Review Article

Snapping Scapula Syndrome: Diagnosis and Management

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Abstract

Scapulothoracic bursitis and snapping scapula syndrome are rare diagnoses that contribute to considerable morbidity in some patients. These conditions represent a spectrum of disorders characterized by pain with or without mechanical crepitus. They are commonly identified in young, active patients who perform repetitive overhead activities. Causes include anatomic scapular or thoracic variations, muscle abnormalities, and bony or soft-tissue masses. Three-dimensional CT and MRI aid in detecting these abnormalities. Nonsurgical therapy is the initial treatment of choice but is less successful than surgical management in patients with anatomic abnormalities. In many cases, scapular stabilization, postural exercises, or injections eliminate symptoms. When nonsurgical treatment fails, open and endoscopic techniques have been used with satisfactory results. Familiarity with the neuroanatomic structures surrounding the scapula is critical to avoid iatrogenic complications. Although reported outcomes of both open and endoscopic scapulothoracic decompression are encouraging, satisfactory outcomes have not been universally achieved.

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Scapulothoracic articulation is unique in that the concave scapula must glide smoothly on the convex thoracic cage to provide a functional foundation for glenohumeral motion. Although several bursal and soft-tissue planes facilitate this motion, it remains an innately irregular articulation. Despite this irregularity, bursitis and snapping scapula syndrome remain relatively rare diagnoses. Symptoms vary from intermittent, mildly symptomatic bursitis to debilitating, recalcitrant crepitus. Early recognition and management are essential to minimize unnecessary disability.

Since its initial description in 1867 by Boinet,[1] understanding of the pathomechanics of snapping scapula syndrome has improved, and surgical management has evolved. Patient-reported outcome measures and return to sport have been integrated into outcome studies; assessment of results based on these stringent criteria suggest that although significant improvement of symptoms can be achieved with surgery, complete resolution is not universal. Therefore, despite recent advances, diagnosis and management of snapping scapula syndrome remains challenging.

Anatomy and Physiology

Bony Structure

Scapulothoracic articulation is unique in that it does not exhibit a true synovial articulation. Scapular

Figure 1

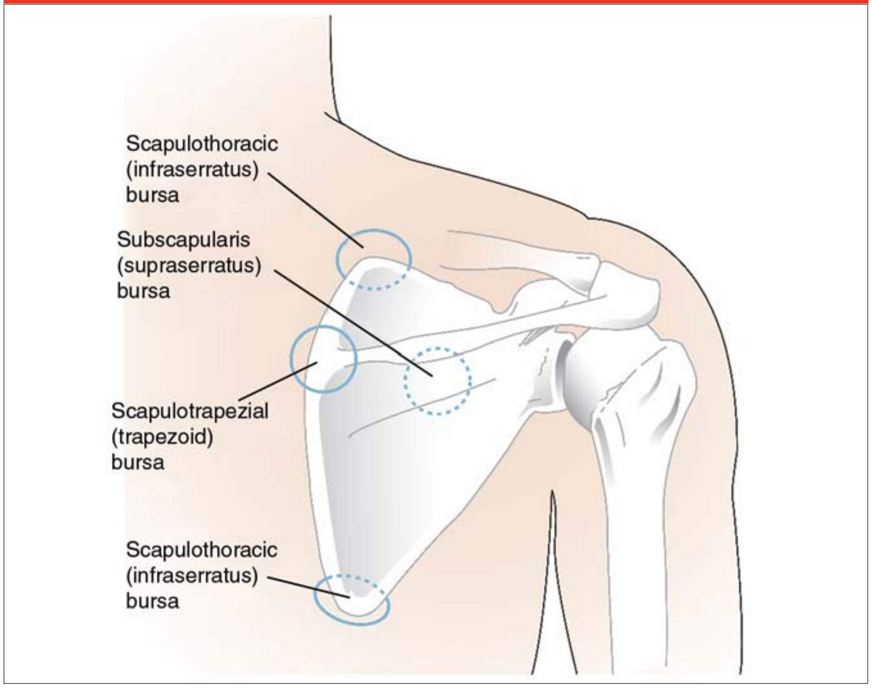


Illustration of right posterior shoulder demonstrating anatomic and adventitial bursae of the scapulothoracic joint.

motion and stability are controlled dynamically through muscular contraction. The scapula itself lies between the second and seventh ribs and is characterized by three borders (medial, lateral, and superior) and three angles (inferomedial, superomedial, and lateral). The costal surface of the scapula undulates, and thickness ranges from 10.5 to 26.7 mm.[2] The superior and inferior scapular angles exhibit considerable variability; the angle of junction with the scapular body ranges from 124° to 162°.[2] The ventral surface of the scapula is concave and articulates on the convex chest wall. The suprascapular notch lies along the medial aspect of the lateral third of the superior border of the scapula. The transverse scapular ligament separates the suprascapular nerve within the notch from the suprascapular artery coursing above it.

