JBJS ESSENTIAL Surgical Techniques

Arthroscopic Treatment of Suprascapular Neuropathy from a Suprascapular Notch Cyst Using a Lateral Subacromial Approach

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Introduction

We describe a safe surgical technique for arthroscopic decompression of a suprascapular notch cyst in the setting of compressive suprascapular neuropathy.

The suprascapular nerve is a branch of the upper trunk of the brachial plexus and contains contributions from C4, C5, and C6. The nerve passes posterolaterally from the brachial plexus through the posterior triangle of the neck and inferior to the transverse scapular ligament to the suprascapular notch, which lies just medial to the base of the coracoid[1]. The suprascapular nerve gives off sensory fibers to the glenohumeral joint and motor function to the supraspinatus and infraspinatus muscles[1,2], and can be compressed along this course. The most well-recognized sites of compression occur at the suprascapular notch below the transverse scapular ligament or at the spinoglenoid notch (Fig. 1)[2-8].

Compression at the suprascapular notch causes shoulder dysfunction, pain, and atrophy of both the supraspinatus and infraspinatus muscles. However, compression at the spinoglenoid notch is typically the result of spinoglenoid ligament hypertrophy or paralabral cysts, and causes only infraspinatus atrophy and isolated external rotation weakness[9,10]. Although suprascapular nerve compression causing neuropathy is relatively uncommon[11], recent literature has suggested that proper diagnosis and management can lead to favorable subjective and objective patient outcomes[6]. Because of this, it is important for treating physicians to keep a high index of suspicion for this entity as it is easily overlooked or misdiagnosed.

We present our preferred surgical technique for safe arthroscopic surgical decompression of a suprascapular notch cyst causing symptomatic compression of the suprascapular nerve, using a lateral subacromial approach (Video 1). This approach is advantageous as it allows for visualization and protection of the coracoacromial ligament and coracoclavicular ligaments, while at the same time providing direct access for release of the transverse scapular ligament and suprascapular nerve. This technique also allows for decompression of contiguous suprascapular and spinoglenoid notch cysts through a single approach without disruption of musculature or the morbidity associated with open decompression. Theoretically, direct visualization and protection of the suprascapular nerve can also decrease the risk of iatrogenic damage to this structure and the associated suprascapular artery. This technique can pose some limitations in that it is technically challenging, is associated with a learning curve, and requires the surgeon to be facile with advanced arthroscopic shoulder techniques and possess a thorough understanding of local anatomy.

Step 1: Position the Patient

Position the patient in the standard beach-chair position.

- Position the patient on the operating table in the standard beach-chair position with the contralateral upper extremity secured in place. Care should be taken to ensure sufficient padding is placed over all osseous prominences and neural elements—specifically, the subcutaneous border of the ulna, olecranon process, and ulnar nerve.
- Perform an examination of the affected shoulder with the patient under anesthesia. This examination should include passive range of motion; assessment of anterior, posterior, and inferior stability; evaluation of the rotator interval; and evaluation of any positions of osseous engagement or other desired instability examinations.
- Standard preparation and draping of the affected shoulder is performed, and arthroscopic instruments are connected. Turning the head slightly to the contralateral side, and positioning the endotracheal tube to the contralateral side of the mouth, can help with ease of exposure and increase the size of the sterile field. It is also important to ensure adequate hemostasis by maintaining pump or gravity pressure at $\geq$50 mm Hg.

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Step 2: Mark Anatomic Landmarks

Palpate and mark the subcutaneous landmarks of the shoulder in preparation for later arthroscopy.

