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Shoulder pain: 3 cases to test your diagnostic skills

Before you conclude that rotator cuff tendinitis is the cause of your patient's pain or order a range of imaging studies, take a look at these cases—and the take-away message each provides.

Shoulder pain is a common reason for visits to primary care physicians, who are most likely to diagnose it as rotator cuff tendinitis[1,2]—often erroneously. The complexity of the joint and the overlapping pathologies that may present as shoulder pain highlight the need to take a closer look when dealing with this diagnostic challenge.

Often, a targeted medical history—including the mechanism of injury and pain-provoking and pain-relieving factors—and a problem-based physical examination (incorporating many of the maneuvers highlighted in the text and tables that follow) will lead to an accurate diagnosis without the need for imaging studies. We recommend that imaging be reserved for patients who don't respond to conventional treatments, cases in which the diagnosis is in doubt, and instances in which surgical intervention is being considered.

The 3 cases* that follow, and the take-away message incorporated in each, will give you an opportunity to test—and to hone—your shoulder pain diagnostic skill.

CASE 1▶ The history: Jesse, a 17-year-old student who's active in football and track, came in during track season complaining of severe left shoulder pain. He denied any traumatic event or previous injury to the shoulder, but reported that any motion involving the shoulder caused pain. It hurt at night, the patient said, when he lay on his left side.

The physical: No muscle atrophy, redness, or swelling was evident, nor was there any indication of asymmetry or ecchymosis in the affected area. Jesse's neck range of motion was normal; he had a very hard time with any active motion of the shoulder, however, because of the pain.

Evaluation of scapular motion demonstrated scapular dyskinesis[3,4] without winging. Passive motion of the glenohumeral joint was much better than active motion. Strength testing appeared to be grossly intact but was limited by the pain. Shoulder impingement testing was positive. Sensation and deep tendon reflexes were intact.

What's the diagnosis?

Subacromial bursitis, suggested by the patient's pain and altered scapular motion, was our working diagnosis, and we administered a subacromial injection of corticosteroid with lidocaine, for diagnostic as well as therapeutic purposes. Reexamination after the injection revealed immediate partial improvement in resting pain, range of motion, and strength. We referred Jesse to physical therapy with a focus on scapular stabilization and rotator cuff strength.

Three months later, Jesse returned to our office, complaining of weakness in his left shoulder. The pain had subsided a week

**Patients' names have been changed to protect their privacy.*

after his first appointment, so he'd never gone to physical therapy. The weakness, which he had first noticed about 2 months after starting a lifting program in preparation for football season, was limited to resistance exercises, especially overhead shoulder presses and bench press. There were no other changes in his history, and he reported no reinjuries.

Physical examination revealed atrophy of the supraspinatus and infraspinatus muscles (**FIGURE 1**) and external rotation and shoulder abduction (in the scapular plane) resistance tests revealed weakness of these muscles. There was no scapular winging. The cervical spine exam was normal, and neurovascular status was intact in both upper extremities.

New evidence points to nerve injury. Based on Jesse's current history and physical, nerve injury was our new working diagnosis. (We considered the possibility of a rotator cuff tear, but this was not corroborated by the history.)

We ordered an electromyogram/nerve conduction velocity study to localize the lesion. The test revealed a brachial plexitis/neuritis (also known as Parsonage-Turner syndrome or brachial amyotrophy). The etiology of most atraumatic brachial plexopathies is unknown, and most are thought to be viral or autoimmune in nature.[5,6]

A classic case of Parsonage-Turner syndrome. The typical presentation of Parsonage-Turner syndrome (like Jesse's) is one of acute, intense shoulder pain for no known reason. After 1 to 3 weeks, the pain resolves and the patient is left with weakness, usually of the supraspinatus and infraspinatus muscles. The weakness typically resolves with time, but full resolution may take 6 to 9 months.[5,6] (In Jesse's case, it took about 6 months.)

The take-away message: Look beyond the shoulder

As this case illustrates, not all shoulder pain originates in the shoulder. When evaluating shoulder pain, it is essential to consider other causes. The differential diagnosis for shoulder pain includes cervical spine disorders, cholecystitis (right shoulder), diaphragmatic irritation (eg, in the case of splenic rupture, usually involving the left shoulder), cardiac disease, and thoracic outlet syndrome.[7]

Evaluation of the cervical spine should be part of a complete shoulder examination. It is vital to follow a systematic approach that carefully assesses the cervical region for the possibility of nerve root impingement and radicular dysfunction masquerading as a primary shoulder disorder. (**TABLE 1**[8,9] details pain and sensory distribution patterns, reflex involvement, and potential motor impairments associated with various spinal nerve root levels.)