Muscular Anatomy

Normal scapulothoracic motion is the result of several muscles working in concert to orient the scapula because no direct bony articulation exists. Dysfunction of any of these muscles may result in abnormal scapulothoracic motion. The trapezius has a midline origin and inserts along the superior lip of the scapular spine, superficial to the rhomboid musculature. It is innervated by the spinal accessory nerve, which runs deep to the muscle with the transverse cervical artery. The concave scapula glides along the convex chest wall, using the serratus anterior and subscapularis muscles as a soft-tissue articulation. The subscapularis originates from the anterior surface of the scapula and is innervated along its anterior border by the upper and lower subscapular nerves. In contrast, the serratus anterior muscle originates from the ribs and inserts along the medial scapular border. The long thoracic nerve innervates the muscle anteriorly, and the nerve is generally at low risk of injury during an open or arthroscopic surgical approach.

The levator scapulae and rhomboid musculature originate from the midline and insert along the medial border of the scapula. The dorsal scapular nerve and artery run deep to these muscles approximately 1 to 2 cm medial to the scapula. These neurovascular structures are at risk of injury during an open approach or with aberrant arthroscopic portal placement.

Scapulothoracic Bursae

Both anatomic and adventitial bursae within the scapulothoracic articulation have been described[3] (Figure 1). Anatomic bursae are thought to be physiologic; they facilitate gliding of surfaces within the scapulothoracic joint (Figure 2). In anatomic studies, two bursae have been consistently found: the infraserratus bursa and the supraserratus bursa, which are separated by the serratus anterior muscle.[3] The infraserratus bursa facilitates gliding of the serratus anterior muscle on the chest wall, while the supraserratus bursae divides the serratus anterior and subscapularis muscles.[4]

Adventitial bursae are typically considered pathologic and are commonly present near the superior or inferior scapular angles. Identification of these bursae is inconsistent in anatomic studies, and their presence is thought to represent a pathologic state.[5,6] Symptoms occurring along the inferior scapular angle are typically secondary to bursal tissue lying between the serratus anterior and the chest wall.[7,8] Debate exists, however, regarding the anatomic location of

Figure 2

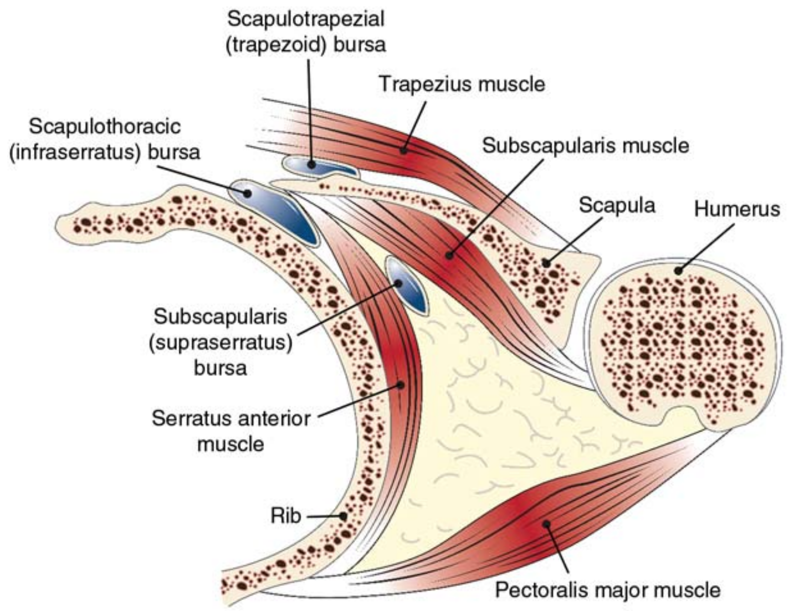


Illustration of an axial cross-section of the scapulothoracic articulation. Note the location of bursae in relation to muscular planes.

Figure 3

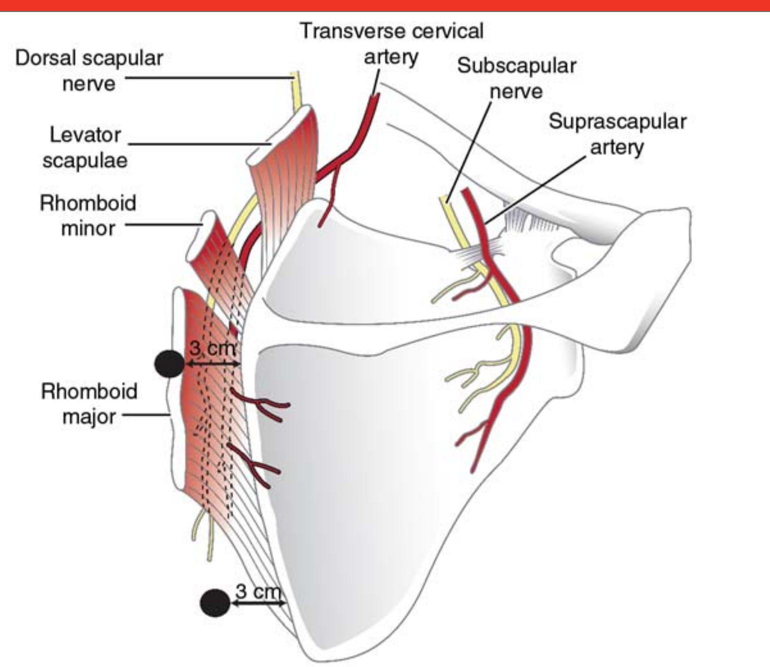


Illustration of the right posterior shoulder demonstrating the gross location of neurovascular structures important in scapulothoracic articulation. Black dots indicate typical portal locations, with the distance from medial scapular border noted.

