Scapulothoracic bursectomy for snapping scapula syndrome

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Seventeen patients (9 women and 8 men) were prospectively evaluated to determine the results of open scapulothoracic bursectomy in the treatment of unremitting, painful scapular crepitus (snapping scapula syndrome). The mean duration of symptoms was 2 years (range, 4 months–6 years). Twelve related an injury history, and 5 had insidious onset of symptoms. Three had previous superomedial angle resections without relief. The mean age at surgery was 35 years (19-53 years), and follow-up averaged 2.5 years (2-6 years). The surgical approach reflected the rhomboid major from the medial scapula, giving access to the scapulothoracic bursa between the serratus anterior muscle and the rib cage. Only 4 cases required primary superomedial angle bone resection and one a revision resection. Mean outcome scores significantly improved preoperatively to postoperatively: American Shoulder and Elbow Surgeons score: from 48 to 91; Simple Shoulder Test: from 6.2 to 10.1; and Visual Analog Score for Pain: from 6.1 to 1.0 (P < .05). Return to work and sports averaged 3.5 months. Open scapulothoracic bursectomy allowed evaluation and treatment of all areas of potential pathology. Symptomatic crepitus was relieved, and pain relief and functional improvement were consistently achieved. (J Shoulder Elbow Surg 2002;11:80-5.)

INTRODUCTION

Painful scapular motion with associated crepitus has been termed snapping scapula syndrome or scapulothoracic bursitis. Abnormal bony anatomy such as osteochondroma, the tubercle of Luschka, or deformity after scapula or rib fractures has been identified as the cause of snapping scapula syndrome.[1,2,4,5,9,10,13,18] These anatomic intrusions into the scapulothoracic space can disrupt the previously smooth motion of the scapula over the rib cage. Acquired pathologic soft tissue structures have also been identified as causes.[1,17,19]

However, snapping scapula syndrome or scapulothoracic bursitis is not well understood, and localized anatomic causes are rarely identified. Most causes of painful scapular crepitus can be attributed to overuse, muscle imbalance, or problems at the glenohumeral joint that cause excessive scapular motion. A careful history and physical examination with conservative management directed toward the suspected underlying cause will yield a favorable result in most patients. However, there are those who do not respond to conservative measures and who do not have abnormal bony anatomy. Operative interventions in the form of open superomedial angle resection,[1,7,9,10] open partial scapulectomy,[2,9,10] open bursectomy,[8,11,17] and in recent reports arthroscopic bony resection[6] and arthroscopic bursectomy[3] have been used to treat painful scapular crepitus.

Consistent bursal structures have been reported at the superomedial angle of the scapula under the trapezius.[16] The large scapulothoracic bursa is consistently located between the serratus anterior muscle and the rib cage.[14] Our surgical approach has been to address these areas of potential pathologic bursae and only resect bone from the superomedial angle when the bone is felt to be abnormally prominent. This prospective evaluation of open scapulothoracic bursectomy for scapulothoracic bursitis that did not respond to conservative management assesses the effectiveness of this approach.

MATERIALS AND METHODS

Seventeen patients (9 women and 8 men) were evaluated at a mean follow-up of 2.5 years (range, 2-6 years). The mean age was 35 years (19-53 years), and the nondominant scapula was involved in 75% of the cases. The mean duration of symptoms was 2 years (range, 4 months–6 years). Twelve patients believed that the onset was the result of a specific injury: a lifting or jerking injury in 6, an automobile accident in 4, and a fall or fight in 2. Five patients had a more insidious onset to their symptoms.

Preoperative evaluation consisted of history and physical examination with anteroposterior and lateral radiographs of the scapula. The American Shoulder and Elbow Surgeons (ASES) score, the Simple Shoulder Test (SST), and the Visual Analog Score for Pain (VAS) were used to eval-

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1058-2746/2002/$35.00 + 0 **32/1/120807**
doi:10.1067/mse.2002.120807

uate function and pain levels (Table). The mean preoperative ASES score was 48 (range, 25-67), the mean preoperative SST was 6.2 (3-10), and the mean preoperative VAS was 6.1 (4-9). Ten patients were off work or on very restricted duty as a result of their condition, 3 were working with pain at clerical jobs, and the remaining 4 were not employed.

Patients were asked to localize and describe their symptoms and pain. Twelve patients described a constant ache beneath the scapula, which they communicated as a sensation of pressure or tightness that would not go away. Fourteen localized the majority of pain and crepitus at or below the level of the spine of the scapula. Six localized the majority at or above the level of the spine of the scapula in the area of the superomedial angle. Thus, 3 patients had symptoms equally above and below the scapular spine level. Three had recurrent pain and crepitus after a previous resection of the superomedial angle of the scapula. No patient was a high-demand overhead athlete.

