Suprascapular nerve entrapment: experience with 28 cases

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Suprascapular nerve entrapment (SNE) in the suprascapular notch is a rare entity that must be considered in the differential diagnosis of radicular pain, as well as that of shoulder discomfort. Over a period of 10 years (1985–1995), the authors treated 28 cases of SNE in 27 patients by surgical decompression of the nerve. One patient underwent operation bilaterally within 5 years. Five patients presented with a history of trauma to the shoulder region. In three patients, a ganglion cyst was the origin of the nerve lesion. In 16 patients, the nerve problem was primarily related to athletic activities. Eight of these patients were professional volleyball players. In the remaining three patients, there was no relationship between the nerve lesion and trauma or athletic activities. Twenty-one patients (22 cases) complained of pain located over the suprascapular notch. Seventeen patients had paresis and atrophy of both the supraspinatus (SS) and infraspinatus (IS) muscles. In 10 patients only the IS muscle was involved. One patient exhibited a sensory deficit over the posterior portion of the shoulder. Electromyography was performed in all cases.

The mean follow-up period in the 25 cases (24 patients) that could be evaluated was 20.8 months (range 3–70 months). Nineteen of 22 cases with preoperative pain could be evaluated. Sixteen of these patients were completely free of pain after surgery and three patients found their pain had improved. Motor function in the SS muscle improved in 86.7% and motor function in the IS muscle in 70.8% of cases. Atrophy of the SS muscle resolved in 80.7% and atrophy of the IS muscle in 50% of cases.

Surgical treatment of SNE is indicated after failed conservative treatment and in cases of atrophy of the SS and IS muscles. The authors recommend the posterior approach, which minimizes risks and complications and produces good postoperative results.

KEY WORDS • suprascapular nerve • entrapment neuropathy

Shoulder pain is a common problem among patients seeking medical attention. Correct diagnosis and therapy may be difficult due to the variety of disorders in question. Differential diagnostic considerations include cervical radiculopathy, rotator cuff tears, bicipital tenosynovitis, glenohumeral and acromioclavicular joint arthritis, and subacromial bursitis.

Entrapment neuropathy of the suprascapular nerve (SN) is seldom considered in the differential diagnosis of shoulder discomfort and is, therefore, probably underdiagnosed. Dörrien20 published details of the first SN lesion reported by Bernhardt in 1886. Kopell and Thompson48 were the first to describe SN entrapment (SNE) at the suprascapular notch in 1959. In 1982, Aiello, et al.,2 described SNE at the spinoglenoid notch.

The current report deals with 28 consecutive cases of SNE in 27 patients over a 10-year period.

Suprascapular Nerve Entrapment

Anatomical Review

The SN originates in the upper trunk of the brachial plexus, which is formed by the C-5 and C-6 roots. It runs through the suprascapular notch, which is covered by the superior transverse scapular ligament. The suprascapular artery and vein pass above the ligament. The nerve is fixed within this osteofibrous canal. Having left the notch, it divides into branches that extend to the supraspinatus (SS) and infraspinatus (IS) muscles.5,43,93 Murakami and colleagues41 observed that the SN contains some sensory fibers that supply a small skin area close to the acromion as well as to the glenohumeral and coracoacromial joints and the coracoclavicular ligament. The branch to the IS muscle passes into the infraspinous fossa around the lateral margin of the scapular spine (spinoglenoid notch) below the inferior transverse scapular ligament, which is a weak ligament between the lateral margin of the scapular spine and the glenoid rim. The inferior transverse scapular ligament is an inconstant finding.17,42

Clinical Features

Patients who suffer from SNE complain of pain over the posterior and lateral area of the shoulder. Movements of abduction and external rotation of the arm can be impaired. In advanced cases, atrophy of the SS and/or IS muscles can appear (Fig. 1).

Injuries in the region of the shoulder with or without a fracture of the scapula can cause a lesion in the SN. A variety of sport activities such as volleyball, tennis, handball, and weightlifting, which require repeated wide
excursions of the scapula, can cause mechanical irritation of the nerve. Without any atrophy of the SS or IS muscles, patients may be unable to lift their arm above the horizontal level and may have a slight impairment of activities such as face shaving and hair combing. In many cases, shoulder pain persists for years without weakness of the muscles. Entrapment of the SN at the IS area usually does not cause pain because there are no sensory fibers in the distal part of the nerve.

A cross-adduction test may provide positive results when administered at the onset of symptoms. The majority of SNEs can be detected after onset of atrophy in the SS and IS muscles. In doubtful cases a suprascapular block, using a local anesthetic injected into the suprascapular notch, is recommended. It may cause pain relief, but negative blocks do not rule out an entrapment.

By determining the latency of the SNE and by electromyographic study of the SS and IS muscles, early identification of this syndrome and differential diagnosis are readily feasible. The normal conduction time from Erb’s point to the SS muscle is approximately 2.7 msec and that to the IS is 3.3 msec.

