Abstract: Snapping scapula syndrome at the superomedial corner of the scapula can lead to significant shoulder dysfunction. Bursectomy with or without partial scapulectomy is currently the most beneficial primary method of treatment in patients in whom nonoperative therapy fails. Arthroscopic access to the scapulothoracic space is simple and reproducible with the technique described in this report. The bursal tissue can be cleared, optimizing visualization of the scapulothoracic space and the anatomic structures. Arthroscopic decompression of the scapulothoracic bursa and resection of the superomedial corner of the scapula are highlighted in a video example.

Snapping scapula syndrome (SSS) is an uncommon shoulder condition often identified in patients who perform repetitive overhead activities.\(^1\) It develops because of repetitive friction between the scapula and the thoracic cage, often because of hooking or excessive angulation of the superomedial scapula.\(^2,3\) SSS is typically characterized by increased pain with overhead activities, with palpable or audible crepitus. Most patients respond to nonoperative treatment, including activity modification, nonsteroidal anti-inflammatory drugs, physical therapy, and injections of steroids and/or local anesthetics.\(^4\)

For patients who do not respond to conservative measures, surgery is an effective option.\(^5\) The arthroscopic anatomy of the space between the scapula and thoracic wall has been described, and the results of arthroscopic treatment of SSS have been published.\(^6-9\) The purpose of this report is to describe, in detail, access to the scapulothoracic space and basic principles for arthroscopic decompression of the superomedial scapula.

Surgical Technique

A demonstration of the procedure for decompression of a patient’s right scapulothoracic space is provided in Video 1. The indications, advantages, and pearls of the procedure are presented in Table 1. The contraindications, limitations, and pitfalls are summarized in Table 2.

Table 1. Indications, Advantages, and Pearls for Arthroscopic Scapulothoracic Decompression

<table>
<thead>
<tr>
<th>Indications</th>
<th>Advantages</th>
<th>Pearls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain at superomedial angle of scapula with demonstrable scapular snapping</td>
<td>Easy access to superomedial corner of scapula</td>
<td>Three-dimensional CT reconstruction may aid in viewing the scapulothoracic articulation and show the amount of bone that needs to be resected.</td>
</tr>
<tr>
<td>Patients who respond to mixture of anesthetic and steroid injections into scapulothoracic bursa</td>
<td>Safe procedure for patient</td>
<td>Ensure adequate internal rotation of the affected arm to ensure safe insertion of arthroscopic instruments.</td>
</tr>
<tr>
<td>Painful, audible, and palpable crepitus not responding to conservative treatment</td>
<td>Easier visualization and resection of bursa and superomedial corner of scapula</td>
<td>Use blunt trocars to minimize iatrogenic injury.</td>
</tr>
<tr>
<td></td>
<td>Resection of superomedial corner using a single working portal</td>
<td>Start with the camera in the medial portal.</td>
</tr>
<tr>
<td></td>
<td>Direct visualization of pathologic condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Early rehabilitation and return to full function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improved cosmesis compared with open procedures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimal dissection of muscle resulting in less pain, less scar formation, and faster recovery rates</td>
<td></td>
</tr>
</tbody>
</table>

CT, computed tomography.
Patient Positioning and Preparation

The patient is positioned on a standard operating room table, and a beanbag positioner is placed under the patient. After the induction of general anesthesia and placement of an endotracheal tube, the patient is placed in the prone position and secured with the beanbag. To lift the scapula up from the chest wall and facilitate safe arthroscopic access, the affected extremity is positioned in full internal rotation by placing the hand on the back in the “chicken-wing” position (Fig 1). The arm is secured with tape to maintain this position throughout the procedure. The video monitor is positioned near the head of the operating table, and the controls for the arthroscopic instruments are positioned on the floor such that the operating surgeon stands on the side opposite the affected shoulder. The patient’s skin is cleaned with chlorhexidine solution, sterile drapes are applied, and the operative site is covered with Ioban (3M, St. Paul, MN). The scapula is palpated to identify important bony landmarks. A marking pen can be used to outline the inferior angle, medial border, scapular spine, and superomedial corner of the scapula.