All patients underwent physiotherapy with an emphasis on posture and scapulohumeral rhythm without resolution of their periscapular symptoms. Resistive and isometric muscle strengthening exercises for the rotator cuff, deltoid, and scapular rotators were performed. Of the 17 patients, 16 had gone to therapy for 2 different sessions of multiple visits without relief.

Before our evaluation, various diagnostic tests had been performed on these patients because of the extensive but nonspecific nature of their symptomatology. Eleven patients had undergone a series of trigger point injections in and around the muscles of the scapula. Seven had undergone shoulder magnetic resonance imaging, 5 EMG testing, 4 cervical magnetic resonance imaging, 2 bone scans, and 1 thoracic magnetic resonance imaging. All diagnostic test results were unremarkable.

Patients were excluded if they had evidence of concomitant cervical radiculopathy or spondylosis, rotator cuff tears or impingement, acromioclavicular arthralgia, glenohumeral stiffness, or instability. There were no radiographic abnormalities such as osteochondroma, previous scapular or rib fractures, or Luschka's tubercle. Four patients who had an elastofibroma in the area of the inferior angle of the scapula were also excluded. There were no predominant inferior angle symptoms included in this series, such as those described in throwers.[16]

Approximately 20 patients with primary painful scapular crepitus responded well to physiotherapy and bursal injections about the scapula and have not returned. Other patients had scapular crepitus as a secondary component to their shoulder problem. In those patients, either the crepitus was not symptomatic or clinical evaluation identified a primary glenohumeral or muscle imbalance problem. These were not categorized as snapping scapula syndrome and were not included in this study.

The anatomy of bursae in the periscapular region includes both permanent structural bursa and acquired bursa. Consistent nomenclature for these bursal structures has not been established. The large, consistently present scapulothoracic bursa is located in the serratus anterior space between the chest wall anteriorly and the serratus anterior muscle posteriorly.[14] Scapulothoracic bursectomy for symptomatic scapular crepitus was described by McCluskey and Bigliani.[8]

Operative technique

All patients underwent open scapulothoracic bursectomy. They were placed in the lateral decubitus position on a beanbag support, with the head of the bed angled up to approximately 30°. The scapula, shoulder, and arm were draped free. The incision was made at the medial border of the scapula from the level of the spine of the scapula distally. The inferior border of the trapezius muscle was identified first. Its thin, fibrous inferior border was mobilized from the fascia and retracted proximally. The Sharpey's fibers of the middle trapezius were elevated from the scapular spine. This allowed mobilization of the trapezius superiorly and facilitated exposure of the rhomboid major and minor and the medial border of the scapula. The release of the Sharpey's fibers from the spine of the scapula allowed access to the subtrapezial bursa between the trapezius and the superomedial angle of the scapula. The subtrapezial bursa was bluntly debrided with a gauze-covered finger, with special attention given to not injuring the spinal accessory nerve. The spinal accessory nerve was on the undersurface of the trapezius, with the wall of the subtrapezial bursa adjacent to the nerve.[16] Thus the blunt dissection of the bursa was always directed anteriorly toward the supraspinatus and superomedial angle.

The most technically challenging part of the procedure was to reflect the rhomboid major from the medial border of the scapula without taking the serratus anterior insertion with it. The medial scapula is quite thin but is the attachment point for both the rhomboid major and serratus anterior. Even though these muscle tendon units insert from different directions, the Sharpey's fibers are very short, and they intermingle as a sleeve and insert into the medial border of the scapula (Figure 1). The use of needle-tip electrocautery on the coagulation setting facilitated the ability to elevate the short Sharpey's fibers of the rhomboid major and to preserve tendon tissue for reattachment to the scapula. If difficulty was encountered, the distal border of the rhomboid major was identified, and a finger swept underneath the rhomboid major to identify the proper plane.

Once the rhomboid major was properly identified, it was tagged and reflected medially. This allowed access to the scapulothoracic bursa (Figure 2). Identification of the scapulothoracic bursa confirmed the proper dissection plane: between the serratus anterior muscle posteriorly and the rib cage anteriorly. In all patients, this bursa was fibrotic, whitish-yellow in color, and adherent to the undersurface of the rhomboids and serratus anterior and to the adventitial covering of the muscles of the thoracic rib cage. Elevation of the medial edge of the scapula with a retractor allowed complete dissection and excision of this bursa (Figure 3).

