]

Affiliations:

[a] The Steadman Philippon Research Institute, 181 West Meadow Drive, Suite 400, Vail, CO, 81657, USA

[b] Department of Sports Orthopaedics, Technical University of Munich, Ismaninger Straße 22, 81675, Munich, Germany

[c] The Steadman Clinic, 181 West Meadow Drive, Suite 400, Vail, CO, 81657, USA

Abstract

Suprascapular nerve entrapment is an uncommon, but important cause of posterior shoulder pain and weakness, particularly in overhead athletes. Common causes include repeated overhead activity and paralabral ganglion cysts associated with labral tears. Entrapment usually occurs at the suprascapular notch or the spinoglenoidal notch. Distal compression at the spinoglenoid notch selectively affects the infraspinatus muscle and may lead to progressive external rotation weakness and muscle atrophy. Diagnosis relies on clinical examination, imaging, and electrodiagnostic studies. When nonoperative treatment fails or neurological deficits exist, arthroscopic decompression offers a minimally invasive option that permits direct visualization of the nerve and release of the compressive ligament, while allowing for the evaluation of intra-articular pathology. This technical note describes a reproducible arthroscopic technique for suprascapular nerve neurolysis with release of the spinoglenoid ligament in a young overhead volleyball player with distal suprascapular neuropathy and infraspinatus weakness.

Introduction

Suprascapular nerve (SSN) entrapment is a rare but clinically meaningful source of shoulder pain and dysfunction. Compression may occur proximally at the suprascapular notch or distally at the spinoglenoid notch[1]. Distal entrapment predominantly affects the motor branch to the infraspinatus, often presenting as isolated external rotation weakness and can lead to visible infraspinatus atrophy[1]. This pattern is particularly relevant in overhead athletes, in whom repetitive traction, posterior capsulolabral pathology, or space-occupying lesions (i.e. paralabral ganglion cysts) may contribute to nerve irritation[2, 3]. Because symptoms can overlap with rotator cuff, labral, and scapular dyskinesis-related disorders, diagnosis requires a high index of suspicion and confirmation with imaging and electrodiagnostic studies[4-6]. Although many patients improve with activity modification and rehabilitation, persistent weakness, progressive atrophy, or documented nerve dysfunction may warrant surgical decompression[3,7]. Arthroscopic release at the spinoglenoid notch provides a minimally invasive approach with direct visualization of the SSN and the ability to address concomitant pathology when present[8,9].

Here, we describe the senior author's technique for arthroscopic suprascapular nerve neurolysis with spinoglenoid ligament release in a 15-year-old young woman who is an elite beach volleyball athlete with distal SSN entrapment.

Pre-Operative Evaluation

Preoperative evaluation focuses on confirming suprascapular nerve dysfunction, localizing the level of compression, and excluding alternative causes of shoulder pain and weakness. Clinical examination commonly demonstrates visible infraspinatus atrophy and weakness with resisted external rotation while passive range of motion remains largely preserved. MRI is useful to evaluate rotator cuff integrity, characterize muscle atrophy and fatty infiltration, and identify compressive and other structural lesions. Electrodiagnostic testing (EMG/NCS) is essential to evaluate nerve dysfunction preoperatively. Furthermore, EMG/NCS helps distinguish distal spinoglenoid notch compression from more proximal pathology.

In the present case, a 15-year-old female elite beach volleyball athlete presented with right shoulder pain and weakness. Examination, MRI, and electrodiagnostic testing were consistent with distal SSN entrapment. EMG showed neurological denervation of the infraspinatus muscle. MRI revealed denervation edema of the infraspinatus. She elected to undergo operative treatment due to progressive weakness and dysfunction after failure of an extensive course of nonoperative management.

