Evaluation of shoulder pain

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KEY POINTS FOR CLINICIANS

- Shoulder pain is a common complaint seen in primary care.
- Subacromial impingement syndrome and rotator cuff tears are the most common disorders encountered.
- The history and physical examination are keys to most shoulder pain diagnoses, particularly when used in combination.
- Imaging studies are indicated for failed conservative therapy, severe shoulder pathology, or unclear diagnosis.

Shoulder pain is a common problem that can pose difficult diagnostic and therapeutic challenges for the family physician. It is the third most common musculoskeletal complaint in the general population, and accounts for 5% of all general practitioner musculoskeletal consults.[1,2] The incidence of shoulder pain is 6.6 to 25 cases per 1000 patients, with a peak incidence in the fourth through sixth decades.[3–6] Shoulder pain is second only to knee pain for referrals to orthopedic surgery or primary care sports medicine clinics.[7,8] Furthermore, 8% to 13% of athletic injuries involve the shoulder and account for up to 3.9% of new emergency department visits.[9,10]

DIFFERENTIAL DIAGNOSIS

The challenge for the physician evaluating shoulder pain is the myriad of etiologies and the potential for multiple disorders. Compounding the challenge is a lack of uniformity in the literature regarding diagnostic classification.[11] As Table 1 shows, the age of the patient will help focus the differential diagnosis. Patients younger than 30 years old tend to have biomechanical or mild inflammatory etiologies for their pain such as atraumatic instability, tendinosis, and arthropathies. Less than 1% of shoulder injuries in persons younger than 30 years are complete rotator cuff tears, which occur in 35% of patients older than 45 years with shoulder pain.[12,13]

The rotator cuff is the most commonly affected structure in the shoulder, and subacromial impingement syndrome is the leading cause of rotator cuff injury.[4,12,14–16] Neer[14] described 3 stages of shoulder impingement that he estimated lead to 95% of rotator cuff tears. Impingement can be caused by repetitive overhead activities, acute trauma, or subtle instability (atraumatic instability). The current theory is that inflammation of the rotator cuff tendons and/or bursa, caused by irritation against the coracoacromial arch, can progress to a complete rotator cuff tear over time.

Referred sources of shoulder pain should be included in the differential diagnosis of shoulder pain. Potential sources include cervical spondylolysis, cervical arthritis, cervical disc disease, myocardial ischemia, reflex sympathetic dystrophy, diaphragmatic irritation, thoracic outlet syndrome, and gallbladder disease.

USING THE HISTORY AND PHYSICAL EXAMINATION

As noted above, the likelihood of specific conditions such as a complete rotator cuff tear varies with the setting, age of the patient, and specialty of the physician.[4,13,17,18] It is important to keep this pretest probability in mind while interpreting the history and

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TABLE 1

Differential diagnosis of shoulder pain

Diagnosis	Primary care setting[4,15] (%)	Age (y) of presentation, Mean (SD)[14]
Subacromial impingement syndrome	48–72	
Stage I (edema and hemorrhage)	16	23 (7)
Stage II (cuff fibrosis and partial tear)	42	41 (11)
Stage III (full-thickness tear)	15	62 (12)
Adhesive capsulitis	16–22	53 (10)
Acute bursitis	17	
Calcific tendonitis	6	
Myofascial pain syndrome	5	
Glenohumeral joint arthrosis	2.5	64 (10)
Thoracic outlet syndrome	2	
Biceps tendonitis	0.8	

physical examination. For example, a positive empty can test in a 50-year-old patient almost certainly represents a rotator cuff tear, whereas many younger patients with this finding will not have a tear. Moreover, certain components of the history and physical examination are more indicative of disorders while others are better at ruling them out. This concept is represented by the positive and negative likelihood ratios listed in Table 2.

The clinical evaluation begins with identification of the chief complaint and a thorough history. Common complaints include pain, weakness, stiffness, instability, locking, catching, and deformity.[26] Determining the duration of symptoms and mechanism of injury will narrow the differential diagnosis. If trauma occurred, the mechanism can determine radiological needs. Aggravating and alleviating factors should be reviewed, including work, recreation, sports, or hobbies. Night pain when lying on the affected side and a history of trauma in a patient older than 65 years both suggest a rotator cuff tear, but no individual symptom is definitive for the diagnosis (Table 2).[19] Pain with overhead work may indicate impingement syndrome, especially if the patient is symptomatic through the arc of 60 to 120 degrees.

