



## Musculoskeletal Case No. 2, November 1999

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### **Presenting Symptom: Shoulder Pain**

**Case prepared by:** Frank J. Salvi, MD

**Presenting Symptom:** Shoulder Pain

**Appropriate Audience:** Residents and practicing physicians

**Learning Objectives:** To help evaluate and treat shoulder pain

### **History**

A 36-year-old right handed female has a 3 week history of left shoulder pain and weakness following an episode of reaching and lifting with her left arm. The pain was initially sharp, but is now characterized as aching, and 5/10 in intensity. The pain is worst over the anterolateral and posterior aspects of the shoulder, with some radiation around the left scapula. She notes an increase in pain and some left shoulder weakness with attempts at reaching and lifting. The areas of pain are decreased with relative rest (avoidance of reaching), ice and naproxen.

She works as a physical therapist, frequently reaching and lifting. She has never been a smoker. She uses a Nordic Track for exercise, which now also reproduces her symptoms. She denies constitutional symptoms.

- *Prior to continuing, please develop a differential diagnosis and list each possible diagnosis in order of likelihood.*

### **Commentary I**

Rotator cuff tendinitis is probably the most common cause of anterolateral shoulder pain subsequent to reaching and lifting activities. The tendinitis is usually secondary to subacromial impingement of the supraspinatus, and is frequently accompanied by subacromial and subdeltoid bursitis. Biceps tendinitis can also develop after repetitive reaching and lifting activities. Musculoligamentous strain or sprain of any of the shoulder girdle muscles can also contribute to regional pain symptoms. Cervical disc disease and C5 or C6 radiculopathies can present with pain in the shoulder region. Shoulder instability is a common cause of secondary rotator cuff tendinitis, especially in teen-age and young adult populations. Thoracic outlet syndrome usually presents with neck and shoulder region pains, often accompanied by C8 and T1 distribution parasthesias with extremes of neck rotation or overhead reaching activities.

Peripheral neuropathy involving either the suprascapular, long thoracic, or axillary nerves can contribute to shoulder region pains and dysfunction.

Glenoid labrum, or Bankhart, lesions and humeral head, or Hill Sachs, lesions can also contribute to shoulder pain and dysfunction, though there is usually some identifiable antecedent trauma. Acromioclavicular joint arthritis, inflammation, or clavicular osteolysis, are other potential contributors to regional pain. Heart disease, and angina pectoris, can refer pain to the shoulder. Tumors related to the breast, lung, and shoulder girdle muscles or bones can present with regional pain, but pain from these sources is often present even



when the patient is at rest. Infection of the shoulder joints can contribute to regional pain, though not likely in absence of constitutional symptoms.

- *Is there any additional information regarding the clinical history that might be helpful in clarifying your differential list or changing its order of priority?*

## **Commentary II**

Is there any history of previous shoulder pain, antecedent shoulder trauma, or instability?

Do other physical activities recreate the shoulder symptoms?

Is there any history of neck pain, distal upper extremity pain, weakness, numbness or paresthesias?

Is there any locking, popping or clicking in the shoulder?

Has she had other joint pain or swelling in the past or is there any now?

Has she had any diagnostic testing and what were the results?

Has she had any other treatment, and if so how has it influenced the pain?

## **History, continued**

She cannot recall any previous episodes of shoulder pain, regional trauma, or dislocation, and she does not sense any shoulder instability.

She denies any exacerbation of symptoms with extremes of cervical range of motion or other physical activities.

She denies a history of neck pain.

She notes a clicking sensation with active shoulder flexion and abduction.

She denies regional or systemic joint swelling in the past or present.

While she was a physical therapy student 8 years ago, one of her colleagues noted left scapular winging on a routine physical exam, but it was never symptomatic.

She has not undergone any other work-up or treatment for her pain symptoms.

- *If necessary, revise your differential diagnosis based on the additional clinical history.*
- *On which details of the physical examination should you focus at this point?*

## **Commentary III**

Rotator cuff impingement and tendinitis with subacromial and subdeltoid bursitis probably remains at the top of our list of differential diagnoses, but peripheral neuropathy, particularly of the long thoracic nerve, moves up on our differential given her history of scapular winging. Scapular winging is usually secondary to long thoracic neuropathy and serratus anterior weakness, but rhomboids and trapezius weakness can also contribute to variations of winging. Shoulder instability contributing to secondary rotator cuff tendinitis is still a consideration. Anterior and multidirectional instability often becomes symptomatic in younger individuals who are involved in sports with repetitive forceful overhead motions



such as baseball, volleyball and swimming. A lax shoulder capsule can force the rotator cuff to work harder in order to maintain the humerus within the glenoid fossa.

