



A Comprehensive Review of Physical Examination Tests of the Cervical Spine, Scapula, and Rotator Cuff

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Abstract

A thorough physical examination of the shoulder and cervical spine is critical in establishing a focused differential diagnosis of the pathology in and around the shoulder joint. Numerous tests have been described in the literature to help improve the diagnostic accuracy of specific shoulder or cervical spine pathology. A comprehensive approach for the physical examination of the cervical spine, scapula, and rotator cuff is presented and descriptions on how the tests are performed and the evidence behind why specific tests are used in enabling improved diagnosis of shoulder pathology are discussed.

Establishing a precise diagnosis of a patient who presents with shoulder pain requires a physical examination of the shoulder and cervical spine following a focused musculoskeletal history. The physical examination of the cervical spine and shoulder should proceed in a systematic manner followed by a more specialized examination based on patient age, symptoms, and occupation/athletic specialty. This article presents common cervical spine, scapula, rotator cuff, and subacromial impingement examination tests, how to perform them, and how to interpret them in an evidence-based manner.

History

A comprehensive history is crucial in helping confirm a suspected diagnosis and in allowing the physician to direct the focus of the physical examination. An adequate history should include the patient's age, occupation, mechanism of injury, location and quality/severity of pain, onset and duration of symptoms, aggravating and alleviating

factors, and previous treatments. The patient should also be asked if pain and/or instability is his or her main report. If instability is a report, previous dislocation/subluxation episodes and the methods required to reduce the shoulder should be clarified. Neck pain, decreased neck range of motion, prior cervical spine surgeries, numbness in the fingers, or radiating pain distal to the elbow should also be elucidated. Throwing athletes should be asked about changes in accuracy, velocity, and stamina and when they tend to experience pain during the throwing motion.

Physical Examination

The physical examination of the shoulder begins with the inspection of the affected shoulder girdle and is compared with the contralateral side. It is crucial to have the patient remove his or her shirt (chest covered in female patients) during the examination because inspection of the shoulder/periscapular region in the resting

Table 1

Diagnostic Accuracy of Cervical Spine Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR-
Spurling	30%-52%	74%-96%	1.9	0.67
Axial manual traction	43%-44%	90%-100%	4.4	0.62
Shoulder abduction	17%-47%	92%-100%	2.1	0.91
Valsalva	22%	94%	3.5	0.83
Upper limb tension	97%	22%	1.3	0.12

LR+ = positive likelihood ratios, LR- = negative likelihood ratios

Table 2

Diagnostic Accuracy of Scapula Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR-
Kibler assessment				
Type I-IV	10%-54%	62%-94%	NA	NA
(Yes/no)	74%-78%	31%-38%	NA	NA
Scapular retraction	26%	70%	NA	NA
Lateral scapular slide				
Position 1	28%	53%-55%	NA	NA
Position 2	50%	58%	NA	NA
Position 3	34%	35%-52%	NA	NA
Scapular assistance	NA	NA	NA	NA

LR+ = positive likelihood ratios, LR- = negative likelihood ratios, NA = not available

the examiner’s hand, external rotation with the arm at the side, and internal rotation (measured by how high the patient can reach on the spine) are most commonly used to assess glenohumeral range of motion. Normal values for these motions are 180°, 90°, 80° to 90°, and T5-T8, respectively. But these values can vary among patients, so they should always be compared with the contralateral side.¹ Patients who have restrictions in both active and passive range of motion (especially external rotation) compared with the contralateral side are likely to have adhesive capsulitis, glenohumeral osteoarthritis, or a posteriorly dislocated shoulder. A detailed history and radiographs can help discern between these pathologies. Restriction in solely active range of motion can result from pain secondary to a variety of shoulder pathologies, including arthritis, subacromial impingement, and rotator cuff injury.