bursal tissue when the superior angle of the scapula is symptomatic. Studies have reported bursal tissue located between the serratus anterior muscle and chest wall (ie, infraserratus bursa)[9] or between the subscapularis and serratus anterior muscles (ie, supraserratus bursa).[10] Occasionally, patients experience pain along the medial base of the scapular spine caused by a trapezoid bursa located deep to the trapezius muscle near the medial attachment of the scapular spine.

Neurovascular Anatomy

Several neurovascular structures course within the scapulothoracic articulation to innervate the surrounding musculature (Figure 3). A thorough understanding of the neuroanatomy of this region is critical to minimize the risk of iatrogenic complications. Ultimately, the risk to individual neurovascular structures is dependent upon the surgical approach used for bursal decompression. The spinal accessory nerve is located along the middle section of the levator scapulae muscle deep to the trapezius muscle.[11] The main branches of the spinal accessory nerve are at risk of injury with portal placement cranial to the scapular spine or with inadvertent dissection during open approaches. Typically, the dorsal scapular nerve is identified deep to the rhomboid major and minor muscles, 1 to 2 cm medial to the medial border of the scapula.[11] The transverse scapular artery gives rise to deep and superficial branches, with the deep branch forming the dorsal scapular artery and accompanying the dorsal scapular nerve. The superficial branch runs along the spinal accessory nerve. These structures are at risk of injury with medial placement of arthroscopic portals or medial dissection during an open surgical approach.

The long thoracic nerve innervates the serratus anterior muscle and runs along the anterior belly of the muscle. Unless dissection is performed considerably more lateral than is typical, this nerve is infrequently at risk of injury during arthroscopic or open surgical techniques. After branching from the brachial plexus, the suprascapular nerve and artery pass toward the suprascapular notch before innervating the rotator cuff musculature. The suprascapular nerve and artery are at risk of injury if a superomedial scapular resection is performed or a superior arthroscopic portal is used. Placement of the portal at the junction of the medial two thirds and lateral third of the superior scapular border generally provides ≥10 mm of distance from the suprascapular nerve.[12] The use of bony landmarks for superomedial border resection generally aids the surgeon in maintaining a 2-to 3-cm margin from the suprascapular notch.[12,13]

Pathophysiology

Under physiologic conditions, the concave anterior scapula glides smoothly over the convex thoracic cage during shoulder motion. This motion is critical to provide a stable foundation for glenohumeral function. The scapulothoracic articulation is unique in that it glides upon muscular layers rather than cartilaginous surfaces, and it has been described as perhaps the most incongruent articulation in the human body. To this end, the presence of bursal tissue is physiologic and necessary to facilitate normal scapulothoracic motion. However, as in other musculoskeletal disorders, abnormal stress persistently applied to normal structures can result in dysfunction. Thus, scapulothoracic syndromes can be thought of as dynamic disorders that are the result of predisposing abnormal anatomy combined with sufficient scapulothoracic motion. Symptoms may be experienced with minimal activity if considerable bony abnormality is present. Alternatively, repetitive overuse may incite symptoms even in the presence of normal anatomy and may result in a spectrum of severity ranging from mild soreness to debilitating crepitus.

Scapulothoracic bursitis is thought to be the result of inflammation caused by overuse of the shoulder girdle. If sufficient irritation is present to create a chronic inflammatory environment, fibrosis of the affected bursa may occur. Fibrosis may ultimately lead to recalcitrant bursitis or snapping even in the absence of overt scapular masses or muscular abnormalities.[6,10]

Overt scapular snapping is frequently the result of bony or soft-tissue masses within the scapulothoracic articulation and may coexist with scapulothoracic bursitis. A spectrum of mechanical causes results in crepitus, including fibrotic or anomalous musculature[7,14,15] and malunion of scapular or rib fractures.[16] Variability in the anatomy of the costal or scapular surfaces is common and may also influence scapulothoracic snapping.[2] This is exemplified by scapulothoracic crepitus associated with scoliosis and kyphosis[17] and the resolution of symptoms with postural training in some patients.[10] In addition, resection of the first rib for management of thoracic outlet syndrome may elicit snapping of the scapula.[15] In a study of 13 patients with thoracic outlet syndrome who underwent first-rib resection and later developed snapping scapula syndrome, scapula symptoms resolved in 9 patients (70%) after resection of the superomedial scapular border. Therefore, scapular crepitation may occur secondary to either scapular or thoracic cage anatomic variation.