- Palpate the surface anatomy of the shoulder. Using a sterile marking pen, outline the coracoid, acromion, and clavicle.
- Place a thumb in the supraclavicular fossa and palpate the posterior border of the clavicle and medial aspect of the lateral aspect of the acromion at the Neviaser point. This point is found just medial to the acromial body in the soft area of the supraspinatus fossa posterior to the clavicle and anterior to the acromial spine[12]. From this location, the clavicle and acromion are traced medially such that a v-shape is formed on the superior aspect of the shoulder at the posterior border of the clavicle and anterior border of the superior aspect of the scapula. The anterolateral and posterolateral corners of the acromion are then palpated and marked, creating a line along the lateral edge of the acromion. Finally, the coracoid is palpated and marked on the anterior aspect of the shoulder (Fig. 2).
- Mark the standard anterior and posterior arthroscopic portals. The posterior glenohumeral entry portal is located 2 cm distal and 1 cm medial to the posterolateral border of the acromion. The placement of the anterior portal can vary on the basis of surgeon preference; however, we prefer an anterior portal located 1.5 cm from the anterior edge of the clavicle, directly in line with the acromioclavicular joint. This places the anterior portal near the anterolateral edge of the coracoid.
- Preliminary marking of accessory portals is then performed. Two accessory lateral subacromial portals located 2 to 3 cm distal and lateral to the lateral edge of the acromion are marked. These are positioned such that the acromion is divided in thirds, at the junction of the anterior and middle one-thirds of the lateral part of the acromion and at the junction of the posterior and middle one-thirds of the lateral part of the acromion. Accessory superior portals are then also marked. The superior Neviaser portal is located at the Neviaser point, and a G (accessory Neviaser) portal is located 2 cm medial to the standard Neviaser portal[2]. These accessory portals are later used for dissection and cyst decompression, as well as to protect the suprascapular neurovascular bundle.
- At this point, it is also helpful to mark the projected course of the suprascapular nerve to provide a reference point throughout the surgical procedure (Fig. 2).

Step 3: Perform Diagnostic Arthroscopy

Create standard anterior and posterior portals for glenohumeral visualization.

- Create a posterior arthroscopic portal at the previously marked location. Insert a 30° arthroscope into the glenohumeral joint. In an outside-in fashion, place an 18-gauge spinal needle into the space of the rotator interval above the subscapularis tendon and below the biceps tendon. Using this trajectory, create an anterior arthroscopic portal at the previously described location. The portal location should be such that it can be used later for instrument insertion into the subacromial space[13].
- Perform the initial diagnostic arthroscopic viewing from the posterior portal with particular attention paid to the biceps anchor superiorly as well as the posterior aspect of the labrum. There are often associated SLAP (superior labral anterior-posterior) tears or posterior labral tears that allow for extravasation of synovial fluid and cyst formation in either the suprascapular or spinoglenoid notch. To fully visualize these tears, it is necessary to place the arthroscope in the anterior portal during the diagnostic arthroscopy.
- Decompression of isolated spinoglenoid notch cysts may be accomplished via debridement directly through the location of the previously described labral tears at the time of glenohumeral arthroscopy. These techniques have been previously described by several authors and are not within the scope of this discussion[14-17].

Step 4: Perform Suprascapular Cyst Decompression Through a Lateral Subacromial Approach

Establish accessory superior and lateral portals and transition to a lateral viewing portal to perform suprascapular notch decompression.

- Using the previously established posterior portal, insert a blunt arthroscopic trocar connected to the arthroscopic cannula into the subacromial space. Use the trocar to sweep bursal tissue from the undersurface of the acromion and create a space for later visualization. Replace the blunt trocar with the 30° arthroscopic camera to provisionally examine the subacromial space.
- Under direct visualization from the posterior portal, create an accessory anterolateral portal in an outside-in fashion at the junction of the anterior and middle one-thirds of the acromion by placing an 18-gauge spinal needle through the skin and into the subacromial space. An arthroscopic

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shaver is inserted through this accessory lateral portal, and subacromial bursectomy with provisional decompression is performed as needed. A second accessory lateral portal located at the junction of the posterior and middle one-thirds of the acromion should also be established at this time, for use in retracting the anterior edge of the supraspinatus when visualizing from the anterolateral portal, to increase surgical exposure later in the case.

