Review

Peri-articular suprascapular neuropathy

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A B S T R A C T

Suprascapular nerve entrapment was first described in 1959 by Kopell and Thompson. Although rare, this condition is among the causes of poorly explained shoulder pain in patients with manifestations suggesting a rotator-cuff tear but normal tendons by imaging studies [2–4]. Suprascapular nerve entrapment may cause 2% of all cases of chronic shoulder pain. Among the many reported causes of suprascapular nerve entrapment, the most common are para-labral cysts, usually in the spinoglenoid notch, and micro-trauma in elite athletes. The potential relevance of concomitant rotator-cuff tears remains debated. Less common causes include tumours, scapular fractures, and direct trauma involving traction. Early diagnosis and treatment are crucial to avoid the development of irreversible muscle wasting. Endoscopic surgery to treat the various causes of suprascapular nerve compression has superseded open nerve release.

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1. Introduction

Suprascapular nerve entrapment was first described in 1959 by Kopell and Thompson [1]. Although rare, this condition is among the causes of poorly explained shoulder pain in patients with manifestations suggesting a rotator-cuff tear but normal tendons by imaging studies [2–4]. Suprascapular nerve entrapment may cause 2% of all cases of chronic shoulder pain.

Among the many reported causes of suprascapular nerve entrapment, the most common are para-labral cysts, usually in the spinoglenoid notch [5–8], and microtrauma in elite athletes [9]. The potential relevance of concomitant rotator-cuff tears remains debated [10–12]. Less common causes include tumours, scapular fractures, and direct trauma involving traction.

Early diagnosis and treatment are crucial to avoid the development of irreversible muscle wasting. Endoscopic surgery to treat the various causes of suprascapular nerve compression has superseded open nerve release.

Here, we will briefly review the relevant anatomy then discuss idiopathic suprascapular nerve entrapment and compression of the nerve by cysts.

2. Anatomy of the suprascapular nerve

The suprascapular nerve is a mixed nerve that arises from the brachial plexus, chiefly from the C5 and C6 roots (C5, 6%; C5 and C6, 76%; C4 and C5 and C6, 18%). The nerve travels downwards and backwards in the neck then enters the shoulder by running under the inferior transverse scapular ligament at the suprascapular notch. The depth of the notch varies widely, and Rengachary et al. described six morphotypes [2]. The suprascapular artery travels over, and the suprascapular vein under, the inferior transverse scapular ligament. The suprascapular nerve then courses through the suprascapinous fossa, under the supraspinatus muscle (3 cm on average from the rim of the glenoid cavity), to the spinoglenoid notch posteriorly, and ends under the infraspinatus muscle in the infraspinous fossa (2 cm on average from the glenoid rim) [11,13]. The nerve trajectory through the spinoglenoid notch is at an angle of about 60° [11].

The suprascapular nerve supplies the supraspinatus and infraspinatus muscles. Its sensory territory, which varies widely, is located at the posterior and superior aspect of the shoulder over the glenohumeral joint space [14]. In addition, a posterior capsular branch contributes to sensation from the glenohumeral joint, particularly its proprioception.

Entrapment of the suprascapular nerve can occur at two sites, the suprascapular notch at the base of the coracoid process (of which anatomic variants are both common and diverse) and the spinoglenoid notch where the nerve runs beneath the inferior transverse scapular ligament [15]. Aiello et al. distinguished involvement of one or both spinatus muscles depending on the site of entrapment relative to the bony scapular notches [16].

3. Diagnostic investigations

Electrophysiological testing shows decreased conduction velocities, increased distal motor conduction latency, and a neurogenic
trace characteristic of neuropathy. Electrophysiological testing is extremely useful in establishing both the diagnosis and the prognosis. Nevertheless, its sensitivity is only 74% to 91% and the results may be inconclusive in patients with muscle wasting.