Practitioners should develop their own approach to "clearing the neck." A logical order is to note posture of the head/neck/shoulders, observe active motion, perform palpation and provocative tests, and then assess neurologic function with sensation/reflex/strength testing. Provocative tests that can help to identify cervical involvement relating to shoulder pain include Spurling's maneuver, axial compression test, abduction relief sign, and Lhermitte's sign.[10,11]

CASE 2 ▶ The history: Mark, a 17-year-old, right-handed volleyball player, presented with

FIGURE 1
Severe shoulder pain, followed by weakness

IMAGES COURTESY OF: NILESH SHAH, MD

Physical examination reveals atrophy of the patient's supraspinatus (^) and infraspinatus (+) muscles.

TABLE 1

Assessing the cervical spine

Nerve root	Pain distribution	Sensory distribution	Reflex changes	Motor involvement
C5	Lateral neck/upper trapezius	Lateral arm	Biceps	Deltoid, biceps
C6	Base of neck/upper trapezius to superior glenohumeral joint	Radial aspect of distal forearm, thenar eminence, and index finger	Brachioradialis	Biceps, extensor carpi radialis longus and brevis (wrist extension)
C7	Base of neck, almost entire upper quadrant of the back	Third finger	Triceps	Triceps, wrist flexion, finger extension
C8	No shoulder pain	4th and 5th fingers, distal half of forearm (ulna side)	None	Finger flexion (grip strength)

Adapted from: Miller JD, et al. *Am Fam Physician*. 2000[8]; Eubanks JD. *Am Fam Physician*. 2010.[9]

Carefully assess the cervical region for the possibility of nerve root impingement and radicular dysfunction masquerading as a primary shoulder disorder.

right shoulder pain, which he felt whenever he spiked or served the ball. The pain started last season, Mark said, diminished during the months when he wasn't playing, then got progressively worse as his activity level increased. The pain was in the posterior aspect of the shoulder.

The physical: Physical examination revealed a well-developed, but thin (6'4", 170 pounds) young man who was not in distress. The general examination was benign, and a joint-specific exam showed no asymmetry or atrophy on inspection and no tenderness to palpation over the posterior and anterior soft tissues of the right shoulder. Rotator cuff testing yielded intact strength for all 4 muscles, but external rotation and supraspinatus testing elicited pain. The crank test, drawer sign, load and shift test, relocation test, and sulcus sign, detailed in **TABLE 2**,[12-14] were all positive for shoulder instability; the Clunk and O'Brien tests were negative, and the contralateral shoulder exam was within normal limits. General joint laxity was observed, with the ability to oppose the thumb to the volar forearm and hyperextension noted in both elbows and knees. There were no outward signs of connective tissue disease.

Because of the chronicity of Mark's pain and the progressive nature of his symptoms, we ordered radiographs, including anterior-posterior, lateral axillary, and scapular Y views. These films showed a nearly skeletally mature male without bony abnormalities; the humeral head was well located in the glenoid.

What's the diagnosis?

Multidirectional instability with recurrent subluxations and probable acute rotator cuff tendinitis was our provisional diagnosis. Treatment focused on physical therapy, with a concentration on scapular stabilization and rotator cuff strengthening.

Shoulder instability is relatively common and represents a spectrum of disorders ranging from dislocation to subluxation to simple laxity.[12,13] A complete loss of humeral articulation within the glenoid fossa is evidence of dislocation, whereas subluxation includes approximation of the humeral head to the limits of the glenoid rim. Dislocation typically results from trauma, whereas subluxation can be the result of microtrauma and repetitive overuse injury. Anterior instability is the most common type and is reported in as many as 95% of all dislocations.[13]

The take-away message: Rule out instability

The shoulder is one of the most complex joints in the body. The rotator cuff structures, the glenoid labrum, and the collective capsular ligaments provide structural stability to the glenohumeral joint.[12,13] The shoulder is vulnerable to instability because the shallow glenoid fossa offers little bony support for the humeral head. Thus, instability should always be included in an assessment of shoulder pain.

