Endoscopically assisted decompression of the suprascapular nerve in the supraspinous fossa: a cadaveric feasibility study

Laboratory investigation

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Object. The suprascapular nerve may become entrapped as it travels deep to the suprascapular ligament, necessitating decompression. The present study was performed to verify the feasibility of a minimally invasive, endoscopically assisted technique for decompressing the suprascapular nerve in the supraspinous fossa.

Methods. The authors performed dissection and decompression of the suprascapular ligament using an endoscopically assisted technique via a 3-cm skin incision in 10 adult cadavers (20 sides). Measurements were also made of the depth from the skin to the suprascapular ligament.

Results. A mean depth of 4 cm was necessary to reach the suprascapular ligament from the skin surface. With the authors’ approach, no obvious injury occurred to the suprascapular or other vicinal neurovascular structures (such as the spinal accessory nerve and suprascapular vessels).

Conclusions. The results of this cadaveric study demonstrate that access to the suprascapular nerve can be obtained endoscopically via a small supraspinous incision. This approach obviates a large incision, entry into the glenohumeral joint, and reduces the risk of spinal accessory nerve injury in the posterior cervical triangle, or atrophy of the trapezius or supraspinatus muscles from a standard larger dissection. To the authors’ knowledge an endoscopically assisted approach to decompressing the suprascapular nerve as it courses deep to the suprascapular ligament has not been reported previously. (DOI: 10.3171/JNS-07/12/1164)

KEY WORDS • anatomical study • brachial plexus • cadaver • shoulder • surgery • upper extremity

T he suprascapular nerve is a branch of the upper trunk of the brachial plexus and is comprised of C-5 and sometimes C-6 ventral root fibers. This nerve travels through the posterior cervical triangle alongside the suprascapular artery and vein in a slightly deeper plane than the posterior belly of the omohyoid muscle as it proceeds toward the medial lip of the suprascapular notch. The suprascapular nerve and vessels become segregated as the nerve continues deep to the suprascapular ligament, and the vessels travel superficial to this band (Fig. 1). In rare cases the nerve and vessels are found traversing the suprascapular foramen together. The suprascapular nerve innervates the supra- and infraspinatus muscles, and may even have a cutaneous branch to the skin over the shoulder. Articular branches of this nerve include fibers to the acromioclavicular and glenohumeral joints. The suprascapular nerve is relatively fixed at the suprascapular foramen and therefore subject to friction at this site, which may lead to nerve dysfunction. Furthermore, the suprascapular ligament may become ossified, thereby leading to stenosis of the supraspinous fossa with consequent compression of the suprascapular nerve. The ligament may completely ossify in up to approximately 4% of the population. Entrapment may also occur secondary to a fracture or mass effect. Patients with en-
trapment of the suprascapular nerve present with a severe dull aching pain in the shoulder that is aggravated by motion at the shoulder. Chronic entrapment may result in wasting of the supra- and infraspinatus muscles and is probably underdiagnosed. This muscular dysfunction is manifested as disability of abduction and external rotation.

We conducted the present study to verify the feasibility of using an endoscopic technique in the release of the suprascapular ligament at the suprascapular notch.

Materials and Methods

In the supine position, five formalin-fixed and five fresh adult cadavers (six female and four male; 20 sides) aged 60 to 80 years (mean 66 years) underwent exposure of their left and right suprascapular nerves via a 3-cm skin incision made at the center of a triangular region composed of the following three points: tip of the acromion process, coracoid process, and the superior angle of the scapula (Fig. 2A). This center was then approached parallel to a vertical line placed posterior to the lateral one third of the clavicle (Fig. 2A). Blunt dissection was performed through the trapezius and supraspinatus muscles with blunt dissection and digital palpation until the suprascapular ligament was appreciated. Next, a 1.1-mm, 0° endoscope (Medtronic, Inc.) attached to a light source was introduced into the surgical portal and the suprascapular ligament was observed. Images were viewed on an adjacent monitor. Maintaining visualization of the ligament with the endoscope, a blunt hook was then used to dissect beneath the ligament, taking care not to injure the underlying suprascapular nerve. A No. 15 scalpel was then used to transect the ligament while maintaining this structure under endoscopic observation (Figs. 2B and 3). After completion of endoscopic surgery (Fig. 4), open dissection (Fig. 5) was performed to verify the endoscopically identified structures and assess potential iatrogenic injuries. Differences in depth from the skin surface to the suprascapular ligament were analyzed for statistical differences between sexes and sides using the Student t-test for which a probability value less than 0.05 was considered significant.