Magnetic resonance imaging (MRI) not only visualises the initial oedema related to muscle denervation and the muscle wasting/fatty degeneration [specific cullet sign] [17], but also detects lesions potentially responsible for compression of the suprascapular nerve (chiefly para-labral cysts). MRI also identifies the main differential diagnoses (tumours and Parsonage-Turner syndrome).

4. Operative technique for nerve release at the suprascapular notch

As complements to the original description by L. Lafosse et al. [18,19], other authors relied on anatomic studies [20–22]; Barwood et al., 2007, #68 305; Plancher et al., 2007, #83 753) to develop either novel approaches or minimally invasive arthroscopic or endoscopic techniques for releasing the suprascapular nerve.

The patient is usually in the semi-reclined position. A posterior optical portal and a superior lateral portal are created. The first step is debridement of the subacromial bursa to the base of the coracoid process. The trapezoid and conoid ligaments are identified anteriorly. The suprascapular notch is located at the attachment site of these two coraco-clavicular ligaments and medial to the coracoid process.

The arthroscope is introduced through the lateral portal. A superior portal is created for the instruments (Neviaser approach), 5 cm from the lateral edge of the acromion. The debrideaments continued cautiously to locate the artery coursing over the inferior transverse scapular ligament, allowing identification of the nerve and therefore division of the ligament under the safest possible conditions.

5. Idiopathic suprascapular nerve entrapment

Idiopathic suprascapular nerve entrapment is difficult to recognise, and the low incidence of this condition often results in diagnostic delays. In situ, nerve release was long performed as an open surgical procedure, with satisfactory results [23–26].

5.1. Our case-series

We retrospectively identified 9 patients who underwent surgery over a 3-year period for isolated suprascapular nerve entrapment. There were 5 males and 4 females with a mean age of 37.6 years (range, 21–66); among them, 7 were manual labourers whose work involved use of the upper limbs. All 9 patients were right-handed and 7 had involvement of the right shoulder. Mean symptom duration was 16 months (range, 7–60 months). All 9 patients underwent Constant score determination before and after surgery, pre-operative electrophysiological testing, and imaging studies that ruled out anatomic rotator cuff abnormalities and cysts putting pressure on the suprascapular nerve (Fig. 1). Surgical treatment consistently involved arthroscopic nerve release, with the patient in the semi-reclined position. The only procedure performed was division of the inferior transverse scapular ligament as described by Lafosse et al. [18,19]. No immobilisation was used post-operatively.

Mean time to re-evaluation was 18 months (range, 6–30 months). A clinical evaluation and repeat electrophysiological testing were performed. No intra-operative or post-operative complications were recorded. Clinical improvements were documented consistently. A single patient reported persistent muscle weakness. The Constant score was 54 before surgery and 81 after surgery, with the largest improvements occurring for pain and strength. Distal motor conduction latency improved after surgery in all 9 patients.

These outcomes are similar to those reported after open surgery. In a retrospective review of 42 patients managed with open nerve release between 1970 and 2002, Kim et al. [25] reported good recovery of supraspinatus function in 90% of patients, compared to only 32% for infraspinatus function. In contrast, the procedure was very effective in providing pain relief. In 36 patients with suprascapular nerve entrapment due to a variety of causes, Antoniou et al. [26] found a mean ASES shoulder score of 86 post-operatively compared to 53 pre-operatively. The severity of the electromyogram abnormalities did not correlate with the severity of the functional impairments. Similarly, after surgery, the degree of electromyogram recovery failed to correlate significantly with the degree of functional recovery.

6. Suprascapular nerve entrapment at the spinoglenoid notch

Suprascapular nerve compression by a para-labral cyst is usually responsible for isolated involvement of the supraspinatus muscle. Although para-labral cysts are generally located in the spinoglenoid notch, they very often extend on either side of the scapular spine. A crucial step is evaluation for a labral lesion responsible for cyst development via a valve effect [7,8]. Labral lesions have been reported in 50% to 100% of cases, the most common being type II SLAP tears. The risk of nerve injury may depend on the size of the cyst, being high if the cyst measures more than 30 mm along the longest dimension. The advent of MRI resulted in the rediscovery of para-labral cysts. MRI visualises the cyst, indicates the type of neurogenic nerve injury, and maps the resulting damage, which is confined to the infraspinatus muscle.

