Arthroscopic Transcapsular Axillary Nerve Decompression

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Abstract: Symptomatic axillary nerve compression can result in debilitating pain and weakness that can result in decreased athletic performance. If a trial of nonoperative treatment is not successful, surgical intervention may be required. Open surgical techniques have provided satisfactory outcomes in small cohorts of patients. Recent advancements in surgical technique have provided the ability to perform all-arthroscopic axillary nerve decompression. Though prospective comparisons of open and arthroscopic axillary neurolysis techniques have not been reported, arthroscopic techniques may facilitate early rehabilitation by decreasing surgical morbidity. We describe a novel technique for all-arthroscopic transcapsular axillary nerve decompression for the treatment of quadrilateral space syndrome.

Key Words: axillary nerve compression, arthroscopic axillary nerve release, quadrilateral space syndrome

(*Tech Should Surg* 2011;12: 72–75)

Quadrilateral space syndrome remains a relatively uncommon shoulder diagnosis. Despite this, it can result in debilitating pain, weakness, and atrophy if a timely diagnosis is not made.[1,2] Fibrous bands are reported to be the most frequent compressive etiology, however malunited fractures, malignancies, humeral osteophytes, and hypertrophied musculature are also occasionally implicated.[1–7]

Quadrilateral space syndrome typically afflicts active patients between the ages of 20 and 40 years.[8] Patients typically present with vague posterolateral shoulder pain and occasionally report declining athletic performance.[2,9] In more subtle cases, fatigue in overhead positions may be the patients' primary complaint.[8] Physical examination often reveals tenderness with palpation of the quadrilateral space and parasthesias may be noted along the lateral arm.[8] Muscular atrophy in more chronic cases can result in clinically appreciable weakness of the deltoid or teres minor.[2] Electromyographic studies are capable of revealing objective evidence of axillary nerve compression however, similar to carpal tunnel syndrome, are often normal in patients with quadrilateral space syndrome.[1] Magnetic resonance imaging is frequently obtained to characterize concomitant shoulder injuries and determine if a soft tissue cause of compression can be identified. If of a chronic nature, these studies may also reveal neurogenic edema or fatty atrophy of the deltoid or teres minor muscles.[10–12]

INDICATIONS

The indications for axillary nerve decompression continue to be defined. In general, patients are initially treated nonsurgically and directed to avoid symptomatic activities. A supervised shoulder-conditioning program should be initiated including scapular stabilization and shoulder strengthening exercises. If this program does not provide sufficient symptomatic relief over a 6-week to 8-week period or if a large compressive lesion is present, surgical intervention is often required.