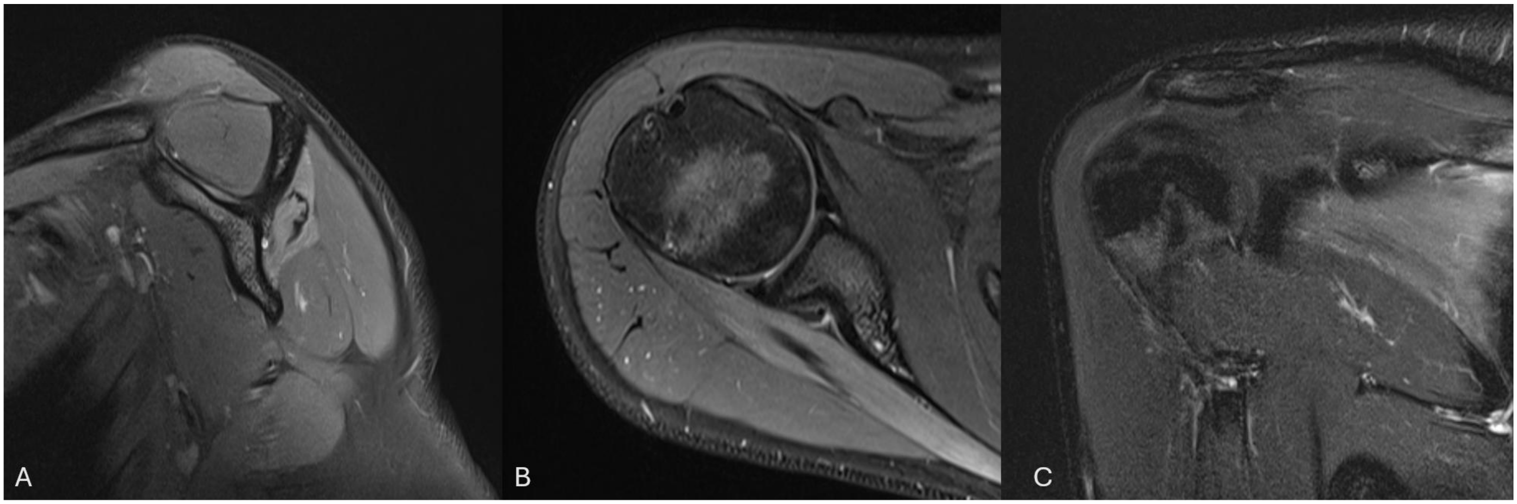

Figure 1A Sagittal **1B** axial and **1C** coronal views of T2 weighted MRI of right shoulder demonstrating neurologic edema in infraspinatus secondary to chronic compression of suprascapular nerve.

Nerve / Sites	Lat. ms	Amp. mV	Dist. cm	Vel. m/s
R Ulnar - ADM				
Wrist	2.71	8.6	6.5	
Ref.	3.50	5.6		
Below Elbow	6.09	7.4	21	62.0
Ref.		5.6		49.0
Above Elbow	7.60	7.1	9	59.6
Ref.		5.6		49.0

F Wave

Nerve	F min ms
R Median	24.74
R Ulnar	24.43

EMG Summary Table									
	Spontaneous				MUAP			Recruitment	Interference
Muscle	IA	Fib	PSW	Other	Amp	Dur.	PPP	Pattern	Pattern
R. First dorsal interosseous	N	None	None	None	N	N	N	N	N
R. Abductor pollicis brevis	N	None	None	None	N	N	N	N	N
R. Pronator teres	N	None	None	None	N	N	N	N	N
R. Triceps brachii	N	None	None	None	N	N	N	N	N
R. Deltoid	N	None	None	None	N	N	N	N	N
R. Biceps brachii	N	None	None	None	N	N	N	N	N
R. Trapezius (upper)	N	None	None	None	N	N	N	N	N
R. Supraspinatus	N	None	None	None	N	N	N	N	N
R. Infraspinatus	N	3+	3+	None	Small	Mildly Long	Mildly Complex	Fast Firing	Discrete
R. PSP (C5,6,7,T1)	N	None	None	None	N	N	N	N	N

Figure 2 EMG results demonstrating neurological denervation of the infraspinatus.

Surgical Technique

Ethics/Consent: Institutional review board approval was not required for this technical note; written informed consent was obtained for publication of de-identified images and video.

Patient Positioning

The patient is positioned in the beach-chair position after induction of general anesthesia and regional nerve block. A thorough examination under anesthesia is performed before arthroscopy to assess passive motion and glenohumeral stability. In the present case, the shoulder demonstrated full passive range of motion with grade no anterior or posterior load-and-shift translation.

Portal Establishment and Diagnostic Arthroscopy

A standard posterolateral portal is established approximately 2 cm medial and inferior to the posterolateral border of the acromion, and a 30° arthroscope is introduced into the glenohumeral joint. Under direct visualization, an anterior portal is created in the rotator interval, followed by an accessory anterosuperior portal to optimize instrumentation and facilitate elevation of the rotator cuff musculature during the extra-articular portion of the procedure. Diagnostic arthroscopy is then performed systematically. In this case, intra-articular evaluation demonstrated intact humeral head and glenoid articular cartilage, an intact superior biceps-labral complex, an intact subscapularis tendon and upper rolled border, and intact articular sided supraspinatus and infraspinatus tendons.