Portal Placement

The scapulothoracic space is initially accessed through 2 superiorly based portals—1 proximal and 1 medial to the superomedial angle of the scapula (Fig 2). By convention, the medial portal is placed first at a minimum of 3 cm from the medial border of the scapula at or just below the level of the scapular spine to minimize the risk of injury to the neurovascular structures (Fig 3). Relative to rotator cuff surgery in the shoulder, this is similar to the posterior subacromial position. A proximal-to-distal sweeping motion with a blunt trocar may help clear some of the bursal tissue. A 3.5-mm-diameter 30° arthroscope (Stryker, Kalamazoo, MI) is placed. The superior Bell portal is placed at the junction of the medial and middle thirds of the superior scapular border with an outside-in technique by use of an 18-gauge spinal needle (Fig 3). This is comparable to the lateral subacromial position in the shoulder. After creation of both portals, diagnostic arthroscopy is performed to fully evaluate the superomedial scapulothoracic articulation (Fig 4A).

Arthroscopic Decompression

With the camera positioned in the medial portal, a 4.5-mm arthroscopic shaver blade (Smith & Nephew, Andover, MA) is used through the superior portal to...
clear the bursal tissue, optimizing visualization of the scapulothoracic space and the anatomic structures (Fig 5A). A VAPR S90 radiofrequency device (DePuy Mitek, Raynham, MA) is used to remove the soft tissue from the deep surface of the superomedial border of the scapula (Fig 5B). Once adequate visualization is achieved, a 4.0-mm arthroscopic burr (Smith & Nephew) is used to perform the partial scapulectomy (Fig 6A and B), removing the hooked portion until the corner appears flat compared with the rest of the bone (Fig 4B). A switching stick may be used to rotate the working and viewing portals, which can aid in complete visualization to achieve the necessary resection (Fig 6C).

Postoperative Rehabilitation

The skin portals are closed with No. 3-0 Ethilon (Ethicon, Somerville, NJ), a sterile dressing is applied, and the patient is placed in a simple sling. Postoperatively, the patient is educated on range-of-motion exercises and discharged from the hospital the same day. The patient is encouraged to use the affected extremity as tolerated. By 4 weeks, the patient has typically recovered from the procedure.

Discussion

Access to the superomedial corner of the scapulothoracic space is simple and reproducible. It is most easily accomplished working through 2 superiorly based portals. Full internal rotation of the affected extremity through the chicken-wing position is important to lift the scapula up from the chest wall and creates a safe, generous potential space in which to work. The important bony landmarks, identified with palpation, are the superomedial angle and scapular spine.

Familiarity with surrounding anatomy is critical to minimize the risk of iatrogenic neurovascular injury. The levator scapulae muscle attaches to the superior part of the medial border of the scapula and divides the transverse cervical artery into superficial and deep dorsal scapular artery branches. The spinal accessory nerve crosses laterally in the middle of the levator scapulae to accompany the superficial branch of the transverse cervical artery deep to the trapezius. The dorsal scapular artery accompanies the
dorsal scapular nerve approximately 1 to 2 cm medial to the medial border of the scapula and deep to the rhomboid muscles.11–13 Medial portal entry into the scapulothoracic space should be more than 3 cm from the medial border of the scapula and inferior to the level of the scapular spine to avoid these structures.6,7,10,14–16 The suprascapular nerve arises from the upper trunk of the brachial plexus and travels with the suprascapular artery to enter the suprascapular notch just medial to the base of the coracoid.10,14 These structures are at risk with portal placement superior to the scapular spine with the instrumentation oriented toward the coracoid process. They can also be injured if the bony resection is taken too far laterally.6,14 Furthermore, when the surgeon is creating the viewing and working portals, blunt trocars must be used and inserted parallel to the ventral surface of the scapula to avoid a perpendicular orientation and over-penetration into the pulmonary thoracic cavity or axillary neurovascular structures.10,14,15,17