Special Tests for Shoulder Pathology

More specialized tests for the cervical spine and shoulder girdle can be performed to help ascertain a diagnosis based on the patient’s history and preliminary examination findings. Beside listing sensitivities and specificities of these tests, likelihood ratios will be described when possible and help specify how much a given diagnostic test result will increase or decrease the pretest probability of the disorder of interest² (Tables 1–6). A likelihood ratio of 1 indicates that the posttest probability is exactly the same as the pretest probability.² The diagnostic accuracy of clinical examination tests are considered acceptable if positive likelihood ratios (LR+) are two or greater or if negative likelihood ratios (LR-) are 0.50 or less.² Tests with a low sensitivity, high specificity, and high LR++ are not useful as a screening test; but clinically, they can

position for asymmetry, scapular malposition, deltoid or rotator cuff atrophy, ecchymosis, erythema, wounds, or surgical incisions can provide valuable information.

After inspection, palpation should start at the cervical spine and proceed along the spinous processes of the cervical spine and the cervical paraspinal muscular region. Tenderness along the cervical spine or paraspinal regions may indicate degenerative disease or fracture of the cervical spine or muscular spasm/strain in the paraspinal or trapezius muscles; any step-off deformity of the cervical spine should also be noted if present. Osseous landmarks are then palpated in a systematic manner for tenderness, deformity, or fracture, and they include the sternoclavicular joint, clavicle, acromioclavicular joint, acromion, coracoid

process, and scapular spine. Soft-tissue landmarks are also palpated, including the lateral shoulder, periscapular region, and the long head of the biceps tendon. Distal pulses, capillary refill, and finger temperature should also be assessed. Finally, dermatomal sensation and resisted isometric strength testing in the C5-T1 distribution are tested and compared with the contralateral side.

Neck range of motion in flexion, extension, lateral flexion, and rotation should be ascertained. Generalized restrictions in neck motion or pain associated with neck motion should alert the physician for possible cervical spine pathology. Both active and passive glenohumeral range of motion should then be evaluated. Forward elevation, isolated glenohumeral abduction with the scapula stabilized by

be beneficial in helping to confirm a diagnosis if positive.³ Conversely, tests with a high sensitivity and low LR– are useful as screening tests because a negative clinical finding effectively rules out the diagnosis.³ Accuracy and predictive values vary with disease prevalence, and thus, these values are dependent on the patient population. Therefore, they are not an ideal estimator of test performance.³

Cervical Spine

A diagnosis of cervical radiculopathy secondary to cervical spine degenerative disk disease or disk herniation should be strongly considered in the presence of neck pain or radicular symptoms of pain, paresthesia, or numbness in the arm extending to the hand. Currently, no benchmark in diagnosing cervical radiculopathy exists because of the false-positive rates seen with cervical spine imaging and electrodiagnostic testing.⁴

Spurling Test

This is performed with the patient in a sitting position and having the patient extend, laterally flex, and rotate his or her head toward the affected side while the examiner axially compresses the patient's head⁵ (Figure 1). The appearance or exacerbation of radicular pain, paresthesia, or numbness in the shoulder or arm/hand are noted and considered a positive finding (Video Spurling, Supplemental Digital Content 1, <http://links.lww.com/JAAOS/A225>).^{2,5,6}

Axial Manual Traction Test

This is performed with the patient in a supine position and an axial traction force equivalent to 10 to 15 kg is performed by the examiner.⁵ A decrease or elimination of radicular symptoms is considered a positive test result (Video Axial Manual Traction, Supplemental Digital Content 2, <http://links.lww.com/JAAOS/A226>).^{2,5}

Table 3

Diagnostic Accuracy of Impingement Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR–
Neer sign				
Subacromial bursitis	75%-86%	48%-49%	1.41-1.69	0.29-0.55
Rotator cuff tear	59%-83%	47%-51%	1.12-1.44	0.52-0.86
Hawkins				
Subacromial bursitis	75%-92%	44%-48%	1.36-2.12	0.19-0.55
Rotator cuff tear	69%-88%	43%-48%	1.33-1.36	0.55-0.65
Painful arc				
Subacromial bursitis	71%	47%	1.33	0.63
Rotator cuff tear	67%-76%	47%-62%	NA	NA

LR+ = positive likelihood ratios, LR– = negative likelihood ratios, NA = not available