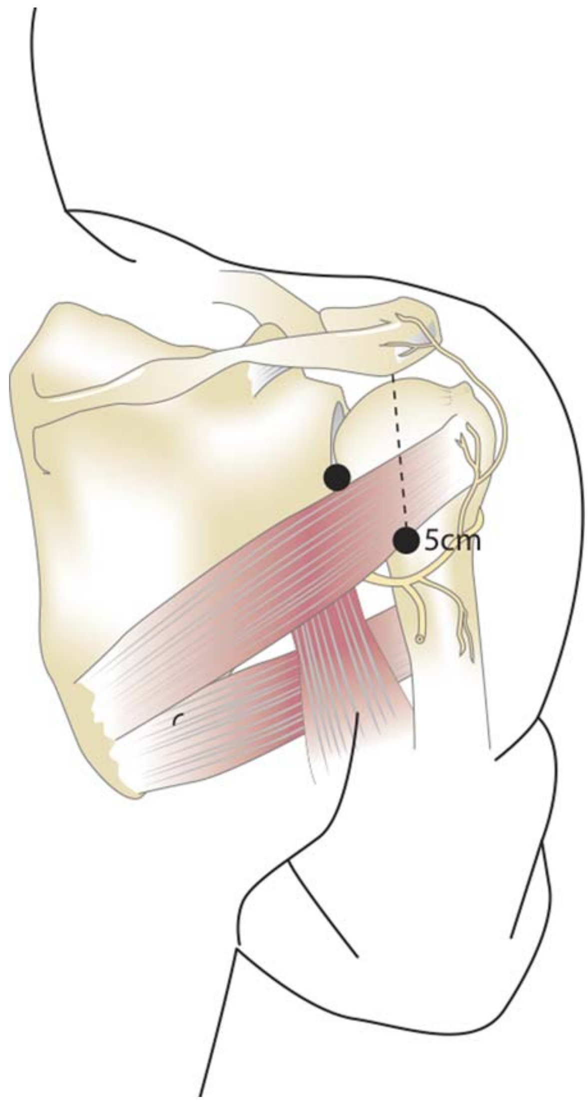

FIGURE 1. Illustration of the posterior aspect of a right shoulder. The posteroinferolateral portal is located approximately 5 cm inferior and in line with the posterolateral acromial border.

Received for publication May 19, 2011; accepted July 13, 2011.
From the Steadman Philippon Research Institute, The Steadman Clinic, Vail, CO.
No financial support in the form of grants, equipment, or other items was received in relation to the completion of this work.
The authors declare no conflicts of interest.
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Traditionally, open surgical techniques have been described to decompress the axillary nerve. Recent arthroscopic advances, however, have provided the ability to develop surgical procedures that minimize the morbidity of open surgical techniques. To this end, we present an arthroscopic transcapsular technique of axillary nerve decompression. In the hands of an experienced arthroscopic shoulder surgeon, this technique provides a reliable method to decompress the axillary nerve.

TECHNIQUE

It is our preference to perform arthroscopic axillary nerve decompressions in the modified beach-chair position. We typically use a regional anesthetic to improve postoperative pain control and a general anesthetic during the surgical procedure. A standard preparation and draping is performed before establishing typical posterior and anterior viewing portals. The arthroscope is then advanced into the glenohumeral joint and a diagnostic arthroscopy is performed. The anterior working portal is used to address any articular pathology identified.

With the arthroscope in the standard posterior portal, the inferior capsular pouch is visualized using either a 30-degree or 70-degree arthroscope. It is our general preference to use the 30-degree arthroscope to visualize the axillary space. We will occasionally substitute the 70-degree arthroscope to improve visualization when necessary. An 18-guage spinal needle is used to establish a posteroinferolateral portal located 5 cm inferior to and in line with the posterolateral angle of the acromion (Fig. 1). It is important to note that the axillary nerve traverses the inferior capsular recess from an anteromedial to posterolateral direction (Fig. 2). Therefore, this accessory portal is most safely established at the junction of the medial and central thirds of the inferior capsular pouch (Fig. 3). This should enter the glenohumeral joint just anterior to the posterior band of the inferior glenohumeral ligament.

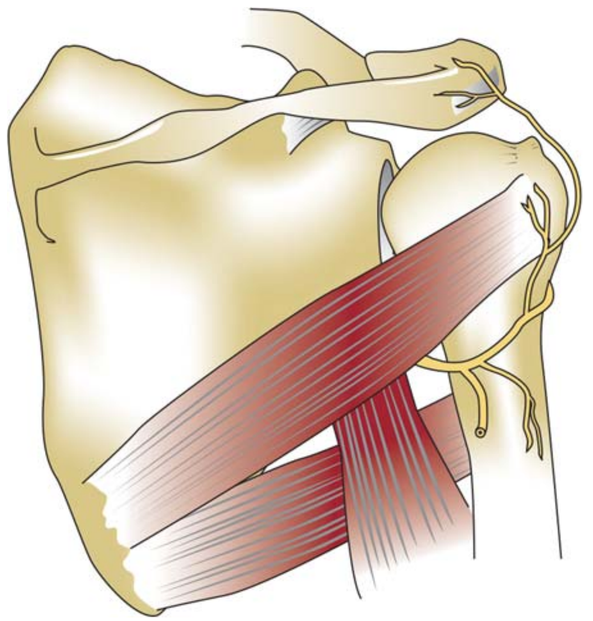

FIGURE 2. Illustration of the posterior aspect of a right shoulder depicting the course of the axillary nerve as it exits from the quadrilateral space. Note its course from anteromedial to posterolateral as it traverses the axillary space.