Exposure of the Spinoglenoid Notch

Attention is then directed to the posterior shoulder. A hook tipped radiofrequency probe (Cool Cut, Arthrex, Naples, FL) is used to open the posterior capsule precisely just medial to the posterior labrum from 11 o'clock to 1 o'clock position, creating access to the interval between the supraspinatus and infraspinatus. This capsular opening provides a controlled path to the spinoglenoid notch and should be made deliberately and under direct visualization to avoid damaging the labrum **(Figure 1)**. A curved elevator is introduced through the anterior portal and used as an elevator to gently lift the supraspinatus and infraspinatus off the scapula, which expands the working space posteriorly and improves visualization of the notch. This maneuver is particularly useful in smaller patients, where the extra-articular working space is limited.

Identification of Suprascapular Nerve

Blunt dissection is carried along this interval until the suprascapular nerve is identified at the spinoglenoid notch. Once visualized, the nerve should be carefully defined via blunt dissection working from proximal to distal before any cutting instrument is introduced. In the present case, the nerve was visibly flattened, diminutive, and surrounded by dense fibrotic tissue, consistent with chronic compression. These intraoperative findings correlated closely with the patient's preoperative external rotation weakness and visible infraspinatus atrophy.

Spinoglenoid Ligament Release

The SSN typically runs directly from the suprascapular notch under the transverse scapular ligament under the supraspinatus muscle and through the spinoglenoid notch where it is traversed by the spinoglenoid ligament. The nerve typically runs right on the scapula. After the nerve is identified and protected, the spinoglenoid ligament is exposed with blunt dissection and released under direct visualization using a meniscal biter and hook-tipped radiofrequency probe. The release is performed in a controlled fashion, staying directly on the ligament to avoid iatrogenic injury to the adjacent nerve and accompanying vessels **(Figure 2)**. The nerve **(Figure 3)** is then gently probed proximally and distally to confirm that it is fully decompressed and no residual tethering remains.

Closure

Following adequate decompression, all portals are irrigated and closed with buried 3-0 Monocryl sutures. Sterile dressings are applied, and the patient is placed in a sling for comfort. Estimated blood loss was minimal, no implants were required, and no intraoperative complications were encountered.

Postoperative Protocol

A sling is used for comfort during the early postoperative period. Passive and active-assisted range of motion are initiated early as tolerated, progressing to full active range of motion. Rotator cuff and scapular stabilizer strengthening are introduced in a phased manner, followed by sport-specific overhead progression once painless motion and near-symmetric strength are restored. Return to full activity is based on achieving full range of motion and being pain-free. Once these milestones have been reached, return to full activity can be expected at approximately 4 months postoperatively. This patient regained full strength within 3 months and returned to full unrestricted activities including elite level beach volleyball at 4 months post operatively. She is expected to be recruited to division 1 college for beach volleyball.

Discussion

Distal suprascapular nerve entrapment at the spinoglenoid notch is an uncommon, yet important etiology of posterior shoulder pain and weakness in overhead athletes[3]. As the distal branch innervates the infraspinatus, patients may present with substantial weakness with resisted external rotation and visible infraspinatus wasting. However, the supraspinatus will be spared, and patients will have preserved forward abduction[3,10]. MRI may reveal denervation edema as a result of suprascapular nerve involvement[1,11,12]. Key pearls and pitfalls of the present technique are presented in **Table I**.

This distinction has important practical implications. In young athletes, persistent shoulder weakness is often initially attributed to rotator cuff strain, labral pathology, or scapular dyskinesis. However, when the examination demonstrates isolated external rotation weakness with posterosuperior muscle atrophy, distal SSN entrapment should be strongly considered[3,7]. MRI and electrodiagnostic studies are complementary in this setting: MRI helps exclude structural tendon pathology and may show secondary muscle changes, whereas EMG/NCS provides objective evidence of nerve dysfunction and guides localization of pathology[1,11]. In the present case, the concordance of clinical findings, MRI, and electrodiagnostic testing strengthened the indication for operative treatment after failure of nonoperative management.