- From the posterior viewing portal, visualize the coracoacromial ligament and trace it toward the base of the coracoid, which lies just lateral to the suprascapular notch (Fig. 3).
- Switch the arthroscope from the posterior portal into the anterolateral portal for viewing throughout the remainder of the procedure.
- Utilizing the initially created anterior portal, continue to expose the coracoid base using a combination of a shaver and electrocautery. Great care should be taken initially to stay very near the coracoid base so as not to drift anteriorly and inadvertently violate the coracoclavicular ligaments on its superior surface. This can be facilitated by initially exposing the posterior undersurface of the coracoid until the flare of the scapula can be visualized where the coracoid takes its origin.
- While viewing the base of the coracoid, place a blunt arthroscopic probe through the accessory posterolateral portal and, with the help of an assistant, utilize this instrument to retract and protect the supraspinatus muscle belly. Visualize and palpate the coracoclavicular ligaments on the superior surface of the coracoid via the anterior portal; these will be encountered just anterior to the base of the coracoid as it takes its origin from the scapula. Protect these ligaments throughout the remainder of the operation and continue to expose the superior aspect of the coracoid base in a medial and posterior direction.
- Pass the arthroscope past the base of the coracoid medially to encounter the suprascapular notch with the associated cyst passing underneath the transverse scapular ligament (Fig. 4). Note that large cysts may initially block the surgeon's view of the transverse scapular ligament and its origin off the bone, making it difficult to view the normal anatomy in this region. In such cases, the cyst wall may need to be penetrated and initially decompressed in order to view the transverse scapular ligament. Care should be taken not to drift too medially during this maneuver as doing so prior to visualization of the transverse scapular ligament may place the suprascapular artery and nerve at risk. Carefully following the cyst stalk until it tracks under the transverse scapular ligament is the best way to accomplish this safely. Further, once the cyst is initially decompressed, one may also be able to visualize the anterior insertion of the transverse scapular ligament on the scapula, which will also help to identify the artery and nerve safely.
- While maintaining retraction of the supraspinatus muscle, pass a sharp arthroscopic spatula or scissors through the anterior working portal to penetrate the wall of the cyst and provisionally express the contents therein (Fig. 5). Electrocautery, a shaver, or an arthroscopic grasper is then used to open and fully expose any remaining unvisualized cyst (Fig. 6). Alternatively, one could elect to create a Neviaser portal at this stage as a substitute working portal if the trajectory is thought to be more direct than the anterior portal.
- Establish the Neviaser portal after first localizing its position and trajectory with a spinal needle. Using a blunt switching stick placed through this portal along with a second switching stick placed in the accessory posterolateral subacromial portal, gently dissect out the cyst until the suprascapular artery, the transverse scapular ligament, and the cyst stalk (which tracks under the transverse scapular ligament) are clearly identified. Once the suprascapular artery is identified, use the blunt switching stick in the Neviaser portal to protect this structure while at the same time continuing to resect and dissect out the cyst as it tracks under the transverse scapular ligament. This can be accomplished by placing a shaver or other device in the anterior portal and following the cyst in the posterior and medial direction under the transverse scapular ligament. If good visualization of the artery is easily achieved, the shaver may alternatively be placed into the Neviaser portal, as it gives the most direct trajectory to the cyst stalk as it tracks under the transverse scapular ligament. Fully decompressing the cyst allows visualization of the suprascapular artery and nerve medial to the cyst as it passes underneath the transverse scapular ligament (Fig. 7).

Step 5: Release the Transverse Scapular Ligament

Establish a G portal and release the transverse scapular ligament using arthroscopic scissors.

- Establish a G portal as described by Lafosse et al.[2]. This portal is located 2 cm medial to the Neviaser portal. It is important to establish this portal as it allows for the passage of blunt instru-

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ments to retract and protect the suprascapular neurovascular bundle during transection of the transverse scapular ligament. Plan the portal trajectory and position with spinal needle localization prior to incision.

- Through the G portal, place a blunt switching stick posterior and medial to the transverse scapular ligament to protect the suprascapular neurovascular bundle. With this blunt retractor kept in place, pass arthroscopic scissors or a straight arthroscopic biter through the Neviaser portal such that the blades of the scissors or biter are circumferentially around the transverse scapular ligament, but lateral to the blunt retractor (Fig. 8).
- Carefully section the transverse scapular ligament, once again with care taken to protect the neurovascular structures. The reason for the sectioning of this ligament is to prevent entrapment of the suprascapular nerve at this level if the suprascapular notch cyst should recur.
- Following release of the transverse scapular ligament, explore the suprascapular nerve using a blunt probe to ensure complete release.