The physical examination should include observation, palpation, range of motion (ROM), and provocative testing. Observation requires adequate exposure of the shoulders bilaterally to identify any gross deformities or abnormalities, including muscle atrophy, acromioclavicular joint disparity, or evidence of trauma. Muscle atrophy of either the supraspinatus or infraspinatus muscles is moderately predictive of rotator cuff tears in the elderly population, with a positive predictive value of 81%. However, this sign is not

TABLE 2

Use of history and physical examination to diagnose shoulder pain

History or maneuver	Study quality (1A–5)*	Sensitivity	Specificity	LR+	LR–	PV+	PV–
Rotator cuff tear							
History of trauma[19]	2B	36	73	1.3	0.88	72	37
Night pain[19]	2B	88	20	1.1	0.6	70	43
Painful arc[17]	2B	33	81	1.7	0.83	81	33
Empty can test[18,20,21]	1B	84–89	50–58	1.7–2	0.22–0.28	36–98	22–93
Drop sign[21]	1B	21	100	>25	0.79	100	32
Lift off test (for subscapularis tears)[21]	1B	62	100	>25	0.38	100	69
Impingement							
Hawkin's test[20,22]	1B	87–89	60	2.2	0.18	71	83
Instability							
Relocation test[23]	2B	57	100	>25	0.43	100	73
Augmented apprehension[23]	2B	68	100	>25	0.32	100	78
Labral tear							
Crank test[24]	2B	91	93	13	0.10	94	90
Active compression test[25]	1B	100	99	>25	0.01	95	100
Acromioclavicular joint							
Active compression test[25]	1B	100	97	>25	0.01	89	100

*Based on the guidelines for evidence quality outlined by the Center for Evidence-Based Medicine (http://163.1.96.10/docs/levels.html).
LR+ = positive likelihood ratio; LR– = negative likelihood ratio; PV+ = positive predictive value; PV– = negative predictive value.

TABLE 3

Imaging tests to diagnose shoulder pain

Diagnostic test	Study quality (1A–5)*	Sensitivity	Specificity	LR+	LR–	PV+	PV–
MRI							
Rotator cuff tears							
Partial[28]	2B	82	85	5.5	0.21	82	85
Complete[15]	1B	81	78	3.7	0.24	—	—
Overall[16,29,30]	2B	89–96	49–100	1.9 to >25	0.08	58	94
Impingement[28]	2B	93	87	7.2	0.08	93	87
Labral tears[31,32]	1B	75–89	97–100	>25	0.11–0.25	100	41
Plain arthrogram							
Rotator cuff tears							
Partial[33]	1B	70	—	—	—	—	—
Complete[15]	1A	50	96	13	0.52	—	—
CT arthrogram							
Rotator cuff tears							
Partial[33]	1B	70	—	—	—	—	—
Complete[33]	1B	95	—	—	—	—	—
Overall[33]	1B	86	98	>25	0.14	96	93
Ultrasound							
Rotator cuff tears							
Partial[33]	1B	80	—	—	—	—	—
Complete[33]	1B	90	—	—	—	—	—
Overall[33,34]	1B	86	91	9.6	0.15	96	73

*Based on the guidelines for evidence quality outlined by the Center for Evidence-Based Medicine (http://163.1.96.10/docs/levels.html).
CT, computed tomography; LR+ = positive likelihood ratio; LR– = negative likelihood ratio; MRI, magnetic resonance imaging; PV+ = positive predictive value; PV– = negative predictive value.

useful if absent, with a negative predictive value of only 43%.[19] No studies have assessed the role of palpation in the evaluation of shoulder pain. Nevertheless, the role of palpation in discerning acromioclavicular joint pathology from shoulder and neck makes it a useful part of the examination.