Arthroscopic decompression offers several advantages over open release. It permits complete intra-articular evaluation, minimizes soft-tissue morbidity, and allows the surgeon to work directly at the site of compression with magnified visualization[9,13]. In the current case, this was particularly valuable because the arthroscopic evaluation confirmed that no additional pathology required treatment and that the patient's symptoms were attributable to isolated nerve entrapment. The posterior capsular window just medial to the posterior labrum, combined with elevation of the supraspinatus and infraspinatus using a curved elevator through the anterior portal, provides an efficient and reproducible pathway to the spinoglenoid notch. This sequence creates enough working room to identify the nerve safely and release the ligament under direct visualization.

Patient selection remains central to achieving a good outcome. Surgical decompression is best reserved for patients with persistent pain or functional deficits, objective weakness or atrophy, and confirmatory imaging and electrodiagnostic findings after an appropriate trial of nonoperative treatment[1,3,14]. Neurophysiological recovery is often significant and may be achieved within six months after surgery[15,16]. Conversely, athletes with traction-related symptoms, but no observable distal compression, are likely to respond well with rehabilitation and activity modification alone[1]. In the present case, surgery was favored because the patient had failed conservative care and demonstrated a consistent triad of examination, imaging, and EMG findings supporting entrapment at the spinoglenoid notch.

In summary, arthroscopic suprascapular nerve neurolysis with spinoglenoid ligament release is a reproducible, minimally invasive technique for distal SSN entrapment that is particularly well suited to young overhead athletes with objective nerve dysfunction. In the present case, the combination of isolated external rotation weakness, visible infraspinatus atrophy, confirmatory electrodiagnostic findings, and intraoperative demonstration of a flattened, fibrotic nerve at the spinoglenoid notch made the indication for decompression clear. Careful portal placement controlled posterior capsular access, direct identification of the nerve, and complete ligament release are the technical priorities that allow safe and effective decompression.