Step 6: Closure

Perform arthroscopic lavage of the subacromial space and glenohumeral joint and close the arthroscopic portals.

- Following complete release of the suprascapular nerve, perform lavage of the subacromial space and glenohumeral joint to remove any remaining debris. Fully decompress the intra-articular fluid following this lavage.
- Close the arthroscopic portals in an interrupted fashion. Place sterile dressings over each portal site, and awaken the patient from anesthesia.

Results

As suprascapular nerve entrapment is a relatively rare entity[6,9,11,18], with only a limited number of studies from which to draw conclusions regarding the outcomes of arthroscopic suprascapular nerve release, Shah et al. recently reported on their results in twenty-four patients using this surgical technique[6]. They demonstrated that a majority of the patients had improvement with regard to pain (71%), American Shoulder and Elbow Surgeons scores (75%), and subjective shoulder value scores (71%) by nine weeks postoperatively[6]. Lafosse and Tomasi analyzed the results of arthroscopic decompression in ten patients without rotator cuff tears and found improvement with respect to pain and function in all patients, with a subjective patient rating of excellent in all cases[4]. Millett et al. evaluated three patients who underwent suprascapular nerve release at the suprascapular notch, two of whom demonstrated marked improvement while the other had only slight improvement in terms of pain[19]. In other reports, authors have included their technical notes on and indications for arthroscopic decompression but without analyzing clinical outcome data[5,7,8,10,18].

Our clinical experience has mirrored reported outcome results, with the majority of patients experiencing symptomatic relief in the early follow-up period, although limited long-term outcomes are available. On the basis of the available literature and our experience, arthroscopic decompression of large contiguous cysts in the suprascapular and spinoglenoid notches is safe and effective and may entail less morbidity than an open procedure. Clearly, further studies on larger series of patients are required to fully evaluate the efficacy and safety of the procedure, but preliminary results are promising.

In conclusion, entrapment and neuropathy of the suprascapular nerve at the suprascapular notch is an uncommon, but debilitating, cause of shoulder pain and dysfunction. Dedicated examination and history are essential for diagnosis. Suprascapular nerve entrapment should be considered in any patient with noted muscular atrophy of the supraspinatus and/or infraspinatus with associated weakness. For patients with proven compression who have failed to improve with nonoperative measures, arthroscopic intervention can be an effective technique for management of this pathology.

What to Watch For

Indications

- Isolated suprascapular neuropathy caused by either a suprascapular notch cyst or hypertrophy of the transverse scapular ligament.
- Contiguous suprascapular and spinoglenoid notch cysts causing suprascapular neuropathy and supraspinatus and infraspinatus atrophy.
- Failure of nonoperative management with dedicated physical therapy and activity modification.

Contraindications

- While spinoglenoid notch cysts can also be addressed through this approach, isolated spinoglenoid notch cysts are more readily addressed through a translabral approach via the glenohumeral joint.
- Medical comorbidities that preclude surgical intervention.

Pitfalls & Challenges

- Inadvertent violation of the coracoacromial or coracoclavicular ligaments caused by failure to identify and/or protect these structures.

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- Iatrogenic damage to the suprascapular neurovascular bundle during transverse scapular ligament release, with local use of electrocautery, or by traction on the nerve itself.

Clinical Comments

- When possible, we prefer to decompress contiguous suprascapular and spinoglenoid notch cysts through this single approach. In our experience, this should be done following repair of associated labral tears or other required intra-articular procedures to prevent extensive extravasation of arthroscopic fluid.
- Following a brief learning curve, this technique is safe and allows for direct visualization, protection, and decompression of the suprascapular neurovascular structures leading to improved outcomes as previously reported by Shah et al.[6].
- The current available literature[6], as well as our clinical experience, demonstrates improvement in both subjective and objective shoulder function using this technique.