Treatment of SNE

Patients with pain only should be treated conservatively, which means avoidance of muscular activity. Many authors have reported complete recovery of muscle function after conservative treatment. We recommend surgical therapy in cases in which there is atrophy of the SS and IS muscles. We have only operated on one patient who exhibited no muscular atrophy; that patient suffered from intractable pain.

We use a posterior approach with the patient lying prone. A skin incision measuring 6 to 8 cm is made slightly above the spine of the scapula (Fig. 2). The trapezius muscle is divided along its fibers and the SS muscle is retracted backward. The SN, the superior transverse scapular ligament, and the suprascapular vessels are identified. Using the surgical microscope, we divide the ligament (Fig. 3). Patients can leave the hospital 1 day after the operation.

Clinical Material and Methods

Over a period of 10 years (1985–1995), we operated on 28 SNEs in 27 patients (21 men and six women). The mean age of these patients at operation was 32.8 years (range 18–59 years). Twenty-one patients underwent operation on their dominant side and five on their nondominant side. One patient underwent operation bilaterally.

Five patients presented with a history of trauma to the shoulder region; one of them had suffered a fractured scapula. In three patients, a ganglion cyst within the notch gave rise to the nerve compression. In 16 patients, the nerve problem was related to prior athletic activities: in eight patients, the activity was volleyball; in two it was tennis; and in one patient each, it was handball, baseball, weightlifting, bodybuilding, drumming, and ballet. The last patient listed was a ballet teacher who initially had the neuropathy on one side, but 5 years later it developed on the other side as well. In all of these cases, the lesion affected the dominant side. In one patient, the nerve compression appeared after daily repetitive movements consisting of cross adduction of the arm as the patient delivered newspapers. In the remaining two patients, there was no relation to trauma or sport activities.

Duration of symptoms before surgery varied. The median duration was 41 months in the trauma cases, 9 months in patients with ganglion cysts, and 13.7 months in the remaining patients.

Twenty-one patients with 22 entrapment syndromes complained of pain located over the suprascapular notch. Two patients experienced additional pain in the arm and...
hand. Seventeen patients had paresis and atrophy of both the SS and IS muscles and 10 had paresis and atrophy only of the IS muscle. Only one patient exhibited a sensory deficit located over the posterior area of the shoulder. Electromyography was performed in all cases, not only to corroborate the diagnosis but also to rule out other afflictions of the shoulder. In all instances we found signs of denervation. Conduction velocity from Erb's point to the muscles was measured in 12 cases. We found an increased conduction time (longer than 2.7 msec to the SS and 3.3 msec to the IS muscles) in nine patients and complete conduction block in three patients. All patients were subjected to an initial trial of conservative therapy for at least several weeks. A diagnostic block of the SN delivered to the IS muscles was measured in 12 cases. We found an increased conduction time (longer than 2.7 msec to the SS and 3.3 msec to the IS muscles) in nine patients and complete conduction block in three patients. All patients were subjected to an initial trial of conservative therapy for at least several weeks. A diagnostic block of the SN delivered to the suprascapular notch was only performed in exceptional cases.

**Results**

The mean follow-up review period in 25 cases (24 patients) was 20.8 months (range 3–70 months). Two patients had undergone operation recently and, therefore, could not be included in the postoperative results. One patient was lost to follow-up review. We were unable to reexamine all of the patients ourselves and had to rely on the reports from the patients’ neurologists.

Nineteen of 22 cases (21 patients) with complaints of preoperative pain could be evaluated. Sixteen of these patients were free of pain after surgery, two exhibited more than a 50% pain reduction, and one exhibited less than a 50% pain reduction.

With respect to paresis and atrophy of the muscles, we determined the strengths of the SS and IS muscles by evaluating 24 cases (23 patients).

Extension of the arm and external rotation of the forearm as functions of the SS and IS muscles were examined using the grading system of the Medical Research Council. In cases involving the SS muscle, motor function improved at 2° in three cases, at 1° in seven cases, and at 0.5° in three cases. In cases involving the IS muscle, motor function improved at 2° in four cases, at 1° in eight cases, and at 0.5° in five cases. No changes in motor function were observed in the SS muscle in two cases and in the IS muscle in seven cases.

Muscle atrophy improved more slowly. At the follow-up evaluation of atrophic muscles, we found intact muscle relief without signs of atrophy in three cases involving the SS muscle and in one case involving the IS muscle. Slight atrophy was found in four cases (one involving the SS muscle and three involving the IS muscle). We observed moderate atrophy of the SS and IS in eight cases. Atrophy remained unchanged after surgery in three SS and 12 IS muscles. The sensory deficit demonstrated in one patient disappeared after nerve decompression.

Electromyography was performed postoperatively in 17 cases and electroneurograms were obtained in eight cases. In two muscles, we still found spontaneous activity, but all muscles showed signs of reinnervation. Only three of eight cases in which conduction time was evaluated after surgery could be compared with the preoperative findings. In all of them, it was markedly improved.