Results

The mean distance from the skin to the suprascapular nerve deep to the suprascapular ligament was 4 cm (range 3.5–6 cm). All suprascapular ligaments and nerves could be easily visualized and the ligament dissected. Dissection, however, was easier in fresh specimens due to the mainte-

![Fig. 2. A: Photograph of right cadaveric shoulder with markings (dots) on the superior angle of the scapula (medially), coracoid process (anteriorly), and acromion process (posteriorly). The posterior edge of the clavicle is marked with a skin marker. Note that the incision used in this study is just posterior to the lateral third of the linear skin marking. B: Photograph obtained after the introduction of the 1.1-mm endoscope and scalpel in the same specimen.](image)

![Fig. 3. Schematic illustration of the right shoulder emphasizing anatomy and surgical technique used. Note the overlying trapezius muscle and deeper lying supraspinatus muscle. The suprascapular ligament separates the deeper suprascapular nerve (yellow) from the more superficial suprascapular artery (red).](image)
Discussion

Endoscopic decompression of the suprascapular nerve in the spinoglenoid notch (greater scapular notch) from a ganglion cyst has been performed by both Iannotti et al. and Lichtenberg et al. via intraarticular approaches. More recently, Bhatia and associates and Lafosse and Tomasi have used various minimally invasive techniques to demonstrate that the suprascapular nerve could also be decompressed at the suprascapular notch. The technique of Bhatia and colleagues used a standard posterior portal performed during glenohumeral and bursal arthroscopy and inserted a 30° arthroscope. Simultaneously, two additional portals were used by these authors: a lateral site 3- to 5-cm posterior to the anterolateral corner of the acromion process for excision of the subacromial bursa and a posterolateral portal midway between the lateral and posterior portals. Lafosse and Tomasi have reported the use of a three- to four-portal arthroscopic technique. These authors used the classic posterior portal to visualize the glenohumeral joint, and a second port was placed between the clavicle and scapular spine approximately 7-cm medial to the lateral acromion process. A third port was made by placing a spinal needle perpendicularly into the suprascapular fossa, which may endanger the spinal accessory nerve as stated by these authors. We found no specimen in which the spinal accessory nerve was injured using our single-incision technique.

Superiorly and topographically, Weinfeld and colleagues found that the suprascapular ligament was located 1.3 ± 0.3 cm posterior to the posterior border of the clavicle and 2.9 ± 0.8 cm from the acromioclavicular joint in a 2D surface plane. These same authors also found that the depth of the suprascapular ligament from the skin surface was 3.9 ± 0.7 cm. Kim and associates found that this distance was 8 to 10 cm. These authors used a skin incision approximately 6.5 cm long. We found a mean distance of 4 cm from the skin to the suprascapular ligament. Bigliani et al. found that the lateral edge of the suprascapular notch had a mean distance of 3.0 cm to the superior edge of the glenoid fossa of the scapula.

The approach used in the present study minimizes the length of the incision and dissection of underlying soft tissue required to access the suprascapular ligament and is lateral enough to avoid the spinal accessory nerve, which travels deep to the trapezius at the level of the superior angle of the scapula. Interestingly, Shupeck and Onofrio have described an anterior approach to the suprascapular nerve, which obviates traversing the majority of the suprascapular ligament.

Fig. 4. Endoscopic views. A: The right suprascapular nerve (arrow) as it exits deep to the suprascapular ligament. B: The right suprascapular ligament (lower arrow) after transection with a scalpel (upper arrow). The suprascapular ligament has been folded superiorly to illustrate its cut end.

Fig. 5. Photograph of muscular dissection of the left side of a cadaver. The trapezius is held apart with a self-retaining retractor and the supraspinatus (S) is seen in the suprascapular fossa. Arrow tip marks the acromioclavicular joint.
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spinatus muscle. However, the skin incision used by these authors was approximately from the acromion tip to the posterior border of the sternocleidomastoid muscle. In patients, our technique could be accentuated with a seated position and the application of distal traction to the upper extremity as illustrated by Lafosse and Tomasi.6 Following a skin incision and splitting of the overlying trapezius muscle, digital dissection could identify the supraspinatus muscle–associated suprascapular artery. The artery could then be avoided and the muscle dissected posteriorly to visualize the suprascapular ligament. Next, the endoscope could be easily admitted through this portal and brought down onto the suprascapular ligament. Transection with scissors or a scalpel could then be performed while visualization is maintained on an adjacent monitor.

Conclusions

The results of our cadaveric study demonstrate that access to the suprascapular nerve can be obtained with an endoscope via a single small incision. This approach obviates a large incision, entry into the glenohumeral joint, and lessens the risk of spinal accessory nerve injury in the posterior cervical triangle or muscle atrophy of the trapezius or supraspinatus from a larger dissection. This technique may prove useful in surgical exposures of the suprascapular nerve and ligament, especially when standard approaches are not feasible. In vivo application of this method is now necessary to confirm our cadaveric findings.

References


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