Musculoligamentous strain or sprain, or acromioclavicular joint arthritis, with recurrent aggravation from reaching and lifting while working as a therapist, is still a consideration. Thoracic outlet syndrome and cervical radiculopathy seem less likely given the absence of any distal upper extremity symptoms. Bankhart or Hill Sachs lesions seem less likely in the absence of any identifiable trauma. Suprascapular and axillary neuropathy might still be considered. Heart disease is unlikely given her lack of risk factors, and since other physical activities are well tolerated.

Popping and clicking can occur with inflammation of the subacromial-subdeltoid bursa or rotator cuff and with labral pathology. Locking is more consistently associated with labral pathology.

Neck pains are usually, but not always present with discogenic radiculopathy. Distal upper extremity pains and parasthesias are common, with C5 radiculopathy classically causing numbness over the lateral elbow and upper arm, while C6 radiculopathy often causes numbness over the lateral forearm and thumb.

#### **General:**

- Neck:
  - Appearance
  - Range of motion
  - Palpation
- Shoulder joints:
  - Appearance
  - Range of motion
  - Palpation
- Neuromuscular exam:
  - Manual muscle testing
  - Sensation
  - Reflexes
- Special tests:
  - Shoulder impingement
  - Spurling maneuver for cervical nerve root impingement

#### **Physical Examination**

She is pleasantly interactive and in no acute distress.

Vitals are unremarkable (T=37, P=60, R=16, BP=126/76).

Spinal curvature is normal. Cervical spine range of motion is normal. There is no tenderness over the cervical spinous processes or paraspinal musculature.

Shoulders appear level, without evidence of regional swelling or erythema. The left scapula is more prominent than the right, with a mild degree of muscular wasting just above and



below the scapular spine. She has active range of motion as follows: external rotation to T5 on the right and T4 on the left, internal rotation to T8 on the right and T10 on the left, and abduction to 170 degrees bilaterally. Passive shoulder range of motion, while supine with the arm abducted to 90 degrees is: external rotation – left 80 degrees, right 90 degrees ; internal rotation – left 60 degrees, right 70 degrees; crossed adduction - 60 degrees bilaterally; abduction -170 degrees bilaterally; and bilateral forward flexion -170 degrees.

She is tender over the left greater tubercle, where the rotator cuff tendons insert onto the humerus, but not elsewhere over the shoulder girdle.

Strength is 4-/5 for left supraspinatus, (shoulder abduction in the "thumb down" position with the arm along the scapular plane), and resisted left shoulder external rotation. Left serratus anterior, tested by resisting shoulder protraction, increases scapular winging. Strength for shoulder internal rotation, abduction, elbow flexion and extension, wrist flexion and extension, finger flexors and hand intrinsics are 5/5 and symmetric.

Sensation is intact.

Reflexes are 2+ and symmetric in both upper limbs.

Normal cervical range of motion includes 45 degrees of forward flexion, 70 degrees of extension, 30 degrees of lateral bending, and 70 degrees of lateral rotation. Normal shoulder range of motion includes 90 degrees of external and internal rotation, 60 degrees of crossed adduction, and 180 degrees of abduction and forward flexion.

Impingement tests: Hawkins impingement test, shoulder forward flexion to 90 degrees and subsequent shoulder internal rotation, is positive, recreating anterolateral shoulder symptoms. Neer's impingement test, shoulder forward flexion with internal rotation, does not reproduce shoulder pain. Spurling maneuver, cervical extension, lateral bending and axial compression, does not reproduce symptoms radiating into the ipsilateral upper extremities.

- *At this point, review your differential diagnosis and revise as appropriate.*
- *Are there additional observations on physical examination that might be helpful in narrowing your differential list?*

## **Commentary IV**

History and initial exam findings are consistent with rotator cuff tendinitis and bursitis. There is evidence of rotator cuff impingement, but also of long thoracic and possibly suprascapular neuropathy, both of which can contribute to rotator cuff tendinitis by altering scapulothoracic motion. Shoulder capsular laxity, which can also cause secondary rotator cuff tendinitis, glenoid labral pathology (Bankhart lesion), and thoracic outlet syndrome must also be considered and tested with specific physical exam maneuvers.