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Fig. 1

T2-weighted magnetic resonance imaging scans demonstrating coronal (**Fig. 1-A**), axial (**Figs. 1-B and 1-C**), and sagittal (**Figs. 1-D and 1-E**) images of a left shoulder with a contiguous suprascapular and spinoglenoid notch cyst. On the coronal image, the cyst is easily visualized occupying the suprascapular notch. The sagittal images reveal supraspinatus and infraspinatus atrophy (asterisks).

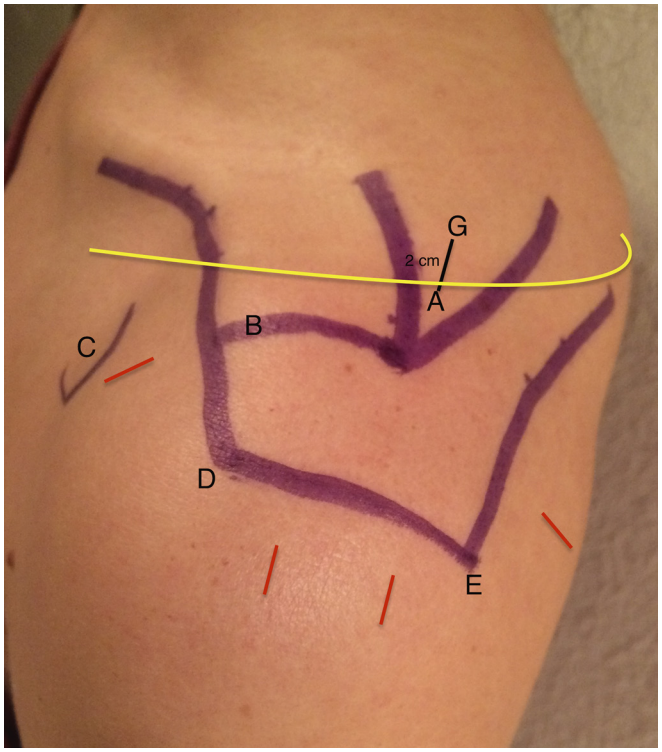

Fig. 2

Superior view of a left shoulder identifying the surface landmarks of the shoulder, including the Neviaser portal (A), the acromioclavicular joint (B), the coracoid (C), the anterior border of the acromion (D), and the posterior border of the acromion (E). The accessory Neviaser portal (G), or G portal, is 2 cm medial to the standard Neviaser portal. The proposed anterior, posterior, and accessory lateral portals are marked with solid red lines in their respective locations. A cutaneous approximation of the course of the suprascapular nerve is marked with a solid yellow line.

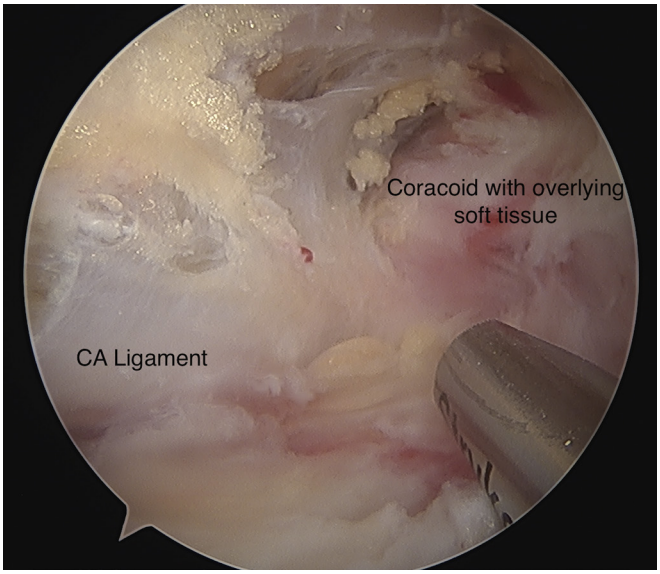

Fig. 3

Arthroscopic view of the coracoacromial (CA) ligament leading to the base of the coracoid.