The undersurface of the superomedial angle was then palpated from underneath. A qualitative assessment of

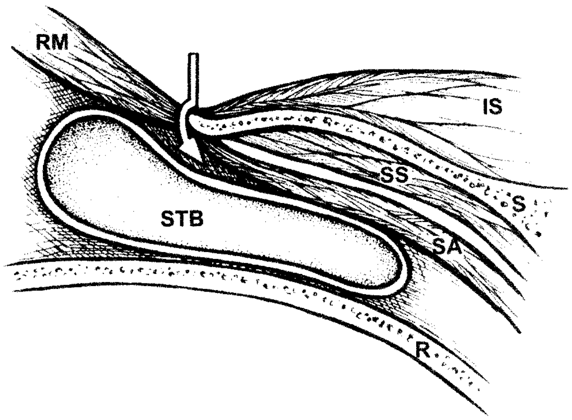

Figure 1 Drawing of cross-sectional anatomy. *Arrow,* The plane of dissection is between the rhomboid major *(RM)* and the medial scapular *(S)* border to access the scapulothoracic bursa *(STB)*. This bursa is in the serratus anterior *(SA)* space between the serratus anterior muscle and rib cage *(R)*. *IS,* Infraspinatus; *SS,* subscapularis.

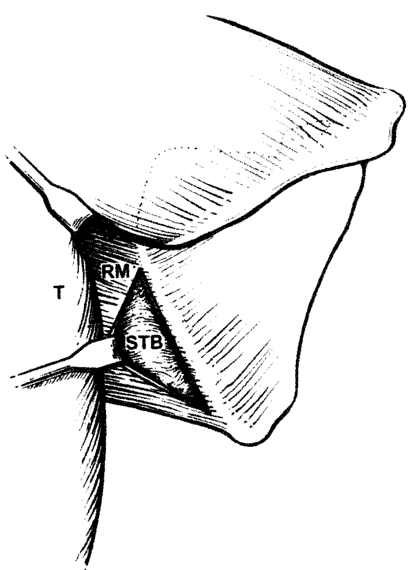

Figure 2 Drawing of posterior view. The inferior trapezius *(T)* is retracted, exposing the rhomboid major *(RM)* muscle. The rhomboid major muscle is retracted, exposing the scapulothoracic bursa *(STB)*, thus confirming the proper dissection plane.

bone prominence, smoothness, uniformity, and soft tissue coverage was made. If the area was felt to be irregular or prominent or lacked soft tissue coverage from the scapulothoracic space, a decision to resect the bone was made. The spine of the scapula was grasped with a tenaculum and brought inferiorly, providing exposure to the superomedial angle. Needle-tip cutting electrocautery was used to elevate the supraspinatus and levator scapulae muscles to expose the superomedial angle of the scapula. A rongeur was used to judiciously resect and smooth the

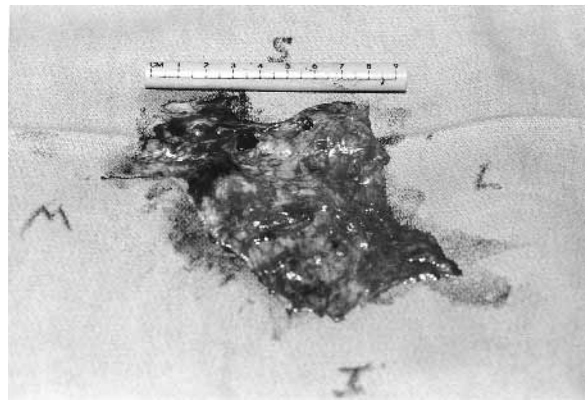

Figure 3 Scapulothoracic bursa after excision. This double-layered structure with the lumen collapsed is representative of all cases in this series. *S,* Superior; *I,* inferior; *M,* medial; *L,* lateral.

bone contour. The levator scapulae and supraspinatus muscle closure provided soft tissue coverage to the now resected superomedial angle bone. The extensive dissection and bone resection method described in other techniques was not used.[7,9,10]

The rhomboid major was closed to the medial border of the scapula with nonabsorbable sutures through drill holes in the edge of the bone. The inferior trapezius was sutured to the fascia from where it had been elevated. A standard skin closure was done. Only 4 patients in this series required primary superomedial angle bone resection and one a revision resection. Three patients had previous superomedial angle resections. Postoperative adhesions between the trapezius and the area of previous bone resection were encountered. Blunt dissection of these adhesions was carefully performed to mobilize the tissue planes and facilitate exposure. The pathology was felt to be scapulothoracic bursal involvement and not adhesions or prominent bone at the previous resection site.