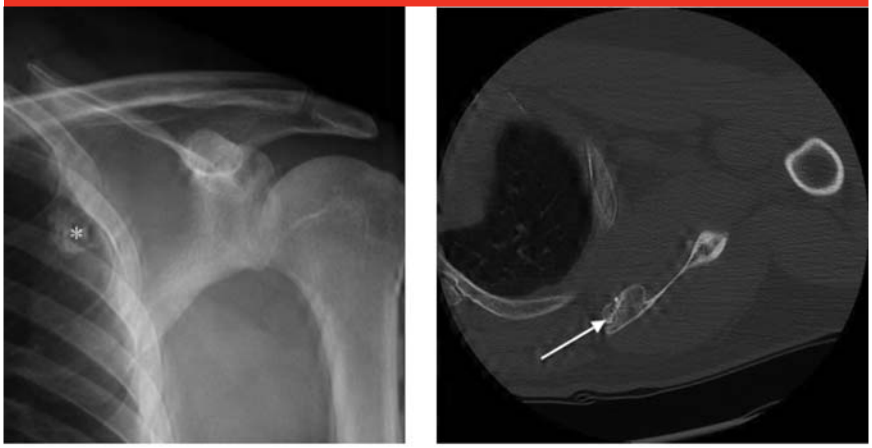
Scapulothoracic Masses

Several scapulothoracic masses can also result in crepitation. Osteochondroma of the rib or scapula is the most frequently reported mass responsible for scapulothoracic symptoms, and resection is frequently curative[18,19] (Figure 4). Infrequently, scapular chondrosarcoma may be encountered in older patients, thereby emphasizing the need for diligent diagnostic evaluation. The presence of an elastofibroma dorsi in the infrascapular region is also occasionally reported. In this location, the mass is capable of elevating the inferior scapular border, thereby creating mechanical symptoms.[20]

Scapular Angulation

The angle of the superomedial scapula may also predispose some patients to scapulothoracic dysfunction. The superomedial scapula and scapular body normally form an angle that measures between 124° and 162°, and anatomic abnormalities in this area may result in incongruity, focal loading, inflammation and, if the angle is of sufficient magnitude, crepitus.[2] Cadaver studies suggest that approximately 6% of scapulae may demonstrate some degree of superomedial hooking, and 8.6% of scapular specimens exhibit superomedial angulation ≥35°.[21] Similar bony abnormality is occasionally identified along the inferior scapular angle, which appears to be the second most common site of symptoms.[21] Osteochondroma or a Luschka tubercle (ie, a bony protuberance of the superomedial scapular border) can also result in persistent symptoms.[7] It is important to note, however, that scapular crepitus may be present in asymptomatic patients. Therefore, mechanical symptoms alone should not be considered

Figure 4



A B

Plain AP radiograph (**A**) and axial CT scan (**B**) of the left shoulder demonstrating a scapulothoracic osteochondroma that can be seen along the medial border of the scapula (asterisk) and within the scapulothoracic articulation (arrow).

pathologic unless they are associated with pain or functional loss.

Clinical Presentation

History

Patients who present with scapulothoracic bursitis or snapping often have experienced symptoms for a considerable period of time. Presenting complaints encompass a spectrum of symptoms ranging from mild, intermittent discomfort to notable functional disability. Some patients may report decreased athletic performance, but many experience increased pain with overhead activities. Patients may also report audible or palpable crepitus, which encompasses a spectrum of severity. It is important to note that bursitis and scapular snapping may exist independently or concomitantly. Traumatic etiology[22,23] and overuse syndrome[8,23] are both commonly reported. Cobey[5] suggested a familial propensity for crepitus at the superior border of the scapula.

Physical Examination

A thorough physical examination is critical to identify an anatomic etiology for the patient's symptoms. The examination should begin with an inspection of the cervical and thoracic spine for fixed or postural kyphosis that may contribute to scapulothoracic incongruity.[5] Cervical degeneration may be responsible for referred pain syndromes. Extremity range of motion should be tested, with specific attention paid to scapulothoracic motion. Active and passive scapulothoracic and glenohumeral motion is evaluated for resultant crepitus. Dynamic examination of the scapula may demonstrate scapular winging resulting from motor dysfunction or scapulothoracic masses. Pseudowinging may also be present if the patient is compensating for pain or has learned motion patterns to avoid crepitus.[10]

Tenderness and bursal fullness may be identified in the symptomatic scapular region. Muscular strength should be evaluated because imbalances may contribute to a pathologic state. The trapezius, rhomboid, levator scapulae, serratus anterior, and lattisimus dorsi muscles should be tested specifically. The rhomboids and levator scapulae muscles are best tested by placing the hands along the iliac crest and pressing the scapulae together by moving the elbows in a posterior direction. Dysfunction of the serratus anterior can be identified clinically by noting the presence of medial scapular winging while the patient performs a wall pushup. Occasionally, patients are able to demonstrate activities or specific motions that result in scapulothoracic crepitus. Careful observation and palpation while the patient is re-creating the crepitus often aids in localizing the pathologic scapular segment. Motions that result in scapulothoracic crepitus may be accentuated if the scapula and thoracic cage are compressed during shoulder abduction.[14]