Palpation should occur over all of the shoulder joints (sternoclavicular, acromioclavicular, and glenohumeral) and over the periscapular musculature.

### **Manual muscle testing to assess for radiculopathy:**

- C1,2: cervical forward flexion
- C3: cervical lateral bending
- C4: shoulder shrug
- C5: shoulder abduction, elbow flexion



C6: radial wrist extension, elbow flexion  
C7: elbow extension  
C8: flexion of middle finger distal phalanx  
T1: hand intrinsics, finger abduction

**Sensory testing to assess for radiculopathy:**

C2: occiput  
C3: neck, supraclavicular  
C4: sternum, periclavicular  
C5: lateral arm and elbow  
C6: lateral forearm and thumb  
C7: middle finger  
C8: little finger and medial forearm  
T1: medial elbow

**Reflex testing to assess for radiculopathy:**

C5: biceps, brachioradialis  
C6: biceps, brachioradialis, pronator teres  
C7: pronator teres, triceps, finger flexors  
C8: triceps, finger flexors

Rotator cuff muscles are best tested by isolating shoulder internal rotation for the subscapularis, external rotation for the infraspinatus and teres minor and abduction in a scapular plane (thumbs up or down) for the supraspinatus.

Periscapular muscular function can be assessed by observing scapulothoracic rhythm during overhead arm abduction.

**Additional special tests:**

Scaption and scapulothoracic rhythm  
Shoulder capsular laxity and instability  
Load and shift to test labral integrity  
Roos maneuver and Adson's tests for thoracic outlet syndrome.

**Physical Examination, continued**

Scapulothoracic rhythm with overhead arm abduction is asymmetric. The scapula serves as the base of support for the shoulder and arm, and its motion normally contributes to 30% of shoulder abduction. Scaption is tested by marking the inferomedial border of the scapulae with the arms resting at the side, then with hands placed on the hips, and then with arms abducted to 90 degrees. A positive scaption test is present if the inferomedial border of the scapula migrates over 1 cm laterally with hands on hips or arms abducted versus with arms resting at sides.

There is no evidence of shoulder capsular laxity, excessive or asymmetric movement of the humeral head within the glenoid labrum.

Load and shift test, with shoulder axial compression while ranging the shoulder, does not reproduce pain or generate palpable clicking or clunking sensations. While there is no labral



pathology on physical exam, posterior capsulolabral injuries, which can leak synovial fluid from the shoulder joint down the scapular spine to the suprascapular and spinoglenoid notches creating ganglion cysts, are felt to be a common cause of suprascapular neuropathy.

Roos maneuver, shoulder abduction to 90 degrees, elbow flexion to 90 degrees, and repeated clenching of fists, does not reproduce shoulder region symptoms. Adson's test, shoulder abduction, external rotation and extension with ipsilateral cervical rotation and a deep breath, does not diminish the radial pulse or recreate shoulder region symptoms. Both tests are fairly sensitive, but relatively nonspecific for thoracic outlet syndrome.

- *At this point, review your differential diagnosis and revise as appropriate.*

### **Clinical Impression**

Rotator cuff tendinitis with bursitis, rotator cuff impingement, long thoracic and possibly suprascapular neuropathy are all still in our differential diagnosis. Glenoid labral pathology (Bankhart lesion) is lower on our list given negative physical exam, but must still be considered given its potential contribution to suprascapular neuropathy.

- *What diagnostic tests would you order at this time?*

### **Commentary V**

Shoulder X-rays looking for evidence of impingement or suprascapular notch pathology. A typical rotator cuff x-ray series includes AP(AC), AP Neer, Axillary and West Point views. For suprascapular notch pathology (callous or bony tumor) check AP view aimed caudad 15 to 30 degrees.

EMG to assess for evidence of long thoracic and suprascapular neuropathy.

### **Test Results**

X-rays were unremarkable.

#### **EMG results:**

1. Symmetric suprascapular nerve motor unit action potential latencies. Suprascapular nerve was tested by inserting a needle G1 pick up between the lateral aspect of the scapular spine and the inferomedial border of the scapula, down to the bone, with a surface G2 over the lower cervical spinous processes, and stimulation over the anteroinferior aspect of the trapezius muscle at the base of the neck - side to side comparison should be within 0.5 ms.
2. Normal median and ulnar motor and sensory nerve conduction.
3. 2+ spontaneous activity with scattered pockets of motor units in the left supraspinatus and infraspinatus muscles.