The aftercare was the same for all patients regardless of whether a superomedial angle resection was performed or not and whether this was a primary or revision procedure. A sling was worn at all times for 4 weeks. Patients were allowed to use the hand, wrist, and elbow in the sling for assistance with eating, dental hygiene, and desktop paperwork. Active motion of the shoulder was not allowed. At 4 weeks, sling use was discontinued around the home and pendulum and active assisted motion was allowed. Patients were instructed to wear the sling in public for another 2 weeks. At 6 weeks postoperatively, a global active motion and isometric muscle strengthening program was initiated for the rotator cuff, the deltoid, and particularly the scapula rotators. Thera-Band resistive strengthening exercises were then initiated 2 weeks later. After 8 weeks, there were no limits placed on the patient's active range of motion or activity level. By 3 months, full work and sporting activities were allowed as tolerated.

RESULTS

All patients reported resolution of the painful crepitus sensation. Two reported very occasional crepitant

Table Scapulothoracic bursectomy series

Patient	Age/ sex	Mechanism of injury	Previous surgery	ASES (maximum 100 points) Before	ASES After	SST (maximum 12 points) Before	SST After	VAS (maximum 10 points) Before	VAS After	Procedure
1	37/F	—	—	50	82	8	9	7	3	STB
2	27/F	Lift/jerk	—	55	85	4	11	6	2	STB
3	36/M	Lift/jerk	SMA	25	92	3	10	8	1	STB
4	26/F	Lift/jerk	—	38	77	7	10	6.5	3	STB and SMA
5	36/F	MVA	—	43	97	7	12	5	0	STB and SMA
6	43/M	Fall/fight	—	36	86	3	10	8	1	STB
7	27/F	—	—	48	85	5	10	6	2	STB
8	46/M	MVA	SMA	56	92	6	11	7	1	STB
9	38/M	Fall/fight	—	46	100	6	12	6	0	STB
10	53/F	MVA	—	63	100	10	12	5	0	STB
11	40/M	Lift/jerk	SMA	32	83	5	9	7	2	STB and revision SMA
12	38/F	MVA	—	50	88	6	10	6	1	STB
13	22/F	Lift/jerk	—	63	97	10	12	4	0	STB and SMA
14	47/M	Lift/jerk	—	67	100	8	12	6	0	STB and SMA
15	38/M	—	—	25	92	4	11	9	0	STB
16	19/M	—	—	63	100	8	12	4	0	STB
17	29/F	—	—	58	90	6	10	6	1	STB

STB, Scapulothoracic bursectomy; *SMA,* superomedial angle resection.

sounds, but with diminished intensity and frequency and no pain. The sensation of pressure under the scapula resolved in all. The mean VAS, on a 10-point scale, dropped to 1.0 (range, 0-3) from 6.1 (4-9) preoperatively (Table). The ASES score, out of a possible 100 points, improved from the preoperative mean of 48 (25-67) to a postoperative mean of 91 (77-100). The SST, out of a possible 12 points, improved from a preoperative mean of 6.2 (3-10) to a postoperative mean of 10.1 (9-12). All outcome score improvements were statistically significant ($P < .05$). The mean time to return to work and sports was 3.5 months.

Of the 13 employed patients, 10 returned to full-duty activity. Three had work restrictions permitting only lighter duties. There were 8 workers' compensation cases. Of these, 6 patients returned to full duty and 2 to modified lighter duty. One patient still complained of pain in the area of the inferior angle of the scapula. One patient had recurrent upper trapezius spasms that initiated headaches, which began approximately 9 months after scapulothoracic bursectomy. This patient did not have recurrent scapular crepitus.

There was 1 reoperation. A patient had undergone superomedial angle resection 4 years prior to a new injury, which resulted in painful scapulothoracic crepitus. He underwent scapulothoracic bursectomy. The area of the resected superomedial angle was not felt to be irregular or prominent. He had no pain or crepitus and was in a work-conditioning program when he strained his shoulder while doing pendulum exercises with a 10-lb weight in his hand. (This exercise was not ordered or advocated by the authors.) He had dramatic new crepitus and pain localized to the superomedial angle resection develop. This did not resolve, and 3 months after the injury (6 months after scapulothoracic bursectomy), the superomedial angle was explored, irregular bone resected, and muscle coverage over the now prominent bone provided. He ultimately had an excellent outcome and returned to full-duty work.

In all cases in this series, the pathologic specimen was an adhesive, tough, fibrous bursal structure that was resected from the scapulothoracic space. Dimensions averaged 8 cm × 10 cm. Histologic evaluation consistently revealed diffuse fibrous tissue with areas of adipose tissue and infiltration of chronic inflammatory cells (Figure 4).