The shoulder's ROM should be evaluated both actively and passively. The shoulder is a mobile joint with a complexity of movements. These include flexion to 180 degrees, extension to 40 degrees, abduction to 120 degrees with palms down and 180 degrees with palms up, internal rotation to 55 degrees, and external rotation to 45 degrees with arms at the side. Although determining abduction ROM is consistent among examiners,[27] interrater reliability is poor for assessment of external rotation ROM. Lack of full ROM that is equally limited with both passive and active examination is found in arthropathies and adhesive capsulitis.

Pain between 60 and 120 degrees of abduction ("the painful arc") is associated with subacromial impingement, whereas pain after 120 degrees is an indication of acromioclavicular joint origin. However, Calis and coworkers[17] found that the presence of subacromial impingement has a positive likelihood ratio of only 1.7.

After assessing the ROM, the next steps are to evaluate the rotator cuff and biceps tendon, perform impingement testing, check for instability, and finally assess the acromioclavicular joint. The tests are listed in Table 2 in our preferred order of examination and represent the tests best supported by the evidence; the results are based on a literature search of Medline, PubMed, DARE, and Sports Discuss. The technique of each examination maneuver has been published elsewhere and is not described in detail here. Figures 1 through 4 illustrate several common examination maneuvers described below. A Web site that demonstrates the physical examination more thoroughly can be found at http://www.nismat.org/orthocor/exam/shoulder.html#Evaluation.

Rotator cuff tests

The drop arm test assesses the integrity of the rotator cuff, predominantly the supraspinatus muscle. The empty can test (Figure 1) isolates the supraspinatus against resistance. The lift off test (Figure 2) assesses the subscapularis integrity.

FIGURES 1 & 2

Figure 1: The empty can test

Figure 2: The lift off test

netic resonance imaging (MRI). Often no imaging is required, or plain radiographs are the sole imaging study needed. Soft tissue injuries are best identified by MRI or US, whereas bony pathology is seen best with plain radiographs or CT. Indications for imaging include severe injury, uncontrolled pain, failure of conservative therapy, return to play considerations, and examiner discretion. Table 3 outlines the accuracy of imaging modalities organized by diagnosis.

Impingement syndrome

Hawkin's sign (Figure 3) is a test for evidence of impingement by re-creation of its symptoms.

Glenohumeral joint stability

The augmented anterior apprehension test evaluates anterior shoulder instability. The relocation test, which helps confirm anterior instability, is carried out immediately after a positive anterior apprehension test.

Labral tears

The crank test is used to identify chronic labral injury, whereas the active compression test[25] (Figure 4) indicates labral injury if pain is deep in the shoulder.

Acromioclavicular joint

The active compression test[25] (Figure 4) indicates acromioclavicular joint inflammation, arthritis, or injury if pain is localized to the top of the shoulder.

DIAGNOSTIC TESTS

Imaging studies used in the evaluation of shoulder pain include plain radiographs, arthrography, computed tomography (CT), ultrasound (US), and magnetic resonance imaging (MRI).

Plain radiographs

Plain radiographs are the first step in diagnostic imaging. They can reveal fractures, dislocation, subluxation, bony lesions, outlet obstruction, acromioclavicular joint pathology, and arthritic changes. No definitive clinical studies on the needs of radiographs have been done. Plain radiographs should be taken when ROM is lost, especially when there is abduction of less than 90 degrees, severe pain, and after trauma. Our preferred x-rays include a glenohumeral anteroposterior (AP) view, a supraspinatus outlet view, and an axillary view. Anteroposterior views with internal and external rotation are added in cases of trauma to help rule out fracture. Positive acromioclavicular joint tests (crossover or palpation) should be followed by acromioclavicular joint radiographs because a shoulder series does not give a clear view of this joint. Additional views of the neck as well as a chest x-ray or abdominal imaging should be considered if a referred source of shoulder pain remains a possibility.