Imaging

Plain radiographs should be obtained to screen for osseous abnormalities that may contribute to scapular bursitis or crepitus. Routine radiography includes AP, lateral, and axillary views in the plane of the scapula. When a lesion is identified or suspected, the threshold for obtaining three-dimensional imaging is low. CT scans provide excellent bony detail, improving identification and characterization of bone masses. Mozes et al[24] compared the use of plain radiography, CT, and three-dimensional CT for evaluation of snapping scapula syndrome in 20 patients (26 scapulae). The authors reported that scapulothoracic incongruity was identified on plain radiographs in 7 of 26 scapulae, whereas incongruity was identified on CT and three-dimensional CT scans in 19 of 26 and 26 of 26 scap-

Figure 5

Three-dimensional CT scan of the posterior right scapula. Note the superomedial scapular border resection (asterisk).

ulae, respectively. On the basis of these findings, three-dimensional CT may best delineate potential bony irregularities responsible for scapulothoracic irritation (Figure 5). MRI is more effective than CT for identification of inflamed bursae and soft-tissue masses. Distended bursae may resemble soft-tissue tumors in some circumstances.[25] Recent advances in imaging techniques and field strength have improved the usefulness of MRI to characterize abnormal anatomy and inflamed scapulothoracic bursae; however, bony resolution remains limited compared with that of CT.[26]

Diagnostic Injections

Selective injections of local anesthetic or a steroid can be useful for identification of symptomatic bursae. A 22-gauge needle is placed along the scapula in the area of maximal tenderness. The injection can be given with the patient positioned prone and the arm internally rotated maximally, with the hand placed along the small of the back. If the patient experiences transient relief, an inflammatory process is likely present.[8] In some circumstances, the injection may be therapeutic.[6] Ultrasound guidance can be helpful for injection localization, and care should be taken to avoid thoracic perforation or intravascular injection. Hodler et al[27] reported that 18 of 20 patients with subscapular pain treated with fluoroscopy-guided scapulothoracic injection experienced symptomatic relief. Others have reported similar results following scapulothoracic injection.[28-30] Symptomatic improvement following the injection can help substantiate the diagnosis and confirm the anatomic location of the symptomatic bursa.

Management

Nonsurgical

In the absence of an aggressive lesion, a trial of nonsurgical management is warranted. Initial phases of rehabilitation focus on minimizing inflammation through activity modification and nonsteroidal anti-inflammatory drugs.[31] Steroid injections also can be useful for decreasing symptoms and facilitating rehabilitation.

Physical therapy should focus on periscapular muscle strengthening and postural training exercises.[8] An upright posture helps to reduce kyphosis and may improve scapulothoracic congruency. Periscapular musculature retraining should include low-intensity, high-repetition exercises that focus on the subscapularis and serratus anterior muscles.[32] Modalities such as ice, heat, and ultrasound also have been used, with varying levels of success.[6,10] Because these modalities are unlikely to contribute to additional scapulothoracic symptoms, they may be applied liberally. Physical therapy is frequently successful in patients with no overt masses; however, 6 months or more of therapy may be necessary.[17] Ciullo[3] reported excellent outcomes in 62 of 72 patients treated with a combination of shoulder girdle strengthening, diathermy, ultrasound, and iontophoresis. Similarly, Groh et al[33] reported good or excellent results in 22 of 30 patients treated with periscapular strengthening. Therefore, symptomatic improvement can be achieved with appropriate nonsurgical measures, but diligence is required, and nonsurgical management appears to be most successful in patients with no scapulothoracic masses.[7]