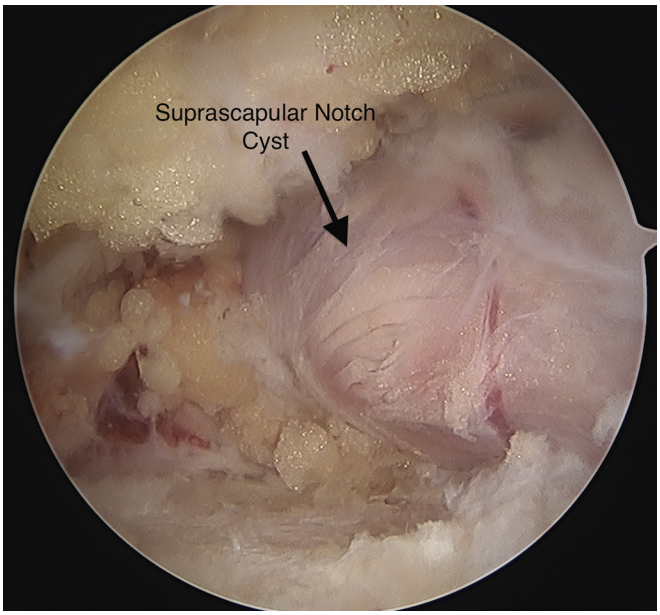

Fig. 4

Arthroscopic view of the suprascapular notch cyst exiting underneath the transverse scapular ligament and causing compression of the suprascapular nerve.

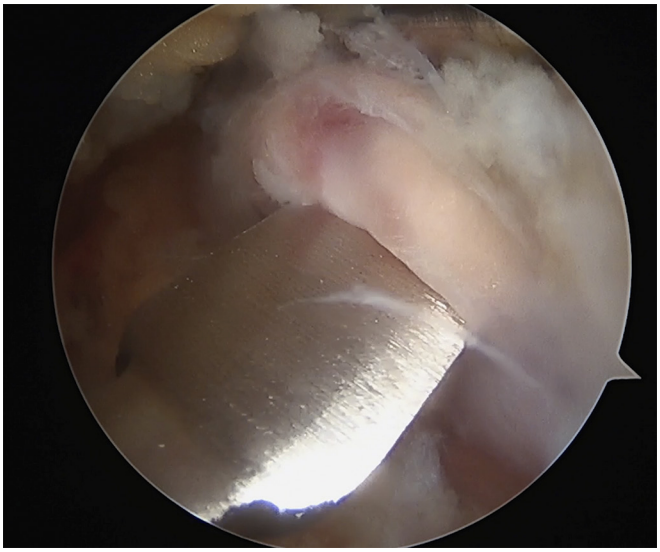

Fig. 5

Penetration of the cyst using a sharp arthroscopic spatula. Care is taken at this stage to avoid iatrogenic damage to the coracoacromial and coracoclavicular ligaments.

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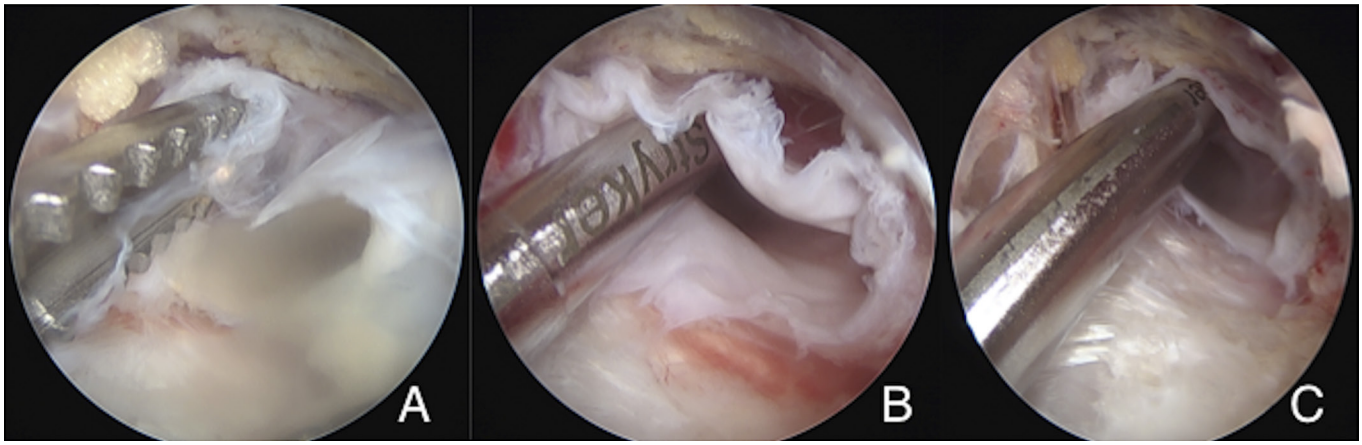