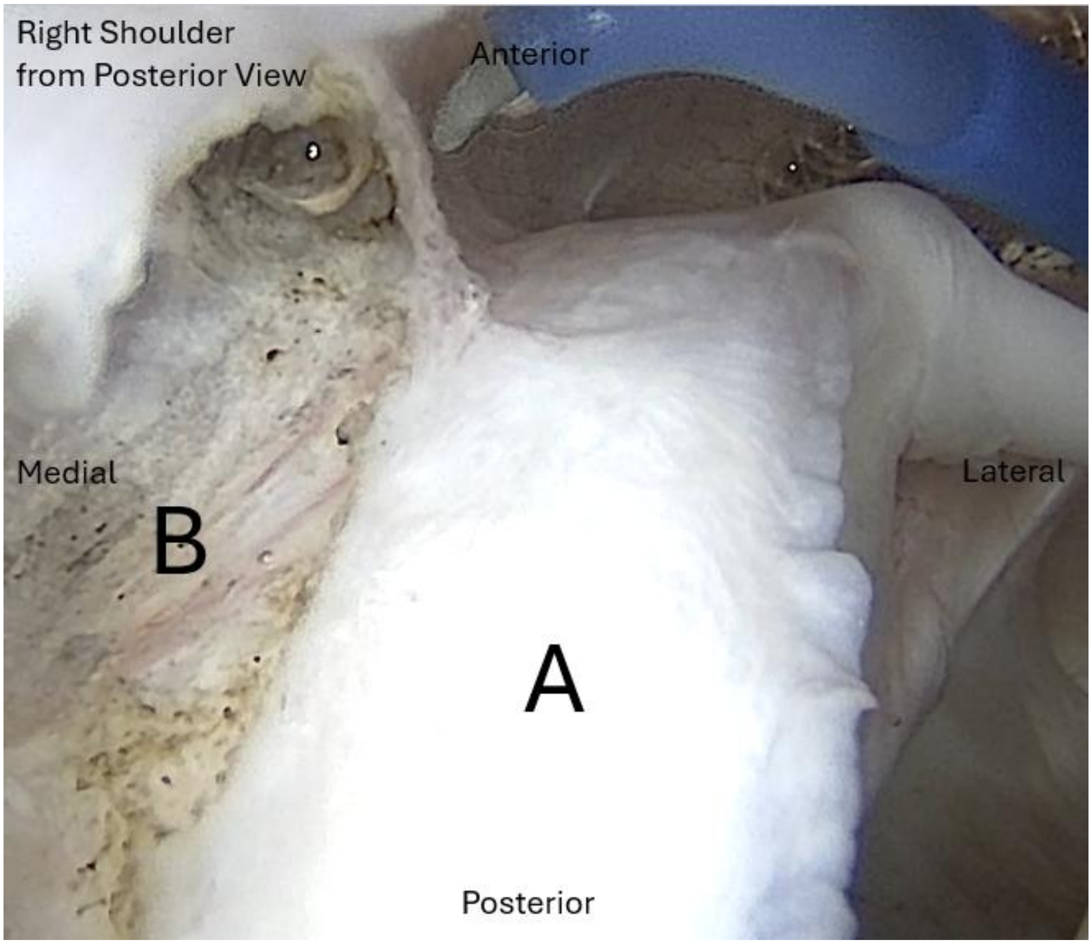

Figure 3 Careful opening of the capsular is performed in order to avoid labrum damage. A indicates the labrum, and B indicates the released capsule.

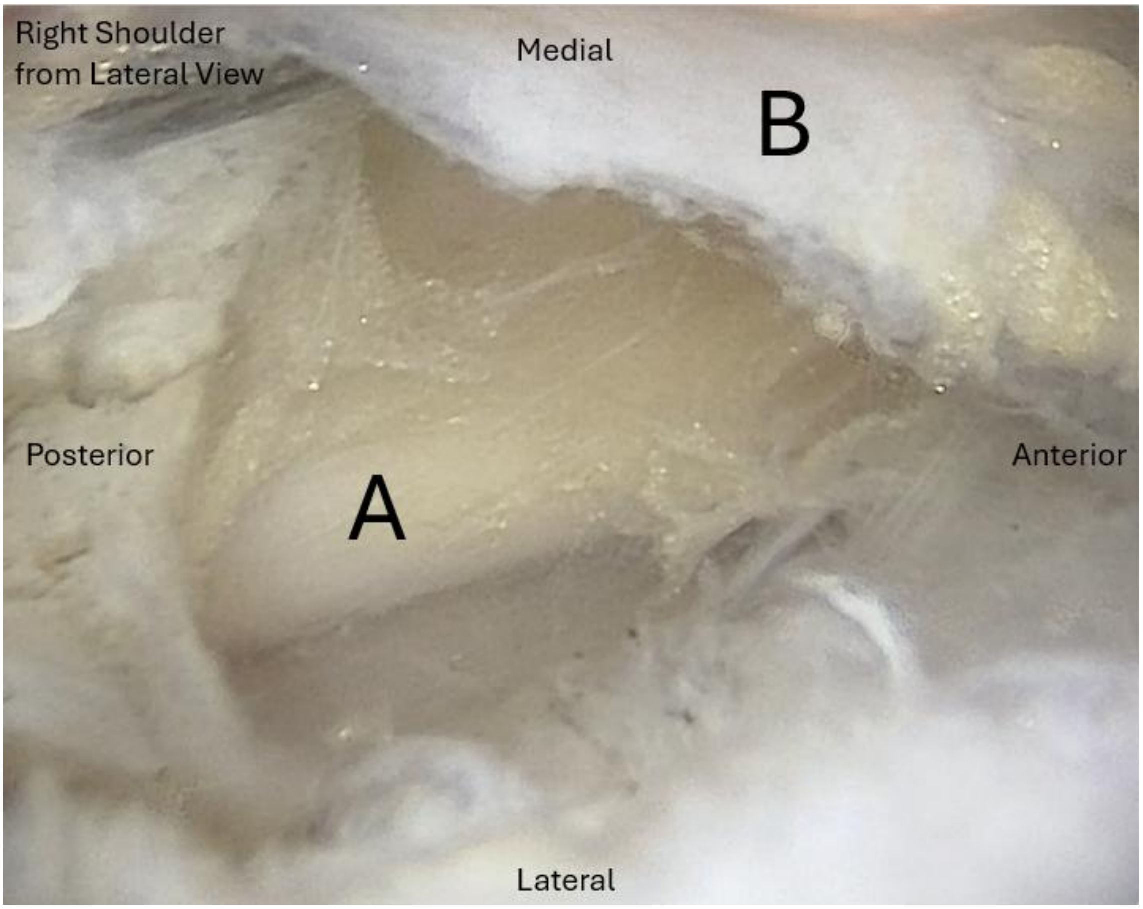

Figure 4 Intraoperative image of the tethered nerve. A indicates the nerve, and B indicates the scar tissue surrounding it.

