Arthroscopic Suprascapular Nerve Release at the Spinoglenoid Notch: A Novel Approach

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POSTERIOR SHOULDER PAIN & SURGERY

I. Suprascapular Nerve Entrapment

A. Introduction: Shoulder pain in athletes is a frequent phenomenon. The common differential diagnosis includes a broad list of disorders including rotator cuff tears, shoulder instability, tendinopathies and degenerative disease.
Nerve entrapment symptoms are not often thought of and are an uncommon etiology of shoulder pain, but they must be considered when a diagnosis is uncertain. Posterior shoulder pain should not be thought of the same as anterior shoulder pain. Entrapment of the suprascapular nerve can occur in a number of locations along its course. It is imperative for the physician to recognize these areas and the different anatomical reasons for entrapment of the suprascapular nerve. It is the most frequently injured peripheral branch of the brachial plexus in athletes.
An accurate diagnosis will lead to timely treatment and hopefully a better outcome than has been listed in the past for posterior shoulder pain.

1. Common causes of suprascapular nerve entrapment include:
   a. Acute trauma
   b. Overuse
   c. Chronic irritation
   d. Ganglion cyst

2. Systemic causes may include:
   a. Systemic lupus erythematosus
   b. Rheumatoid arthritis

B. Anatomy
1. Suprascapular nerve anatomy is unique
2. The suprascapular nerve is a mixed motor and sensory nerve that arrives from the upper trunk of the brachial plexus (originates from the 5^{th} and 6^{th} cervical roots, 50% contributions from the fourth cervical nerve root.
3. The nerve courses through the posterior triangle of the neck, and runs under the anterior border of the trapezius, descending in the upper border of the scapula with the suprascapular artery.

Notes:

4. The suprascapular nerve enters the supraspinatus fossa through the suprascapular notch that forms the bony fibrous foramen as a result of the overlying bridge attachment of the suprascapular or superior transverse scapular ligament. Six types of notches have been reported depending on configuration and enclosure.
5. The nerve then exits the notch under the superior transverse scapular ligament and runs obliquely deep to the supraspinatus muscle, around the spinoglenoid notch to enter into the infraspinatus fossa. The artery travels above the ligament.
6. The suprascapular nerve gives off two motor branches to the supraspinatus muscle. The first originates under the superior transverse scapular ligament within 1.0 mm distal to the nerve it enters.
    a. Recurrences of the occlusion of the first motor branch originating before the suprascapular notch are rare.
    b. The second branch is more commonly occluded, as this is from a sensory branch on the capsular ligamentous structures of the AC joint in the anterior superior glenohumeral joint.
7. The nerve courses around the spinal glenoid notch and **comes in close proximity of the glenohumeral joint, passing within 20 mm of the glenoid rim.**
    a. It is at this close approximation of the glenohumeral joint that the inferior branch of the suprascapular nerve now divides into three or four motor branches to the infraspinatus and the sensory branches from the posterior superior glenohumeral joint. This close relationship to the glenohumeral joint explains the problem with cyst formation and then occlusion on the nerve.
8. Ferretti reported an inferior transverse scapula ligament expanding the spinoglenoid notch under which the nerve passes in approximately 50% of people.
    a. Plancher has reported this ligament in 100% of patients in a cadaveric experiment.
9. Entrapment of the nerve under the inferior transverse scapular ligament is the cause of isolated infraspinatus atrophy or denervation of the infraspinatus. The ligament originates at the lateral scapular spine and inserts into the posterior glenohumeral capsule.
10. Remember that the suprascapular artery courses with the nerve through the neck, however, it passes over the superior transverse scapular ligament and then rejoins the nerve in the supraspinatus fossa. The vessels course lateral to the nerve and therefore are closest to the glenoid rim as they enter the infraspinatus fossa. It is essential to understand this unique anatomy to better understand the nerve entrapment symptoms that not only

occur in the suprascapular foramen, but also in the region of the spinoglenoid notch.

11. The nerve lies 3.0 cm from the supraglenoid tubercle at the suprascapular notch and 2.0 cm from the posterior glenoid rim to the nerve at the spine of the scapula.

C. Etiology

1. Hypertrophy superior transverse scapular ligament
2. Narrowed suprascapular notch
3. Ganglion
   a. Present at both superior transverse scapular notch or spinoglenoid ligament. It is more commonly seen as a spinoglenoid ligament.
4. Overuse with chronic irritation
5. Acute trauma
   a. Fracture of the shoulder or scapula
6. Shoulder dislocation
7. Knife wounds to the neck
8. Ossification of the ligament.

NB1: Acute wounds will present with pain and weakness, but obviously no atrophy will be present.