Fig. 6

Arthroscopic imaging demonstrating decompression of the suprascapular notch cyst. A grasper is used to preliminarily open the cyst further after initial penetration. Synovial fluid extravasation can be seen thereafter (**Fig. 6-A**). Following this, a standard arthroscopic shaver can be used to evacuate septations and remove the bulbous edges of the cyst (**Figs. 6-B and 6-C**).

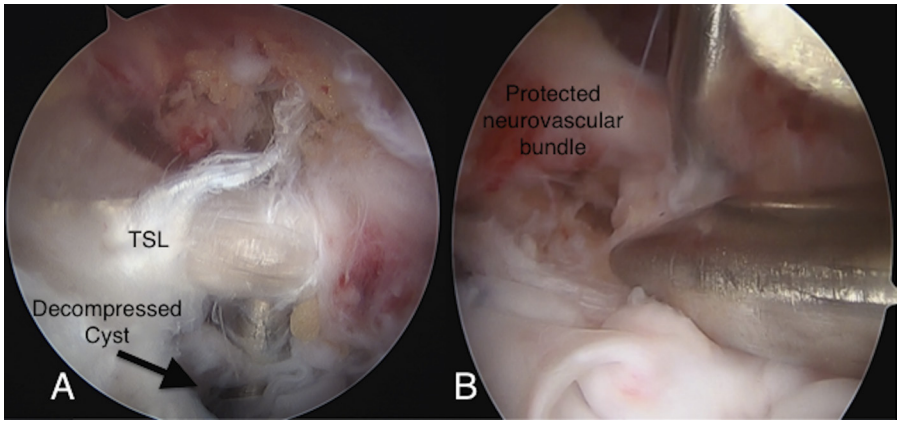

Fig. 7

Arthroscopic images demonstrating blunt dissection of the decompressed cyst and suprascapular nerve (**Fig. 7-A**), while the suprascapular neurovascular bundle is protected using blunt probes placed through a Neviaser portal (**Fig. 7-B**). TSL = transverse scapular ligament.

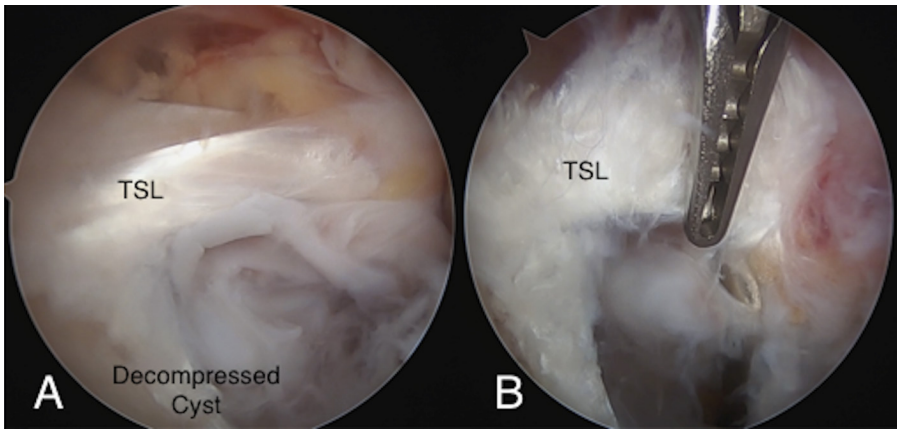

Fig. 8

Views of the intact transverse scapular ligament (TSL) with the decompressed cyst below (**Fig. 8-A**) and subsequent release (**Fig. 8-B**).

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