When both the working and viewing portals are placed inferior to the spine and medial to the medial border of the scapula, their proximity and the depth of penetration required through the rhomboid muscles makes the superomedial corner difficult to access.10 The superior Bell portal described by Chan et al.10 is located at the junction of the medial and middle thirds from a line connecting the superior angle of the scapula medially and the outer aspect of the acromion laterally. It averages 35 mm from the spinal accessory and dorsal scapular nerves and 21 mm from the suprascapular nerve.10 Pavlik et al.7 evaluated the results of arthroscopic resection of the superomedial corner of the scapula in 10 patients using the superior Bell portal, and there were no reported cases of technical problems or neurovascular injury. They concluded that this superior portal is safe and allows for easier access and quicker resection of the superomedial corner. The superior portal also eliminates the need for an inferomedial portal and inadvertent penetration of the serratus anterior muscle fibers into the axillary neurovascular contents.

Several authors have reported satisfactory outcomes after arthroscopic treatment for SSS. Pearse et al.16 reported the outcomes of 13 patients who underwent arthroscopic bursectomy, 3 of whom also underwent

**Fig 4.** Arthroscopic images of the superomedial corner of the scapula (A) before and (B) after resection with a 4.0-mm arthroscopic burr. The view is from the camera positioned in the medial portal (right shoulder) with the patient in the prone position.

**Fig 5.** Arthroscopic decompression of the scapulothoracic space viewed from the medial portal (right shoulder) with the patient in the prone position. (A) A 4.5-mm shaver is used to clear the bursal tissue, optimizing visualization of the scapulothoracic space and the anatomic structures. (B) A radiofrequency device is used to remove the soft tissue from the deep surface of the superomedial corner of the scapula.
arthroscopic resection of the superomedial corner. Of the 13 patients, 9 (69.2%) showed improvement in pain and function. Pavlik et al.\(^7\) reported the outcomes of 10 patients in whom the superior portal was used for resection of the superomedial corner of the scapula. The patients were followed up for an average of 11.5 months (range, 3 to 23 months). Scapulothoracic crepitus resolved in 2 patients and decreased in 8. There was a reduction in pain in all cases, and all patients reported that the procedure was worthwhile. Millett et al.\(^6\) reported a retrospective study of 23 shoulders, of which 21 underwent both arthroscopic bursectomy and scapuloplasty whereas the remaining 2 underwent bursectomy alone. At a mean follow-up of 2.5 years, the median American Shoulder and Elbow Surgeons score showed measurable improvement from 53 points preoperatively to 73 points postoperatively. Blond and Rechter\(^9\) reported a prospective study of 20 patients who underwent arthroscopic bursectomy and bony resection of the superomedial corner of the scapula. After a mean follow-up of 2.9 years (range, 2 to 5 years), 18 of 20 patients (90.0%) reported noticeable improvement in pain and function. Moreover, 19 of 20 patients reported that they would undergo this surgical procedure again. Lastly, Cole et al.\(^{18}\) reported good to excellent results in 22 of 23 patients (95.7%). Overall patient satisfaction was high in 95.7% of patients, and there was a statistically significant improvement in function and decrease in pain.

Arthroscopy of the scapulothoracic space can be helpful to assess and address causes of SSS that fail to resolve with conservative treatment. The obvious advantage of arthroscopic decompression is the less invasive nature of the procedure compared with traditional open techniques that involve more muscle stripping and dissection of muscular attachments.\(^6\)

Earlier postoperative rehabilitation and return to full function, faster recovery rates, better cosmetic appearance, and shorter hospital stays have also been reported.\(^6\) The morbidity of scapulothoracic access is minimal. Potential concerns might include fluid extravasation or iatrogenic injury to the neurovascular structures of the region, but these risks should be minimal with careful technique.

**Acknowledgment**

The senior author thanks Michael Austin, D.O., for his commitment to teaching. All the technical issues reported in this article have come from what the author learned from Dr. Austin at the McLaren Orthopedic Hospital, Lansing, Michigan. The authors thank Ryan
Saper, M.F.A., for his assistance in developing the electronic artwork for this project.

References