6.1. Management

Non-operative management has no role in the treatment of para-labral cysts. Similarly, cyst aspiration under ultrasound or computed-tomography guidance carries a 75% to 100% rate of failure or recurrence. Surgery is, therefore, mandatory. Arthroscopy is the optimal method for treating not only the cyst, but also the associated labral lesion. Standard portals are used to explore the joint and to evaluate the extent of the lesions. The best course of action in patients with both a cyst and a labral lesion is not agreed on. Isolated repair of the labrum has been described as sufficient to ensure healing and resolution of the cyst. However, combining cyst evacuation and labral repair has been advocated. When no labral lesion is found by imaging studies or during surgery, evacuation of the cyst can be achieved either by detaching the inferior aspect of the labrum then reattaching it at the end of the procedure or by performing a juxta-labral incision in the joint capsule. A discharge of mucoid fluid indicates evacuation of the cyst. Nerve release at the
Scapular notch remains controversial; in no case is this procedure performed routinely.

Outcomes are good after para-labral cyst surgery. Resolution of the pain and muscle weakness can be expected, provided surgery is performed early, before the development of muscle wasting. In 90% of patients, the imaging studies indicate disappearance of the cyst. One of the largest case-series with the longest follow-up is that reported by Schroder et al. [7]. Labral repair without cyst evacuation resulted in cyst disappearance in 92.8% of patients. Similar results were obtained by Kim et al. [25].

Another mechanism of injury described in volleyball players is traction with stretching of the suprascapular nerve in the spinoglenoid notch [27,28]. This mechanism should be considered in overhead athletes presenting with isolated infraspinatus muscle involvement and no evidence of compression by a supraglenoid or retroglenoid cyst. Conservative methods should be used as the first-line treatment, the success rate being 92% in a case-series study by Fereti et al. [29]. Nerve release may be in order if conservative treatment fails or as the primary treatment when MRI shows severe muscle oedema.

### 7. Suprascapular nerve entrapment related to rotator-cuff tears

An association linking rotator-cuff tears and suprascapular nerve damage was suggested recently based on experimental and conceptual arguments [29,30]. Either tendon retraction or tendon stretching during the repair procedure may pull on the nerve, which is tethered at the two scapular notches. The studies remain highly controversial, and their results are strongly conflicting (so that even the existence of an association is debated). Consequently, the available data provide no guidance regarding the appropriateness of nerve release at the scapular notch. Lafosse et al. [18] and Romeo et al. [31] stated that this procedure was clearly beneficial, whereas results reported by Collin et al. [12] can be interpreted as challenging the concept of traction neuropathy or as suggesting that electromyography may lack sensitivity for detecting neuropathy in patients with muscle wasting.

### 8. Conclusion

In patients with suspected suprascapular entrapment syndrome, the first step is to determine whether the compression is at the suprascapular or spinoglenoid notch. Then, the mechanism of the lesion must be identified. A clinical evaluation, electrophysiological testing, and MRI should be performed in combination to meet these objectives.

Testing for muscle weakness in abduction or rotation with the elbow by the side can theoretically show whether the entrapment is located before or after the suprascapatus muscle. The investigations confirm the diagnosis and determine the site of the entrapment. MRI evaluation of the muscle belly seems to be gaining ground as a diagnostic and, above all, prognostic tool in patients with suprascapular neuropathy.

Whether an association exists between suprascapular neuropathy and retracted rotator-cuff tears remains highly controversial. We believe the important point is an early diagnosis to allow arthroscopic nerve release in patients with documented idiopathic entrapment or a para-labral cyst.

**Disclosure of interest**

P. Clavert is consultant for Mitek.
H. Thomazeau has no conflict of interest regarding this paper.

**References**