Table 4

Diagnostic Accuracy of Supraspinatus Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR–
Jobe				
Partial thickness tear or tendinitis	62%	54%	NA	NA
Full-thickness tear	41%	70%	1.37	0.84
Large or massive full-thickness tear	88%	70%	2.93	0.17
Full can				
Pain	66%-80%	50%-64%	NA	NA
Weakness	77%-83%	53%-74%	1.78-2.98	0.31-0.32
Drop arm	10%	98%	5.0	0.92
Painful arc	67%-98%	10%-62%	1.27-1.98	0.39-0.69

LR+ = positive likelihood ratios, LR– = negative likelihood ratios, NA = not available

Table 5

Diagnostic Accuracy of Infraspinatus and Teres Minor Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR–
External rotation				
Pain	54%	NA	NA	NA
Weakness	76%-84%	53%-57%	1.76	0.3
Patte (Hornblower)	79%-100%	67%-93%	12	0.05
External rotation lag sign	33%-100%	66%-100%	6.33	0.7

LR+ = positive likelihood ratios, LR– = negative likelihood ratios, NA = not available

Shoulder Abduction Test

This is performed with the patient in a sitting position and has the patient lift

his or her hand above his or her head.⁵ A positive test result is a decrease or elimination of the radicular symptoms

Table 6

Diagnostic Accuracy of Subscapularis Examination Tests				
Examination Tests	Sensitivity	Specificity	LR+	LR-
Belly press (Napoleon's)	28%-50%	96%-99%	12.2-20	0.61
Belly-off	86%	91%	9.67	0.14
Liftoff	12%-25%	95%-100%	4.96	NA
Bear hug	19%-60%	81%-92%	7.5	0.32
Internal rotation lag sign	20%-32%	93%-97%	NA	NA
Internal rotation resistance test at abduction and external rotation	77%	80%	NA	NA

NA = not available

(Video Shoulder Abduction, Supplemental Digital Content 3, <http://links.lww.com/JAAOS/A227>).^{2,5}

Valsalva Test

This is performed with the patient seated and having the patient take a deep breath and holding the breath while attempting to exhale for 2 to 3 seconds.² A positive test result leads to the reproduction of the radicular symptoms (Video Valsalva, Supplemental Digital Content 4, <http://links.lww.com/JAAOS/A228>).²

Upper Limb Tension Test

This is performed with the patient in a supine position and has the examiner sequentially depress the patient's scapula, abduct the shoulder, supinate the forearm, extend the wrist and fingers, externally rotate the shoulder, extend the elbow, and finally laterally flex the neck away from and then over to the affected side.² A positive test result occurs if the patient's radicular symptoms are reproduced, if a side-to-side difference of >10° is observed in elbow extension upon the completion of all motion sequences, or if symptoms are increased with contralateral lateral flexion of the neck or decreased with ipsilateral lateral flexion of the neck (Video Upper Limb Tension Test, Supplemental Digital Content 5, <http://links.lww.com/JAAOS/A229>).²

Cervical Spine Summary

The only useful screening test for the cervical spine is the upper limb tension test (sensitivity, 97%; LR-, 0.12).² The Spurling, axial manual traction, shoulder abduction, and Valsalva tests have a high specificity and LR+, meaning that they are useful in confirming the diagnosis of cervical spine pathology.^{2,5,6}

Scapular Dyskinesis

Variations in static positioning and dynamic motion of the scapula have been associated with numerous types of shoulder pathologies.⁷ Although the serratus anterior, trapezius, levator scapulae, rhomboids, and pectoralis minor help stabilize the scapula, the serratus anterior and trapezius are thought to be the most important for proper scapulothoracic motion.¹

Kibler Assessment

Visual assessment of the scapula is performed by inspecting bilateral scapular motion during shoulder elevation and lowering in the scapular and sagittal planes for any asymmetry in position or motion (Video Kibler Assessment, Supplemental Digital Content 6, <http://links.lww.com/JAAOS/A230>). Type I dyskinesia has a prominent inferior medial scapular border, type II has a prominent entire medial scapular border, type III has an excessive

Figure 1



Spurling test.