NB2: The suprascapular nerve does not slide in the suprascapular foramen with the result of a fixed proximal nerve, and a fixed distal nerve (attached to the brachial plexus). Stretching the nerve 6% beyond its resting length leads to altered conduction

NB3: The spinoglenoid ligament tightens with cross-body adduction and internal rotation. The supraspinatus and infraspinatus tendons can compress the nerve to the infraspinatus with abduction-external rotation.

D. Diagnosis

1. History
   a. Discussion of pain or weakness. Please note the type of pain, location and relation to activity.
   b. Athletes may have little dysfunction. Teres minor and posterior deltoid may compensate for infraspinatus atrophy.
2. Physical examination
   a. You must note atrophy of the supraspinatus or infraspinatus (patient seated aids in evaluation).
   b. Make note of the muscle weakness of supraspinatus or infraspinatus atrophy.
3. A positive EMG consists of delayed conduction velocity and relation potentials. EMGs are also reported as normal, even with weakness and

atrophy, therefore a **negative** EMG does not rule out a diagnosis of suprascapular nerve entrapment.

5. MRIs can often show a ganglion cyst or a concomitant SLAP lesion of the glenohumeral joint. Also shows muscle atrophy

E. Treatment

1. Conservative treatment with rest, physical therapy and posterior capsular stretches and non-steroidal anti-inflammatories. May take 6 to 12 months for resolution.
2. Operative treatment: A precise location for a lesion must be known prior to excision of any ganglion cyst as a surgical approach was different for the suprascapular or spinoglenoid notch.

F. Surgical Techniques

1. Anterior approach
   a. Dangers involve neurovascular injury
   b. Dissection is difficult at times
   c. Visualization posterior to the suprascapular notch is limited
   d. The scar is usually unsightly
2. Posterior trapezius splitting approach
   a. Extensive detachment of the trapezius is necessary from the spine of the scapula to allow for adequate visualization
3. Posterior trapezial elevating approach
4. Superior cranial approach
   a. The preferred method
   b. The technique involves the placing the patient in the lateral decubitus position; a Saber incision is started at the distal third of the scapula spinous directed anteriorly just medial to the AC joint, from the distal third of the clavicle. Subcutaneous tissue is dissected free from the underlying trapezius and mobilized to allow for good mobilization for the tissue underneath. The trapezius is then divided longitudinally at its lateral fibers for approximately 4.0 – 5.0 cm. The blunt dissection of the fat pad in the supraspinatus muscle is elevated and retracted posteriorly allowing palpation of the superior border of the scapula. The suprascapular notch is easily identified by palpation over the origin of the muscle lying medial to the notch. It should be noted the notch is more lateral than one appreciates. The suprascapular artery and vein pass over the transverse scapular ligament, and must be protected at all times. The suprascapular nerve courses beneath this ligament and the suprascapular notch and a nerve hook can be used between the nerve and the ligaments with the artery gently

retracted and then the ligament is divided under direct visualization.

If the trapezius has been detached rather than divided longitudinally from the lateral attachment of the clavicle or the acromion, it can be reattached with suture anchors or Ethibond sutures. With a split longitudinally we just approximate our trapezial fascia with absorbable suture. The rest of the wound is closed in routine fashion and a drain may at times be placed.

G. Entrapment of the Suprascapular Nerve

1. Entrapment of the suprascapular nerve at the glenoid notch because of a granulating cyst

a. Surgical technique – shoulder arthroscopy is performed in a lateral decubitus position. Identification, probing for a SLAP tear must be done meticulously to find the origin of the ganglion, usually at the 7 o'clock or 5 o'clock position. The extent of the SLAP lesion allows us to débride and evacuate the cyst with a shaver. Because of the close proximity of the suprascapular nerve at the edge of the glenohumeral joint, blind debridement is not recommended. We repair our SLAP lesions with suture anchors, while some use absorbable tack. The important point is to get a good bleeding surface to repair the superior labrum. With a debridement of the origin, evacuation of the cyst, and repair of the SLAP, one usually finds the cyst absorbs as a result of the decompression of the entrapment of the suprascapular nerve at the spinoglenoid notch.

An open procedure can be recommended with a 4.0 cm transverse incision in line with fibers of the deltoid, begun at the posterior lateral corner of the scapula spine extending laterally. The incision is carried down to the subcutaneous tissue, elevated underneath the underlying deltoid fascia. The deltoid is split in line with the fibers, but must be restricted through the dissection to 4.0 – 5.0 cm of the acromial edge to avoid damage to the axillary nerve. With the deltoid split and retracted, the spinoglenoid notch is readily palpated. The superior edge of the supraspinatus can also be seen.

The suprascapular nerve is dissected free from the cyst, and the cyst is dissected free from the soft tissue. With the cyst removed the spinoglenoid notch is palpated for any other types of entrapment. If the ligament is seen, it is surgically cut under direct visualization. The nerve is visualized to

make sure it is lying free on the bed as it passes through the spinoglenoid notch; the fascia of the deltoid is closed.