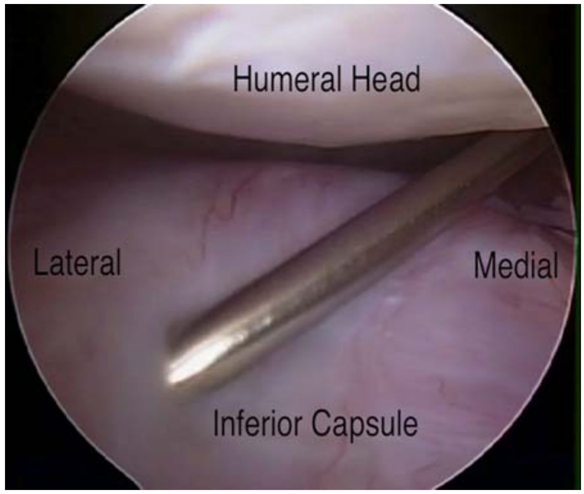

FIGURE 3. Left shoulder viewing from a standard posterior portal in the modified beach chair position. A spinal needle is seen passing through the junction of the medial and middle thirds of the inferior glenohumeral capsule just anterior to the posterior glenohumeral ligament capsule.

Once the portal is located, just the skin is incised. A switching stick is used to enter the glenohumeral joint bluntly, thereby minimizing potential injury to the axillary nerve. Dilators and a 5.5 mm cannula are advanced over the blunt switching stick to facilitate instrument insertion. A radiofrequency device or meniscal punch is used to begin the inferior capsulotomy near the portal entry site (Fig. 4). Once the capsulotomy has been initiated, a blunt trochar can be used to separate the capsule from the underlying soft tissue. A meniscal punch or RF probe can then be safely used to divide the capsular tissue. This technique is repeated until the axillary nerve is identified.

If debris accumulates, the arthroscopic cannula can be used as a shield to protect neurovascular structures, whereas debris is suctioned into the cannula and removed using an oscillating shaver. In our experience, many of these patients exhibit a considerable amount of thick fibrous tissue overlying

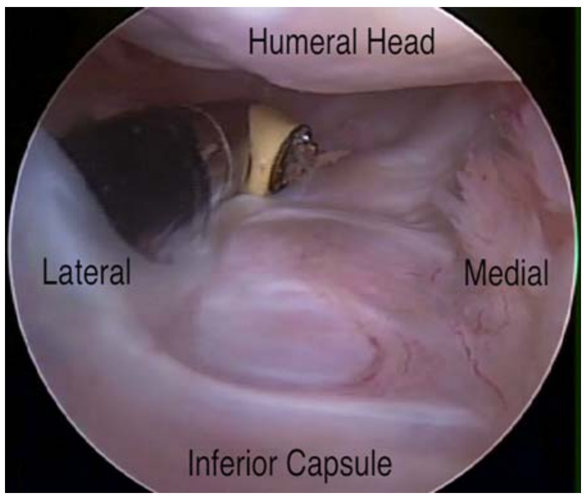

FIGURE 4. Left shoulder viewing from a standard posterior portal in the modified beach chair position. A radiofrequency device is used to open a small capsular window posteriorly.

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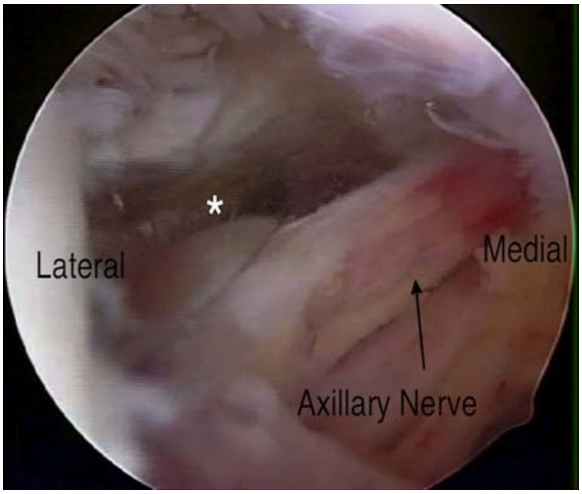

FIGURE 5. Left shoulder viewing from a standard posterior portal in the modified beach chair position. A blunt probe (*) is being used to separate adhesions from the axillary neurovascular bundle.