Key factors to consider in identifying shoulder instability include the location of the pain, the direction of traumatic force

TABLE 2

Testing for shoulder instability[12-14]

Test	Procedure	Positive result/implication
Apprehension	Patient supine, arm abducted 90°, externally rotated with anteriorly directed force applied to humeral head	Pain/apprehension with force suggests anterior instability
Relocation*	Patient supine, posteriorly directed force applied to humeral head	Relief with force suggests anterior instability
Crank	Patient sitting, arm abducted 90°, elbow flexed to 90°, humerus supported with forced external rotation	Pain/apprehension with forced external rotation suggests anterior instability
Load and shift	Patient supine, arm held by examiner and abducted 90°, force applied along axis of humerus to "seat" the humerus within the glenoid, followed by anterior force directed to humeral head	Pain and appreciable translation felt with anterior force suggest anterior instability
Drawer	Patient sitting, arm at side, proximal humeral shaft grasped by examiner, seating the humeral head within the glenoid then applying anterior translational force	Pain and appreciable translation felt with anterior force suggest anterior instability
Sulcus	Patient sitting, arm at side, forearm grasped by examiner with an inferior/caudally directed force applied	Sulcus or depression seen inferior to acromion as humeral head subluxes posteriorly, pathognomonic for multidirectional instability
Clunk	Patient supine, examiner grasps at forearm and humeral shaft, with humeral head seated within the fossa, taking the arm through passive ROM from extension through forward flexion	Clunk sound or clicking sensation suggests labral tear
O'Brien	Patient sitting, arm is forward flexed to 90° and fully adducted and internally rotated; patient resists downward motion. If pain is elicited, the maneuver is repeated in external rotation	Pain elicited with resisted downward motion in internal rotation but relieved with external rotation suggests labral pathology

*Perform only if apprehension test is positive.

ROM, range of motion.

Instability should always be included in an assessment of shoulder pain.

applied, the presence of a known complete dislocation vs apprehension with specific movement, the position of the arm in which pain is elicited, a previous occurrence of instability (subluxation or dislocation), and the presence of tingling or numbness.[12-14] The maneuvers detailed in **TABLE 2**[12-14] can help identify instability, as they did in this case. Patients with hypermobility are at increased risk for shoulder instability, so a targeted exam and patient history aimed at identifying signs and symptoms of hypermobility is needed, as well.

Ask the patient to attempt to:

- bend the thumb to the volar forearm
- place hands to the floor with hyperextended knees
- perform maximal hyperextension of the fifth metacarpophalangeal joint (>90° is a positive result).

Findings from the medical history that indicate a predisposition to instability include generalized joint laxity, Ehlers-Danlos syndrome, Marfan syndrome, osteogenesis imperfecta, hyperhomocysteinuria, hyperlysinemia, benign joint hypermobility syndrome, juvenile rheumatoid arthritis, and previous shoulder or patellar dislocations.

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TABLE 3

Suspect rotator cuff involvement?[7,15-17]

Rotator cuff component	Name of test	Maneuver	Postive result
Infraspinatus muscle	French horn test (external rotation)	Patient stands with arms adducted against the side of the body, shoulder in neutral rotation, and elbow flexed at 90° and resists the examiner's attempt to push the arm/hand forward by creating an external rotation force	Weakness or pain is indicative of a positive test
Subscapularis muscle	Lift-off test	Patient places hand of the affected shoulder behind the back at the belt line, then pushes outward away from the body, countering an inward push on the palm applied by the examiner	Inability to resist the examiner indicates a lesion in the subscapularis muscle
	French horn test (internal rotation)	Positioning is the same as that used to test the infraspinatus muscle; however, the patient pulls inward toward the abdomen against resistance	
Supraspinatus muscle	Empty can test (Jobe test)	Patient rotates the arms so that the thumbs are pointing to the floor; resistance is applied by the examiner with the arms in 30° of forward flexion and 90° of abduction (simulates emptying of a can)	Weakness or pain is indicative of a positive test
	Full can test	Supraspinatus may also be tested in the thumbs-up (full can) position	
Teres minor muscle	French horn test (external rotation)	See description of infraspinatus muscle testing	Weakness or pain is indicative of a positive test