Surgical

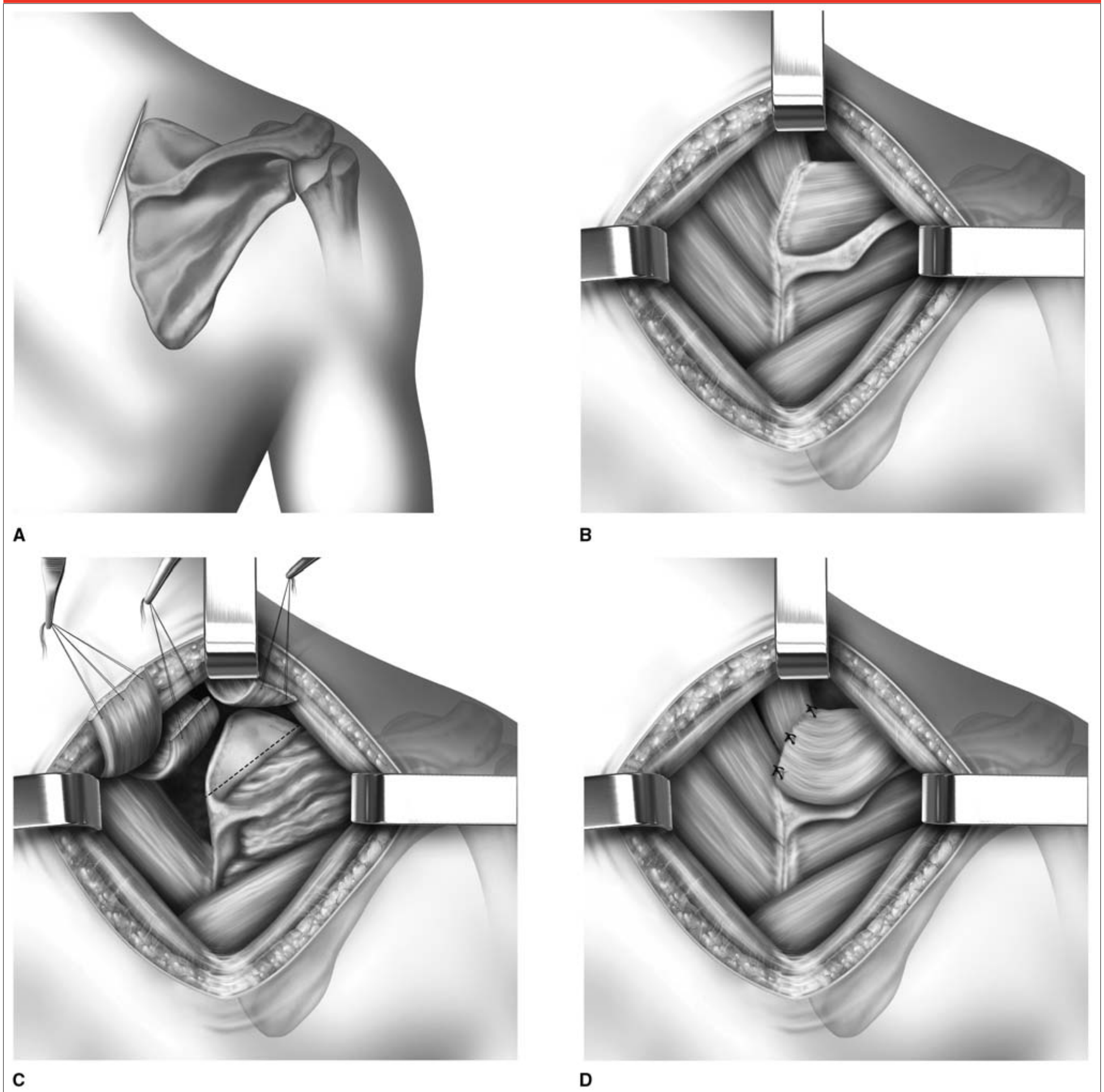
Indications

Surgical intervention is considered in the setting of scapulothoracic bursitis or snapping scapula syndrome when nonsurgical treatment has failed to yield symptomatic improvement. Outcomes of surgical intervention may be more reliable if the patient experiences symptomatic relief following local anesthetic injection of the symptomatic bursae.[10,17,30] Thus, the lack of symptomatic improvement after a diagnostic injection should be considered a relative contraindication to surgical intervention.[29] Patients who exhibit cervical spine disorders, neurologic deficits, or periscapular wasting should be carefully evaluated before surgical intervention.[29]

Open Technique

Surgical intervention for bursitis and snapping scapula syndrome may be accomplished using an open approach with the patient positioned prone.[14,29] The surgical extremity is commonly draped free. A vertical incision is made overlying the medial border of the scapula and centered over the symptomatic bursa (Figure 6). After dissection of subcutaneous tissue, the trapezius muscle is split in line with its fibers over the scapular spine. Preservation of the spinal accessory nerve, which crosses just lat-

Figure 6



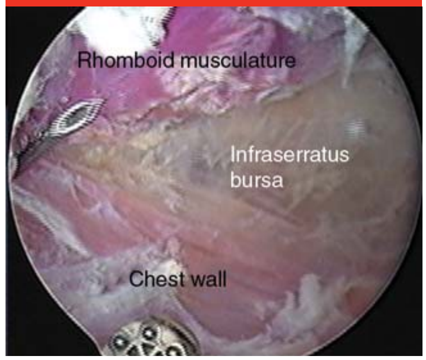
Illustrations demonstrating the technique for open scapular resection and bursectomy. **A,** An incision is made overlying the medial scapular border. **B,** The trapezius is split and retracted, exposing the deep posterior shoulder musculature. **C,** Muscles are detached subperiosteally as necessary to adequately expose the scapula for resection (dashed line). **D,** After scapular resection, sutures are used to reattach the detached muscles to the scapular border.

eral to the superomedial scapular angle and deep to the trapezius, is critical.[34] To provide adequate scapular exposure, the rhomboids and levator scapulae muscles are elevated subperiosteally, with care taken to protect the dorsal scapular nerve located 2 cm medially. After bursal excision, the angle of the scapula can be excised to alleviate mechanical crepitation or recurrent bursitis if indicated. Ultimately, the detached musculature is reattached through scapular drill holes with heavy nonabsorbable suture. A similar tech-

Figure 7

Intraoperative photograph demonstrating patient positioning for an arthroscopic approach. The patient is positioned prone with the arm in the "chicken wing" position. The portals (asterisks) are placed a minimum of 3 cm from the medial scapular border to minimize the risk of injury to neurovascular structures.