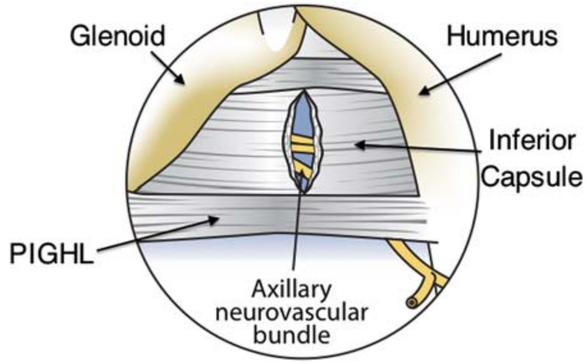

FIGURE 7. Illustration of an arthroscopic view from a posterior portal in a right shoulder. Depicted is the inferior capsulotomy necessary to perform an arthroscopic axillary nerve neurolysis. Note that it is made between the anterior (AIGHL) and posterior bands (PIGHL) of the inferior glenohumeral ligament. The axillary nerve can be visualized coursing from anteromedial to posterolateral through this capsular window.

the axillary neurovascular structures. In this situation, a blunt trochar is used to tease the thick capsular tissue from the underlying soft tissue structures (Fig. 5). As these tissues are separated, a basket punch can be used to continue carefully opening the inferior capsule in a posterior to anterior direction (Fig. 6).

The axillary neurovascular bundle is typically identified near the junction of the middle and anterior thirds of the inferior capsular pouch (Fig. 7). The axillary nerve arborizes unpredictably after it passes under the subscapularis muscle. Therefore, it is not uncommon to encounter multiple branches of the nerve during the dissection. In many of these cases fibrous scar-like tissue is closely adherent to the axillary nerve, placing it at higher risk of injury (Fig. 7). Working from a proximal to distal direction best prevents iatrogenic injury to smaller nerve branches. An adequate decompression is achieved when the axillary nerve is visualized from the subscapularis to the teres minor with no soft tissue impingement (Fig. 8). Hemostasis should be achieved with judicious use of a thermal device to prevent hematoma formation. The portals are closed in a standard fashion.

POTENTIAL COMPLICATIONS

There are a number of potential complications that should be discussed with prospective patients before arthroscopic decompression. These include iatrogenic axillary nerve injury and fluid extravasation into the axillary space resulting in elevated upper extremity compartment pressures. Expeditious decompression and moderate fluid pressures could help minimize these risks.

It is established that the inferior glenohumeral ligament is an important structure to the stability of the shoulder. To this end, inadvertent release during the inferior capsulotomy could potentially result in shoulder instability. The axillary nerve

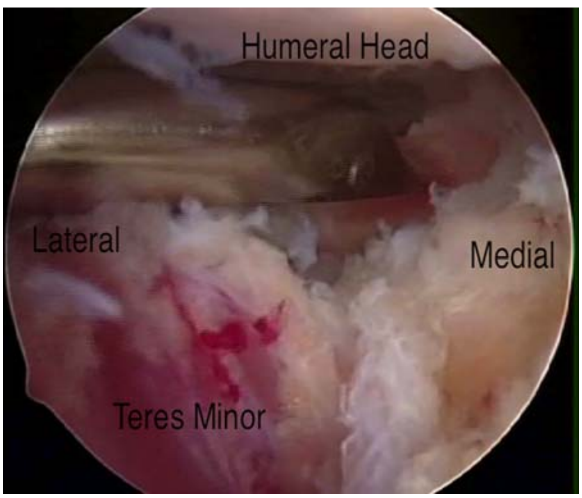

FIGURE 6. Left shoulder viewing from a standard posterior portal in the modified beach chair position. A standard biting basket is used to extend the inferior capsulotomy anteriorly. The teres minor and humeral head are also visualized.