Arthrography

Arthrography was the diagnostic test of choice

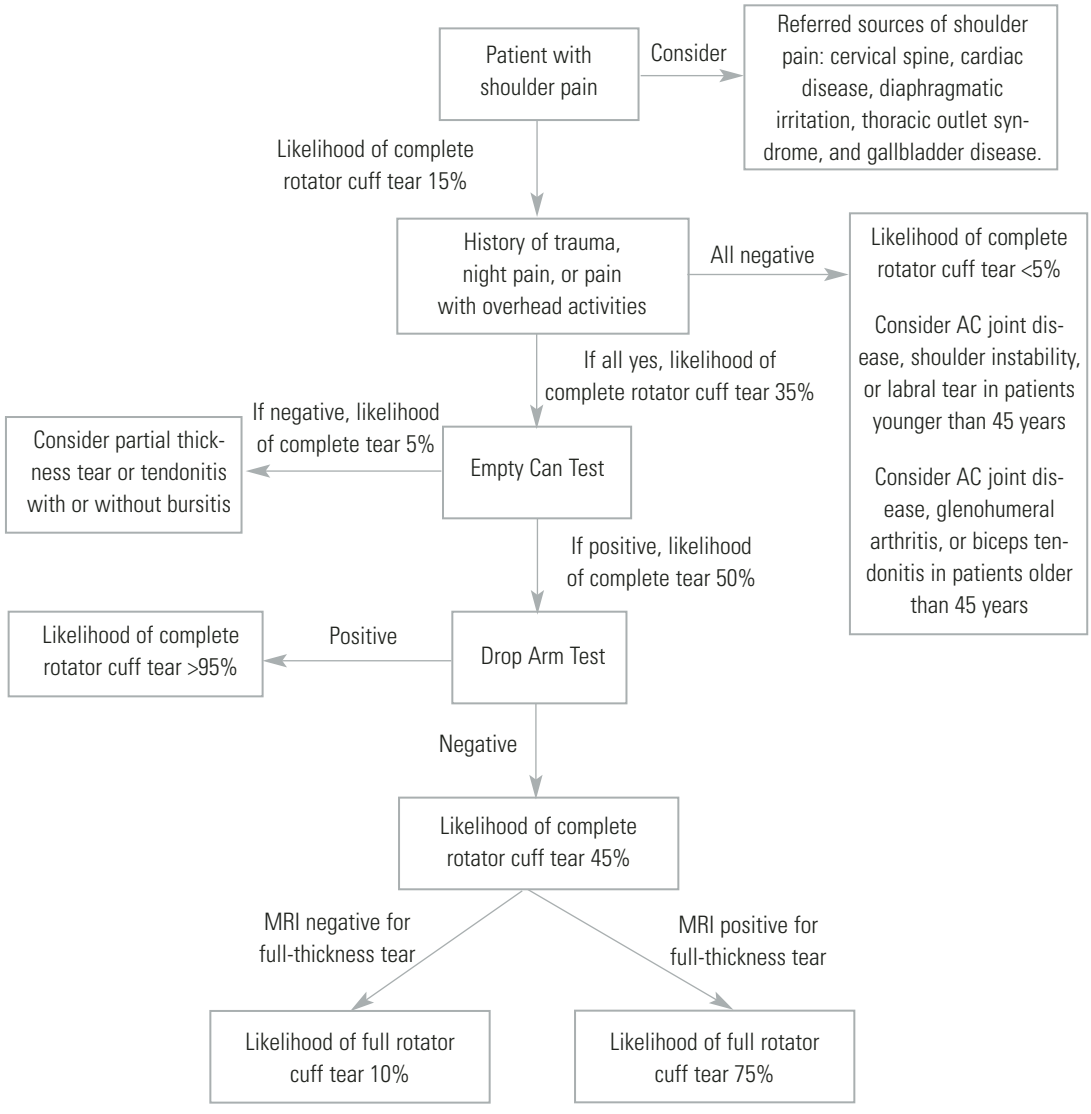
FIGURES 3 & 4

Figures 3A & 3B: Hawkin's sign

Figure 4: The active compression test

FIGURE 5

Basic approach to assess for complete rotator cuff tear



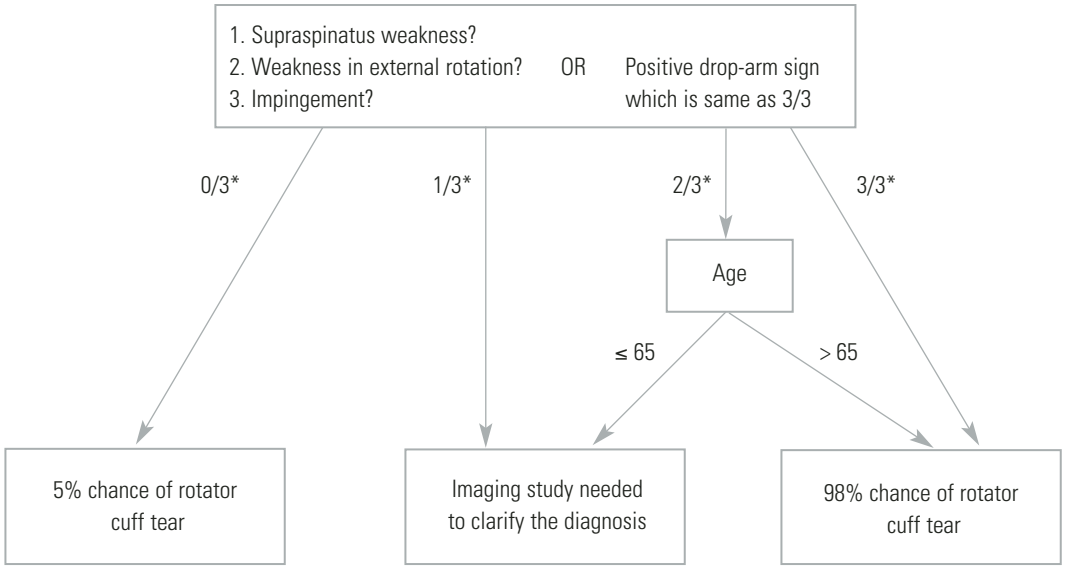
before MRI. It is specific for rotator cuff tears but lacks sensitivity[15] because it cannot detect partial-thickness or associated soft tissue injuries of the shoulder. Arthrography still has a role in evaluating adhesive capsulitis by demonstrating decreased intracapsular volume.[26] The test can be therapeutic if the capsule is dilated during the procedure. Additionally, patients with claustrophobia may be good candidates for arthrography if a full-thickness tear is suspected and MRI is not possible.

Computed tomography

Computed tomography may be used to evaluate bony lesions, including glenoid rim fractures, humoral fractures, and acromioclavicular joint disease. Computed tomography arthrograms may have a role in assessing labral tears and full-thickness rotator cuff tears.[35] The use of CT arthrography has fallen into disfavor compared with MRI because of the risks associated with contrast exposure and poor sensitivity for partial-thickness rotator cuff tears or associated soft tissue injury.

FIGURE 6

Alternative approach to a suspected rotator cuff tear



*Indicates number of physical examination findings that are present out of the 3 listed above.

Ultrasound

Ultrasound has been used in the evaluation of rotator cuff tears with varying degrees of sensitivity and specificity.[12,29,34] This inconsistency may be related to variation in operator skill. Advantages of US include relatively low cost, speed, and noninvasiveness.