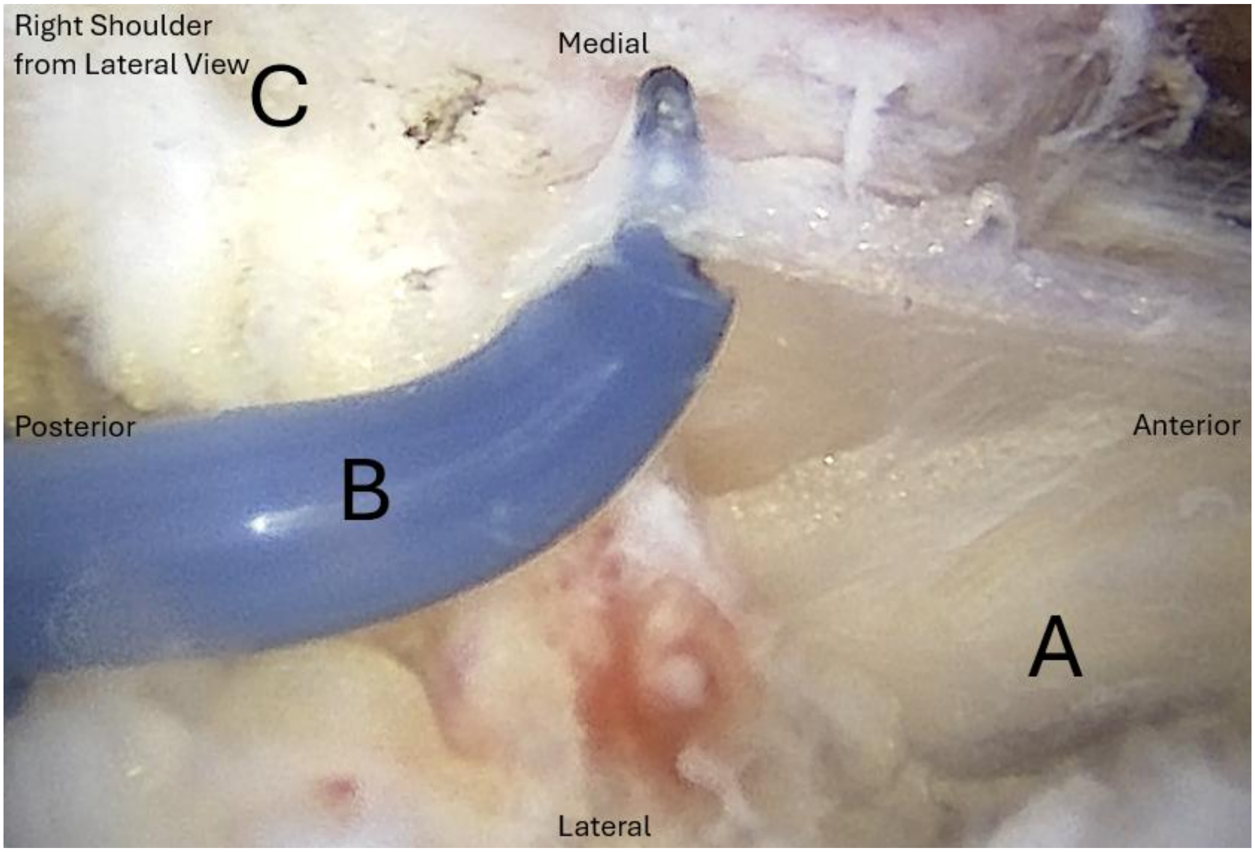

Figure 5 Diligent neurolysis of the suprascapular nerve. A indicates the nerve. B indicates a small radiofrequency device for neurolysis. C indicates the surrounding scar tissue.