There was no incidence of wound infection or other postoperative complications.

**Discussion**

Compression of the SN is a relatively rare phenomenon. Since the first report from Kopell and Thompson in 1959, many authors have published reports of their clinical experience with palsies of the SN.1–4,9,10,12–14,16–18,22–26,28–42,45–47,50–60,63–66,68,70,72–75,77–85,87–92,94–99 Our series of 28 SNEs in 27 patients is the second largest series reported to date, the largest consisting of 66 operated cases reported by Vastamäki and Göransson.22

Post and Mayer examined 2520 patients with painful shoulder symptoms and attributed 10% (0.4%) to SNE. The cause of the nerve compression, as gleaned from the literature, was direct trauma such as falling on the shoulder with or without fracture of the scapula. Compression of the nerve at the suprascapular notch leads to the cardinal symptom of a deep ache in the shoulder. Patients often suffer for months or years before seeking medical attention. The pain may be exacerbated by movement of the shoulder girdle, particularly with cross-body adduction of the extended arm.48,52 Weakness of abduction and external rotation of the arm and atrophy of the SS and IS muscles are common secondary symptoms.

Radiography of the shoulder and neck and computerized tomography (CT) scanning of the cervical spine should be performed to rule out a herniated disc at the level of C4–5. Anteroposterior and lateral plain x-ray films may reveal a scapular fracture or another nonentrapment entity may be identified as the cause of the shoulder discomfort.39 A roentgenographic evaluation, specifically directed toward the notch, is obtained by an anteroposterior view of the shoulder with the x-ray beam directed 15° to 30° caudally.74

Murray considered the diagnosis of SNE to be a diagnosis by exclusion. Rotator cuff tear can cause similar symptoms and findings such as shoulder pain, weakness, and muscle atrophy.19,21,92 A rotator cuff tear can be associated with lesions of various nerves in connection with the initial injury.24 Donovan and Kraft recommended per-
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forming arthrography of the shoulder to distinguish rotator cuff injuries from SN palsy. Fritz and associates27 reported 27 masses adjacent to the SN that were identified by magnetic resonance (MR) imaging of the shoulder. These masses included 21 ganglion cysts, two synovial sarcomas, one Ewing sarcoma, one chondrosarcoma, one metastatic renal cell carcinoma, and one hematoma associated with a fracture. Barth and Warzok described a case in which the patient was operated on for a malignant neurinoma of the SN.

Compression of the SN by a ganglion cyst, particularly at the SS fossa or spinoglenoid notch, has been described in 25 surgical cases.5,26,32,34,36–38,55,56,63,65,66,68,85,88–91,94 Although Ganzhorn, et al.,28 presumed that such ganglia communicate with the glenohumeral joint, Thompson and colleagues90 found no such communication. Ogino and coworkers65 and Goss, et al.,12 noted that the ganglia in their cases seemed to originate within the fibers of the posterior glenohumeral joint capsule and had no demonstrable communication with the joint space. This correlates with our experience. The ganglia in our three cases extended from the spinoglenoid to the suprascapular notch. All three patients had pain and atrophy of both muscles. One patient was operated on 1 month ago. In the other two patients, the pain disappeared and weakness of the SS and IS muscles improved 53 and 59 months after surgery, respectively.

There are many opinions concerning indications for and timing of surgery for SNE. Conservative treatment in which the patient is advised to avoid arm movements such as cross-body adduction, physical therapy, and use of anti-inflammatory agents for 3 to 6 months are often recommended.12,21 An SN block induced by an injection of lidocaine (with or without cortisone) may relieve the shoulder discomfort and serve as a useful diagnostic maneuver.14,19,28,30,36,42,62,95 Vastamäki and Göransson92 reported that in 54 of their 66 patients prompt disappearance or marked diminution of pain occurred in 72%. After a mean follow-up period of 5.6 years, 81% of their patients seemed to have benefited from surgery. Postoperative atrophy was found in four of 16 patients with preoperative atrophy of the SS muscle and in 23 of 26 patients with atrophy of the IS muscle. Ninety-one percent of 27 cases reported by Callahan and associates12 were free of pain immediately after surgery but only 81% remained that way after a mean follow-up period of 47 months. Eighty-seven percent of these patients had originally experienced complete pain relief and resolution of their weakness.

In our series in which 18 patients with preoperative pain could be evaluated, 83% were free of pain at the mean follow-up time of 20.8 months. In the remaining three cases, pain had markedly improved. Those three patients had a history of shoulder trauma. Additional rotator cuff involvement might have been present in these patients. Motor function improved in 13 (87.6%) of 15 cases involving the SS muscle and in 17 (70.8%) of 24 cases involving the IS muscle. Atrophy of the SS muscle resolved in 12 (80%) of 15 cases and atrophy of the IS muscle in 12 (50%) of 24 patients. In the remaining cases, atrophy remained unchanged.

References


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