Magnetic resonance imaging

Magnetic resonance imaging has become the gold standard for diagnostic imaging of the shoulder related to soft tissue injury. The advantages include its noninvasive nature, lack of contrast exposure, nonionizing radiation, high degree of resolution, and the ability to evaluate multiple potential pathologic processes.[36] Magnetic resonance imaging is the preferred test for evaluating impingement syndrome and rotator cuff pathology. A normal MRI greatly reduces the chances of a rotator cuff tear, with a negative likelihood ratio of 0.08.[16,29,30] Magnetic resonance imaging is also useful in the evaluation of avascular necrosis, biceps tendon disorders, inflammatory processes, and tumors.[13] The diagnosis of labral lesions can be challenging given the relatively low sensitivity and negative predictive value noted in several trials.[16,28,31] Finally, it is important to note that up to one third of all asymptomatic patients and more than half of those older than 60 years demonstrate asymptomatic rotator cuff tears on MRI.[37]

APPROACH TO THE PATIENT

A general approach to the patient with shoulder pain is summarized in Figure 5. Pre- and posttest probabilities are included to give an understanding of how tests may help diagnose or rule out a complete rotator cuff tear. A recent prospective study combining multiple examination maneuvers demonstrated that a combination of 3 physical examination findings (supraspinatus weakness, weakness in external rotation, and impingement) along with the patient's age can often diagnose or rule out a rotator cuff tear.[38] This group of tests did not distinguish full versus partial thickness tears. This approach is summarized in Figure 6.

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