4. No spontaneous activity and normal appearing motor units in the serratus anterior, trapezius, deltoid, biceps, triceps, pronator teres, first dorsal interosseous manis, and cervical paraspinal muscles.
  - *If necessary, augment or change the clinical impression based on the test results.*

The EMG provided physiological evidence for axonal suprascapular neuropathy, felt to be contributing to her muscular atrophy and scapular dysfunction

- *What additional diagnostic testing would you order?*

## Commentary VI

MRI of shoulder, including cuts through the scapula (suprascapular and spinoglenoid notches). MRI can evaluate the rotator cuff musculature, labral integrity, and the supraglenoid and spinoglenoid notches. Suprascapular neuropathy often occurs because of impingement at the suprascapular (effecting both supraspinatus and infraspinatus muscles) or spinoglenoid (effecting only the infraspinatus muscle) notches.

## Test Results, continued

### MRI results:

1. No evidence of pathology (ganglion cyst, tumor or hematoma) at the suprascapular or spinoglenoid notch compressing the suprascapular nerve.
2. Mild atrophy of the supraspinatus and infraspinatus muscles.
3. No evidence of rotator cuff pathology or labral injury.
  - *What is the impact of the additional test results on the final diagnosis?*
  - *Considering all the data from the history, physical examination and laboratory studies, what is/are your final diagnostic impression(s)?*

## Final Diagnostic Impression

Shoulder pain secondary to suprascapular neuropathy. Clinically, rotator cuff tendinitis and impingement is present. This may be secondary to abnormal scapulothoracic biomechanics, and the repetitive reaching and lifting that our patient must perform in her position as a physical therapist.

## Commentary VII

The suprascapular nerve can be effected at the suprascapular or spinoglenoid notches. Proposed mechanisms include trauma (scapula fracture, proximal humerus fracture and shoulder dislocation), space occupying lesions (tumors, ganglia, hematomas), repetitive kinking or stretching, ischemia from microemboli to the vaso-nervorum, and idiopathic injury. Supplemental radiologic testing did not find structural impingement of the rotator cuff or suprascapular nerve, so kinking, stretching, ischemia, or some type of idiopathic injury seem most likely.



While the MRI did not show significant inflammation within the rotator cuff, when scapular motion is limited, which can occur secondary to trauma, nerve injury, or repetitive overuse of the periscapular muscles (most often serratus anterior, trapezius, and rhomboids), extremes of shoulder abduction (especially when combined with lifting) will tend to pinch the rotator cuff (usually supraspinatus muscle and tendon) under the relatively immobile acromion creating tendinitis. Once the rotator cuff muscles are inflamed, they become weak, so when the more powerful arm muscles (biceps, triceps and deltoid) are activated, the rotator cuff muscles can no longer hold the head of the humerus tightly in the glenoid cavity and the humerus migrates upwards towards the acromion, perpetuating the cycle of impingement and tendinitis.

- *What treatment would you now initiate for this patient?*

### **Commentary VII**

Physical therapy, 2X/wk X 6 weeks with initial focus on scapular stabilization, progressing to rotator cuff stretching and strengthening to decrease impingement symptoms. As the supraspinatus and infraspinatus muscles are denervated, intensive physical therapy focusing exclusively on the rotator cuff is not likely to be successful.

Caution therapists to avoid active overhead arm abduction.

Work restrictions: avoid heavier lifting above waist level, as long as it continues to be symptomatic. Also, avoid more frequent reaching, especially overhead, with the left arm, as reaching overhead can predispose to further impingement.

Anti-inflammatory medication p.r.n. for pain.

### **Follow Up**

We chose to reevaluate our patient at 6 weeks.

Her shoulder pains had modestly improved. Overhead reaching continued to be bothersome.

Her physical exam was without significant change.

We recommended that she continue with conservative therapy.

### **Final Discussion**

In our case, the combination of repetitive reaching and lifting with abnormal scapulothoracic function seems to have contributed to a suprascapular nerve tension and injury.

Suprascapular neuropathy went on to cause rotator cuff muscle (supraspinatus and infraspinatus) weakness, so with reaching and lifting activities, upwards traction on the humerus could not be offset by the rotator cuff muscles, and impingement, tendinitis and bursitis occurred. Acute inflammation likely calmed to an extent, by the time the MRI was completed, so imaging was unremarkable. Alternatively, regional pains may have been secondary to increased intermittent tension on the suprascapular nerve.



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