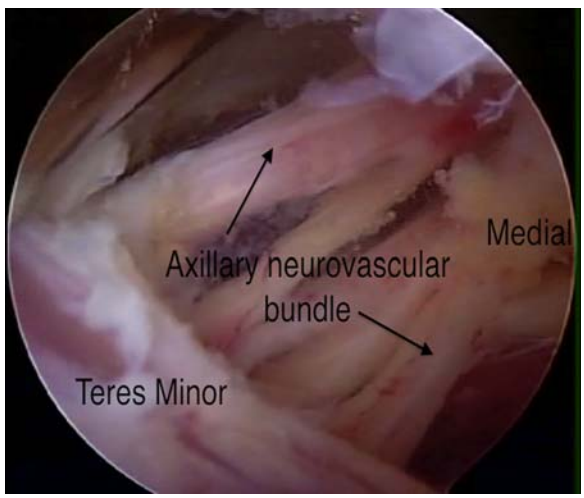

FIGURE 8. Left shoulder viewing from a standard posterior portal in the modified beach chair position. After decompression, the axillary neurovascular bundle can be seen extending from the subscapularis to the teres minor (visualized) without fibrous adhesion.

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decompression is optimally performed between the anterior and posterior bundles of the inferior glenohumeral ligament. Preservation of these bands minimizes the risk of iatrogenically induced shoulder instability.

Though these potential complications were not experienced in our initial series of patients, we have had 1 patient develop shoulder stiffness postoperatively who is improving with focused physical therapy. An additional patient required revision neurolysis after recurrent symptoms were experienced approximately 8 weeks postoperatively. At revision surgery, additional scar tissue had developed within the inferior capsular pouch and its removal provided symptomatic relief postoperatively. Rehabilitation protocols emphasizing early motion and meticulous surgical hemostasis may help avoid these complications by minimizing scar tissue formation.

DISCUSSION

This arthroscopic technique provides a facile, reliable, and less-invasive technique for the treatment of quadrilateral space syndrome. It is important, however, that the shoulder arthroscopist have a detailed understanding of the arthroscopic anatomy of the axillary nerve before undertaking this technique. To this end, it is critical to realize that the axillary nerve arborizes near the long head of the triceps origin.[13] Therefore, the surgeon should expect to encounter a variable number of branches during the axillary dissection. Failure to recognize these branches may result in iatrogenic axillary nerve injury.

Quadrilateral space syndrome typically presents as posterolateral shoulder pain and may be associated with shoulder weakness in chronic cases.[2,9] It is believed that the etiology of this condition is a mechanical compression of the axillary nerve. To this end, existing literature indicates fibrous bands, venous distention, muscular hypertrophy, or space occupying lesions can result in this type of compression.[1–7] Traditionally, these lesions have been decompressed using a posterior deltoid reflecting approach.[1,2,7,14] Using this technique, Cahill and Palmer reported significant symptomatic relief in 16 of 18 patients.[1] McAdams and Dillingham[7] reported on a series of 4 overhead athletes who were able to return to full activity without discomfort at an average of 12 weeks postoperatively. Successful outcomes have also been documented in a small number of case reports.[2,3,14]

We recently reported a series of 9 arthroscopic axillary nerve releases in 8 patients for quadrilateral space syndrome.[15] At an average of 3 months (range, $1-8$ mo) postoperatively, each patient reported decreased pain, improved function, and were highly satisfied with their surgical outcome. Two minor complications were noted, including recurrent symptoms in 1 patient who required revision nerve release and a second patient who developed posterior capsular tightness and is improving with therapy. No iatrogenic axillary nerve injury or other major complications occurred in this series.

It is therefore apparent that open techniques are capable of successfully eliminating axillary nerve compression, however less-invasive methods may provide some advantages. Analogous to arthroscopic suprascapular nerve decompression, an arthroscopic approach to axillary nerve decompression may minimize operative morbidity and facilitate accelerated rehabilitation protocols. A comparison of open and arthroscopic techniques will be necessary to determine the relative efficacy of each procedure.

CONCLUSIONS

Quadrilateral space syndrome is a relatively uncommon etiology of shoulder dysfunction. It typically presents with posterolateral shoulder pain and occasionally with atrophy of the deltoid and teres minor. Although initial treatment is always nonoperative, surgical decompression has provided satisfactory results. Decompression of the axillary nerve is traditionally accomplished using open techniques. Arthroscopic axillary nerve decompression is capable of providing excellent visualization and may decrease operative morbidity as compared with open surgical decompression. This technique can be technically challenging and should only be performed by experienced shoulder arthroscopists.

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