H. Postoperative protocol

1. Progressive strengthening program is not permitted until six weeks because of the underlying pathology. We need to let the deltoid and trapezius heal, so we focus on eccentric low-demand load with a rehabilitation program that strengthens the rotator cuff and maintains range of motion. We like to hold our patients in a sling for three weeks, although we will allow contraction of the biceps with isometric exercises. Full range of motion is begun at the 2-3 week mark. Three months following the repair full plyometric exercises can be expected.

II. Spinoglenoid Ligament: Anatomy, Morphology, histology, Clinical Relevance and Endoscopic Release

A. Introduction

1. Posterior shoulder pain
2. Isolated infraspinatus atrophy

B. Posterior Shoulder Pain - Reported Activities

1. Volleyball
2. Throwing
3. Weightlifting
4. Tennis
5. Swimming
6. Heavy labor
7. Basketball

C. Posterior Shoulder Atrophy - Suprascapular Nerve

1. Areas of compression
    a. Transverse scapular ligament
    b. Spinoglenoid ligament
        i. Distal branch entrapment

D. Posterior Shoulder Atrophy - Etiology

1. Cervical spine
2. Soft tissue
    i. Mass
    ii. Ganglion Cyst
3. Superior transverse scapular ligament
    i. Atrophy of both; Supraspinatus muscle and infraspinatus muscle
4. Spinoglenoid ligament
        i. Atrophy of only the infraspinatus muscle

E. Diagnostic Studies – Aid in Diagnosis

1. Cervical pathology
2. Rotator cuff pathology

3. Supraspinatus atrophy
4. Supraglenoid cyst
5. Isolated infraspinatus

F. Posterior Shoulder Atrophy - Diagnostic Studies
   1. Radiographs
      a. Cervical pathology
      b. Shoulder pathology
   2. Ultrasound
      a. Posterior shoulder
   3. MRI
      a. Cervical pathology
         i. Cervical disc
         ii. Bony spur
      b. Shoulder pathology
         i. Rotator cuff
         ii. Supraspinatus atrophy
         iii. Infraspinatus atrophy
         iv. Spinoglenoid cyst
   4. EMG
      a. Isolated infraspinatus atrophy

G. Isolated Infraspinatus Atrophy - Theories
   1. Entrapment of the nerve
      a. Mass
   2. Repetitive activities
      a. Acute
         i. Traumatic
      b. Chronic
         i. Microtrauma
   3. Pressure changes
      a. Hypertrophic ligament
      b. Scapular tunnel syndrome
   4. Sling effect

H. Spinoglenoid Ligament - Incidence

I. Spinoglenoid Ligament - Types of Cadavers
   1. Embalmed
   2. Fresh Frozen

J. Spinoglenoid Ligament - Research Objectives
   1. Part I - Static
   2. Part II – Dynamic
   3. Part III - Treatment

K. Spinoglenoid Ligament - Static Observations/Methods
   1. Anatomy
      a. Posterior shoulder dissection
      b. Measure Anatomic Dimensions
      c. Statistical Analysis
      d. Histologic analysis
   2. Incidence
   3. Morphology
   4. Histology

L. Results
   1. Part I - Morphology
   2. Part I - Histology
      a. Collagen fibrils
      b. Scapular insertion
      c. Glenoid insertion

M. Spinoglenoid Ligament Compression
   1. Subjective Study
      a. Nerve compression
      b. Video documentation
   2. Objective Study
      a. Nerve compression
      b. Documented pressure change
      c. Visual contact and pressure

N. Dynamic Anatomy
   1. 28 fresh frozen shoulders
   2. Visualized spinoglenoid ligament during range of motion of the glenohumeral joint

O. Dynamic Video – Contact Pressure Sensor
   1. Under the spinoglenoid ligament
   2. Pressure changes with glenohumeral range of motion

P. Dynamic Video – Contact Pressure Statistics
   1. ANOVA
   2. Separable analysis
   3. Right and left shoulders
      a. Spinoglenoid ligament intact

b. Spinoglenoid ligament released

4. Pressure changes documented
   a. During range of motion
   b. With the spinoglenoid ligament intact

Q. New Surgical Treatment – Minimally Invasive
1. New Techniques
   a. Identify portals
   b. Understand anatomy
   c. Visualize the spinoglenoid ligament endoscopically
   d. Under direct vision release the spinoglenoid ligament
   e. Practice procedure

R. Conclusion
1. Overhead athletes: increased awareness
2. Failed conservative treatment
3. Entrapment of the nerve by the spinoglenoid ligament
4. New Surgical Technique

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