Figure 8



Arthroscopic image of the right shoulder viewed from the inferomedial portal after partial resection of the infraserratus bursa. Note the location of rhomboid and chest wall musculature.

nique has been successfully used to remove the infraserratus bursae in a small series of professional baseball players.[8]

Arthroscopic Technique

As arthroscopic skill has improved, endoscopic techniques have been introduced to manage snapping scapula syndrome.[35,36] Similar to other arthroscopic procedures, endoscopic techniques offer the ability to preserve muscular attachments to the scapula, which may decrease the need for immobilization and facilitate accelerated rehabilitation timelines.[37] It is important to note, however, that an optimal approach has not yet been defined in the literature.

Similar to open approaches, the patient is positioned prone and the affected extremity is draped free (Figure 7). The arm is placed in near maximal internal rotation by placing the dorsum of the hand in the small of the back. Functionally, this position increases the potential space between the scapula and chest wall, facilitating safe portal placement.[35,36] The infraserratus bursa is insufflated for distension and to improve surgical hemostasis. Portals are bluntly established 3 cm medial to the medial scapular border and inferior to the scapular spine to avoid the dorsal scapular nerve and vessels.[11] The initial portal is placed at the level of the inferior angle of the scapula. The trochar should be placed as parallel to the chest wall as possible to avoid thoracic penetration.[11]

A 30° arthroscope is inserted through the inferior scapular portal, and a diagnostic arthroscopy is performed. Under direct visualization, a second arthroscopic portal is made just inferior to the medial confluence of the scapular spine. Within the infraserratus bursae, the intercostal muscles should be visualized inferiorly, the rhomboid and levator musculature medially, and the subscapularis laterally (Figure 8). The bursa is then excised, with care taken to avoid excision of muscle fibers. We prefer to skeletonize the superomedial border of the scapula with a radiofrequency ablator regardless of whether a partial scapulectomy is to be performed. This ensures resection of the symptomatic supraserratus or infraserratus bursa in this location. If necessary, a spinal needle can be placed under fluoroscopic guidance along the superior scapular border to aid orientation and to mark the lateral extent of the arthroscopic scapular resection.[35] A shielded round burr is used to perform the partial scapulectomy, removing the convexity of a portion of the scapula if necessary (Figure 9). A dynamic examination is then performed to ensure adequate resection, the portals are closed, and the shoulder is placed in a standard sling.

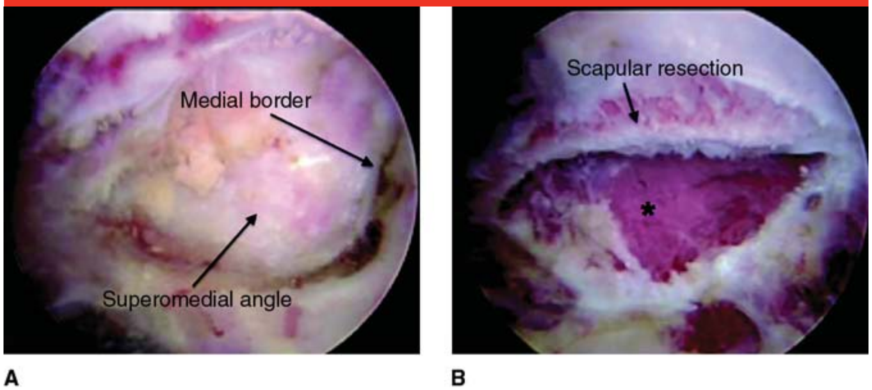
The suprascapular nerve is at risk of injury along the lateral one third of the scapula during bony resection. To avoid injury, surgical instruments should not pass lateral to the spinal needle placed to mark the resection goal. Creation of a superior (Bell) portal located at the junction of the medial one third and lateral two thirds of the superior scapular border can also be helpful to facilitate scapular resection.[13,38]

Management of Scapulothoracic Masses

The presence of a scapulothoracic mass requires an appropriate oncologic work up to confirm a benign etiology. If an osteochondroma or elastofibroma are confirmed, the surgical approach is frequently dictated by the location and size of the mass. Pedunculated osteochondromas are easily removed arthroscopically, whereas elastofibromas or particularly large or sessile osteochondromas may be better managed with an open surgical approach.