Imaging tips: Scapular Y and/or axillary lateral views should always be included when ordering imaging studies for suspected instability/dislocations, as 50% of posterior dislocations are missed on standard shoulder x-rays that do not include them.[12] In reviewing the x-rays, it is important to look for signs of a compression fracture of the posterior humeral head (known as a Hill-Sachs lesion) for anterior shoulder dislocations, and fractures to the anterior glenoid rim (known as a Bankart lesion).[12-14]

CASE 3▶ The history: Robert, a right-handed, 50-year-old motorcycle instructor, came to our office because of chronic right shoulder pain. The pain, located over the anterior portion of the glenohumeral joint, developed insidiously about 3 or 4 years ago, the patient reported. He had finally decided to seek help because he'd recently experienced an acute exacerbation of pain brought on by shoveling snow, after which he also noticed associated weakness, a clicking/popping on active motion, and mild loss of motion.

The physical: Robert's cervical spine exam was unremarkable. He demonstrated full active range of motion (ROM) without exacerbation of right shoulder symptoms, and special tests for disc pathology at the neck were negative. Active ROM testing of the right shoulder revealed full abduction, with only minimal pain; full flexion, with moderate pain noted initially at 49°; full extension, with a painful arc noted at 50°; and full horizontal adduction, with a painful arc noted at the halfway point. The testing also revealed that his right thumb was 3 inches lower than the left on reaching for the opposite scapula. At the superior aspect of the acromioclavicular (AC) joint, 2+ tenderness was noted; 3+ tenderness was noted at the greater tubercle of the humerus.

After inspecting the shoulder region for

alterations in bony landmarks, muscle bulk, carrying position, and movement characteristics, palpation of the region was performed.

When assessing shoulder strength, there are a variety of tests for each functioning component of the rotator cuff structures (**TABLE 3**).[15-17] Manual muscle tests revealed: 4-/5 on external rotation (French horn test), 3+/5 on the lift-off test, and 5-/5 on all other tests for right shoulder function. Impingement testing was slightly positive, or pain producing, on Hawkins and Neer tests.[18,19] For the Hawkins test, the examiner flexes the arm to 90° of shoulder flexion with the elbow flexed at 90°, then internally rotates the shoulder. For the Neer test, the arm is fully elevated in the scapular plane and internally rotated by the examiner.

The subscapularis muscle, which functions primarily in internal rotation, is tested by the French horn and lift-off tests. The teres minor muscle, which performs external rotation, is tested by the French horn test of external rotation. And the supraspinatus muscle, which performs abduction and external rotation, is tested by the empty can (also known as the Jobe) and full can tests. Some researchers suggest that the empty can test is better for diagnosing impingement, based on evidence showing that the full can test is better at diagnosing supraspinatus tears because it causes less pain during testing.[20]

What's the diagnosis?

Rotator cuff tear was suspected because Robert had positive elements of the "rotator cuff triad"—supraspinatus weakness (as indicated by a positive empty can test), external rotation weakness (revealed by the French horn test), and a positive Hawkins impingement test. We ordered diagnostic studies, including plain radiographs, which revealed degenerative changes at the acromioclavicular joint, decreased acromiohumeral interval, and no significant changes at the glenohumeral joint (**FIGURE 2**), and magnetic resonance imaging (MRI) of the right shoulder. The MRI revealed a large, full-thickness rotator cuff tear of the supraspinatus tendon with retraction. A torn and retracted biceps tendon and AC joint osteoarthritis were also shown, likely causing a mass effect on the supraspinatus. The patient underwent surgery to repair the torn rotator cuff, with excellent results.

FIGURE 2

Chronic right shoulder pain

An AP view of the patient's right shoulder shows acromioclavicular joint narrowing and degeneration and subtle narrowing of the acromiohumeral interval.

The take-away message: Keep the rotator-cuff triad in mind

Because none of the tests that comprise the triad is specific enough alone to diagnose a rotator cuff tear,[15,20,21] Murrell and Walton[16] suggested that the 3 tests be considered together for diagnostic purposes. If all 3 are positive, there is a 98% chance of a rotator cuff tear; if 2 tests are positive and the patient is older than 60 years, the findings are suggestive of a tear; and if all 3 tests (plus the drop arm test) are negative, there is less than a 5% chance of a major rotator cuff tear.[16] JFP

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