DISCUSSION

Scapulothoracic bursitis or snapping scapula syndrome is an uncommon condition. Symptoms can be diffuse and nonspecific in the periscapular area. In patients who do not have a readily apparent architectural abnormality, treatment can be problematic. Most periscapular symptoms are related to other causes, such as cervical radiculitis or radiculopathy, muscle strain of the scapula rotators, glenohumeral joint problems that result in excessive scapular motion, or overuse syndromes with muscle fatigue. The identification of these potential causes and changes in work or recreational habits will resolve the problem in the vast majority of patients. However, there are those who do not respond and whose symptoms are primarily localized to the scapulothoracic region.

Resection of the superomedial angle has been advo-

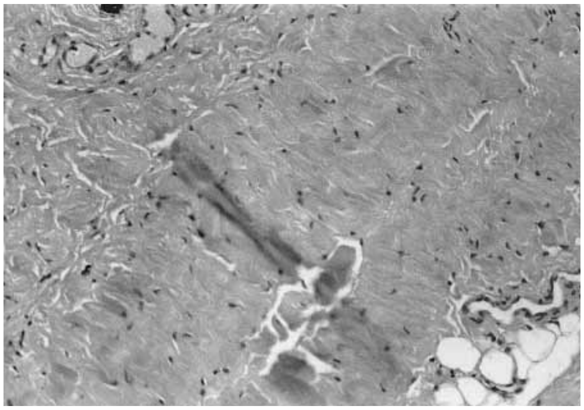

Figure 4 Histologic section of scapulothoracic bursa revealing predominant fibrous character, intermittent chronic inflammatory cells, and adipose tissue (hematoxylin-eosin stain, magnification ×20).

cated as a surgical option and has been described in both open[7,9,10,18] and arthroscopic procedures.[6] However, neither of these methods addresses the scapulothoracic bursa between the serratus anterior muscle and the rib cage. Removal of bone that may not be pathologic in the first place may not completely address all areas of pathology and may lead to recurrent symptoms. Of the 17 patients in this series, 3 had undergone previous open superomedial angle resections and had recurrent symptoms. Scapulothoracic bursectomy resolved their symptoms.

Very little information is available on the normal anatomy of the superomedial angle of the scapula or on its relationship to the thoracic cage.[5,15] The superomedial angle is extremely variable in its size, shape, and contour, as well as its relationship to the rest of the scapula. In a study of 420 scapulae done by the senior author, which examined acromion morphology and age-related changes, the superomedial angle was also qualitatively studied.[12] The superomedial angle in those specimens showed no abnormal bony prominence, roughening, or ossification of tendon insertions. There were no apparent changes in this area of the bone noted in the older specimens.

The findings of that study[12] and our clinical findings have led us to believe that the superomedial angle could not be responsible for all symptoms in all patients. Recent reports have identified consistently present bursal structures at the superomedial angle of the scapula under the trapezius[16] and in the scapulothoracic space between the serratus anterior muscle and the rib cage.[8,11,14] We felt that the common complaint of pain in the region of the superomedial angle could be a contribution from fibrosis and inflammation of the subtrapezial bursa in conjunction with involvement of the scapulothoracic bursa.

Patients also consistently complained of a sensation of pressure under the scapula. Most located the majority of symptoms below the level of the spine of the scapula. The scapulothoracic bursa deep to the serratus anterior muscle is quite large and consistently present.[14] All patients in this series exhibited thick, adherent, fibrotic bursal material that essentially obliterated this space. Dissection to peel and resect this thickened robust pathologic bursa off the undersurface of the rhomboids and serratus and off the rib cage was required, re-establishing the anterior space between the serratus anterior muscle and the rib cage.

As a result of our operative findings and the recent reports on bursal anatomy, we now use injections into the subtrapezial bursa and scapulothoracic bursa for both diagnostic and therapeutic purposes when treating symptoms of painful scapular crepitus that have not responded to conservative management.

When operative intervention is finally undertaken in this uncommon condition, all sites of potential pathology should be evaluated. Direct, open superomedial angle resection will traverse the subtrapezial bursa but not address the scapulothoracic bursa. The recently reported arthroscopic superomedial angle resection technique[6] does not address the subtrapezial bursa, such as that found in the cases in this series. Open scapulothoracic bursectomy allowed resection of the scapulothoracic bursa and subtrapezial bursa, evaluation of the bone at the superomedial angle (and other areas of the scapula), and resection of bone if felt to be abnormally prominent. This approach provided symptomatic relief from the crepitus and pressure sensations. Functional improvement and pain relief were consistently achieved.

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