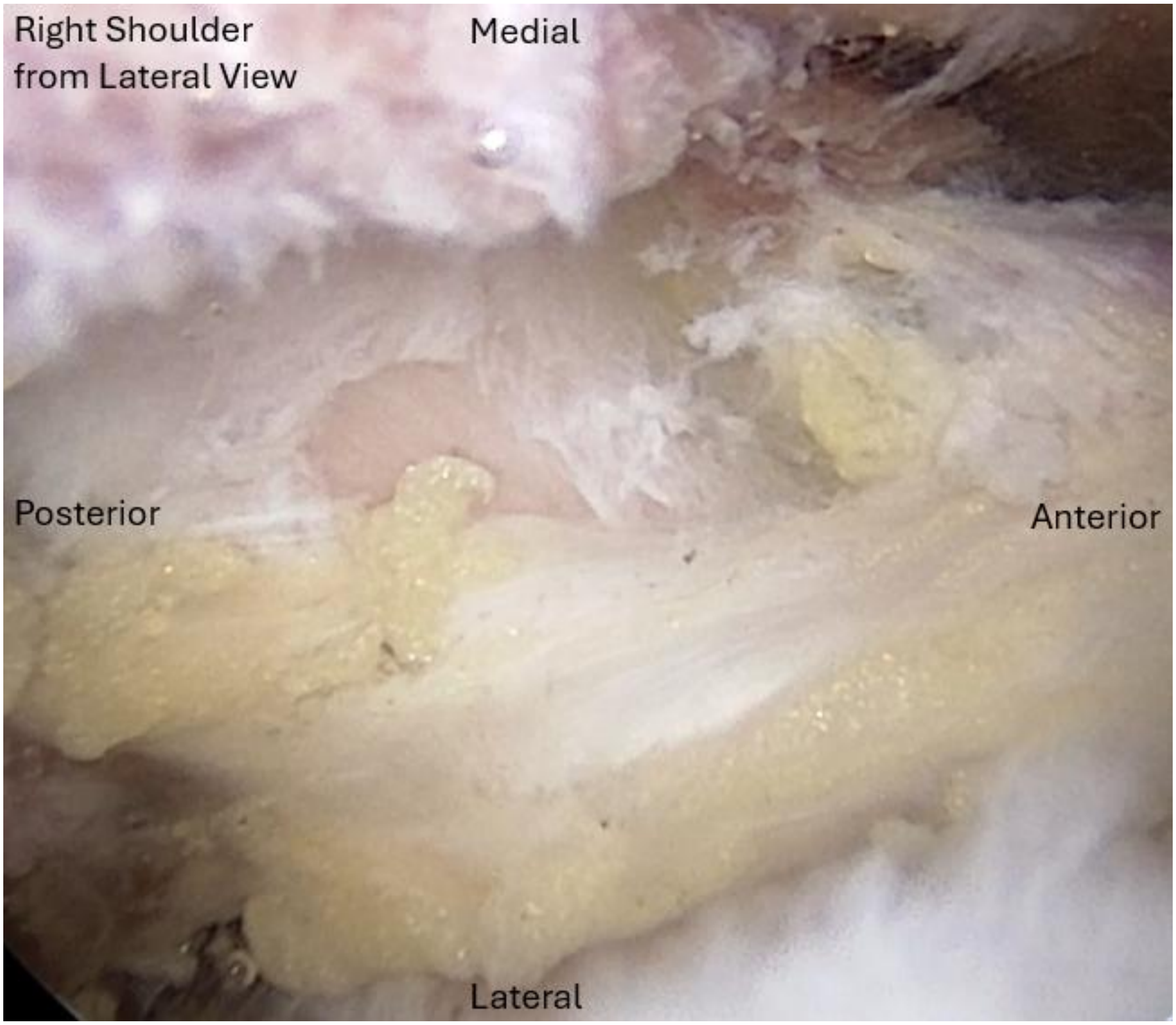

Figure 6 Intraoperative image of the fully released suprascapular nerve.

Figure 7. Patient returning to volleyball after procedure.

Pearls	Potential Pitfalls and How to Avoid Them
Identification of anatomic landmarks: Identification of the Ligamentum transversum scapulae, which is 3.6 cm medial the AC joint.	**Careful neurolysis:** Stay close to the transverse scapular ligament during neurolysis to avoid iatrogenic nerve injury.
Portal placement: Adequate portal placement is of utmost importance to provide optimal access to the spinoglenoid notch.	**Anatomic variations of the suprascapular vessels:** Anatomic variations of the suprascapular vessels may increase the risk of vascular injury.
Blunt dissection: Blunt dissection working from proximal to distal along the suprascapular nerve helps prevent iatrogenic nerve injury. The nerve is typically right on the scapula.	**Loss of orientation:** Inadequate dissection of the nerve may lead to loss of orientation, increasing the risk of neurovascular injury and incomplete neurolysis.
Hook-tipped radiofrequency probe confirmation of successful decompression: After decompression has been performed, a hook probe should be carefully used to confirm that no residual tethering remains	**Insufficient decompression:** Inadequate neurolysis or incomplete release of the transverse scapular ligament may result in persistent symptoms.

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