Controversy exists regarding whether a partial scapuloplasty should be performed in the absence of an identifiable bony mass. In general, partial scapuloplasty is performed only if the scapular angle is prominent, as visualized arthroscopically or radiographically. In a study of 13 patients with scapular snapping, bone from the superomedial

Figure 9



A, Arthroscopic image of the left scapula viewed from the inferomedial portal demonstrating the superomedial scapular border. **B,** Arthroscopic image demonstrating the completed resection of the superomedial border. Note the absence of the hooked superomedial border of the scapula; the supraspinatus musculature (asterisk) can be visualized, as well.

angle was resected if it was prominent during arthroscopy.[28] At final follow-up, 9 patients reported improvement of symptoms. Others have reported poorer outcomes at a minimum 2-year follow-up in patients who did not undergo partial scapulectomy compared with those who received a partial scapulectomy.[32,39] Therefore, some authors suggest that excision of the symptomatic scapular angle be performed in all settings. Although prospective studies that directly compare outcomes of patients treated with or without partial scapulectomy are lacking, some evidence suggests that scapuloplasty may have a positive influence on patient outcomes regardless of the presence of mechanical symptoms.[39]

Rehabilitation

Although rehabilitation protocols vary, timing of rehabilitation depends on the surgical approach used for bursal and scapular decompression. If an open technique is used, the shoulder is typically immobilized in a sling for up to 4 weeks postoperatively to facilitate muscular healing. The patient can begin pendulum and passive motion exercises shortly after surgery. Active motion is typically initiated at approximately 8 weeks, depending on the type of muscular repairs performed. Strengthening exercises are begun at approximately 12 weeks, followed by a progressive functional regimen that focuses on strengthening of periscapular musculature. In contrast, after arthroscopic decompression, a sling is used for comfort and is discontinued within the first postoperative week. Passive motion and pendulum exercises are begun immediately. Progression to active motion and strengthening occurs based on patient tolerance.

Outcomes

The literature suggests that both open and arthroscopic management of snapping scapula syndrome can provide symptomatic improvement. In a prospective study of 17 patients with snapping scapula syndrome treated with open scapulothoracic bursectomy, Nicholson and Duckworth[30] reported good outcomes in all patients, with improvement in American Shoulder and Elbow Surgeons and visual analog scale pain scores. McCluskey and Bigliani[23] reported similar results in a series of nine patients with refractory scapulothoracic bursitis treated surgically, with six excellent and two good outcomes. One poor outcome secondary to a spinal accessory nerve injury also was reported. Finally, Arntz and Matsen[22] reported that 12 of 14 shoulders treated with partial scapulectomy had complete pain relief at a 42-month follow-up.

Approaches that incorporate arthroscopic bursectomy and mini-open scapulectomy have also been described for management of snapping scapula syndrome. Lien et al[40] performed this technique in 12 patients; at a mean 3-year follow-up, the authors reported that American Shoulder and Elbow Surgeon scores improved from 36.3 preoperatively to 88.3 postoperatively. Visual analog scale pain scores also decreased from 8.3 preoperatively to 2.3 postoperatively. The authors concluded that the combined technique was a reliable alternative treatment option for snapping scapula syndrome.[40] Moreover, Lehtinen et al[29] found no statistical difference between open and arthroscopic techniques with regard to successful outcome; however, this study was likely underpowered.

Arthroscopic techniques represent the most recent evolution in surgical management of snapping scapula syndrome. Arthroscopic techniques may facilitate early functional recovery, decrease hospital stay, and provide a cosmetic advantage compared with alternative techniques.[18] Several authors have reported that outcomes of arthroscopic surgery are similar to those of open and combined approaches.[3,18,28,41] Recently, Millett et al[39] reported on a series of 21 patients with snapping scapula syndrome who underwent arthroscopic scapulothoracic bursectomy. Significant improvement of symptoms was noted at a minimum 2-year follow-up. Moreover, the authors noted that those patients who underwent bursectomy and partial scapulectomy experienced better outcomes than did those who underwent bursectomy alone.[39] Pearse et al[28] reported similar results in a study of 13 patients; 9 patients reported improvement in symptoms following bursectomy with or without partial scapulectomy. Thus, arthroscopic management appears to be a reliable management method for snapping scapula syndrome.

Surgical results are now commonly measured based on patient-specific outcome measures and the ability to return to the prior level of sport, in addition to symptomatic improvement. Recent literature suggests reliable improvement of symptoms can be achieved with open or arthroscopic techniques; however, complete resolution of symptoms may not be achieved universally. Millett et al[39] reported that although patients' symptoms substantially improved following arthroscopic procedures, outcome scores remained lower than expected. Similarly, Pearse et al[28] noted that only six of nine patients returned to their previous level of sport.

Summary

Scapulothoracic bursitis and snapping scapula syndrome represent a spectrum of disease with symptoms that range from mildly irritating to debilitating. Nonsurgical therapy remains the initial treatment of choice but appears to be less successful in patients with anatomic scapulothoracic abnormalities. If nonsurgical measures fail, surgical intervention, including open, arthroscopic, and combined techniques, have been successful in providing adequate relief of symptoms. Regardless of the surgical approach used, familiarity with the neuroanatomic structures that surround the scapula is critical to avoid iatrogenic complications. Although reported outcomes of open and endoscopic scapulothoracic decompression are encouraging, satisfactory outcomes are not universally achieved.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 1, 3, 5-8, 14-16, 18-20, 22-30, 32, and 39-41 are level IV studies. Reference 35 is level V expert opinion.

References printed in **bold type** are those published within the past 5 years.

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