superior migration of the superior medial scapular border, and type IV has normal and symmetric scapular motion that is described as posterior tilting, external rotation, and upward rotation of the scapula during arm elevation.⁸ When comparing patients with shoulder injuries with those who had asymptomatic shoulders, the overall prevalence of scapular asymmetry in any plane was not different in scaption or flexion. This signifies that scapular asymmetry should not be used as the only criteria in deciding the clinical importance of scapular dyskinesia.⁹ In addition, Kappa coefficients for intertester reliability demonstrated only a fair-to-moderate level of agreement.^{9,10}

Scapular Retraction Test

This test first grades supraspinatus strength by performing an usual "empty can" manual muscle test with the patient placing his or her arm in 90° of abduction, 30° of horizontal adduction, and full internal rotation

while resisting downward force from the examiner's hand and then retests strength after the examiner places the scapula in a retracted position by applying pressure along the medial border of the scapula and manually stabilizes the scapula during strength assessment.^{7,11} A slight modification to this test occurs when the examiner also applies a posterior tilt to the scapula by pulling posteriorly on the acromion at the same time (Figure 2). A positive test result occurs when there is an increase in supraspinatus strength with scapular retraction (Video Scapular Retraction, Supplemental Digital Content 7, <http://links.lww.com/JAAOS/A231>).⁷

Lateral Scapular Slide Test

This test evaluates the position of the inferomedial border of the scapula on both sides in relation to the nearest spinous process in three different positions, with the arm relaxed at the sides, the hands on the hips with the thumb posterior and fingers anterior, and the arms at 90° of elevation with maximum internal rotation at the glenohumeral joint.^{12,13} A difference of 1.5 cm or greater between the side-to-side measurements is considered a positive finding.¹⁴

Scapular Assistance Test

During this test, the examiner supports scapular upward rotation and acromial elevation usually created by the serratus anterior and lower trapezius.⁷ This is performed by having the examiner push laterally and upward on the inferior medial scapular angle as the patient actively elevates the arm.⁷ A slight modification to this test adds assisted posterior tilting of the scapula during arm elevation by pulling backward on the superior aspect of the scapula¹⁵ (Figure 3). A positive test result occurs when there is relief of painful symptoms (Video Scapular Assistance Test, Supplemental Digital Content 8,

Figure 2



Scapular retraction test (with scapular retraction/posterior tilt).

<http://links.lww.com/JAAOS/A232>).⁷ Rabin et al¹⁵ demonstrated moderate intertester reliability when evaluating the modified scapular assistance test in patients with a variety of symptomatic shoulder disorders. No sensitivity or specificity of this test has been performed to date in the literature.

Scapular Dyskinesia Summary

No likelihood ratios are reported in the literature, making it difficult to determine how much these tests change the pretest probability (Table 2). Furthermore, none of these tests have been consistently reported to have high specificities or sensitivities or greater than fair-to-moderate inter-reliability.^{9-13,15} These tests should be interpreted with caution secondary to the challenges associated with assessing scapulothoracic motion

Figure 3



Scapular assistance test.

beneath the overlying muscle and subcutaneous tissues, the three rotational movements and two translations of the scapula, and their weak association with clinically relevant shoulder pathology.⁹

Rotator Cuff and Subacromial Impingement

The rotator cuff muscles are important rotators of the humerus in the coronal and axial planes and also are significant dynamic stabilizers of the glenohumeral joint via concavity compression.¹ When evaluating the rotator cuff, the examiner should always also assess the contralateral shoulder for comparison. In addition, the rotator cuff tendons and greater tuberosity pass near the coracoacromial arch and can lead to impingement syndrome in certain positions if contact develops between these structures. Impingement syndrome incorporates rotator cuff tendinitis, partial thickness or full-thickness rotator cuff tears, and subacromial bursitis. All the tests described below used arthroscopic findings as a reference standard

Figure 4



Jobe test.

unless mentioned otherwise. In comparison, MRI has a reported sensitivity and specificity of 71% to 89% and 71% to 97% in diagnosing rotator cuff tears.¹⁶

Subacromial Impingement

Neer

The Neer sign is performed by preventing scapular rotation with one hand while the other hand of the examiner passively forwardly elevates the arm with pain in the anterior or lateral shoulder signifying a positive result (Video Neer Sign, Supplemental Digital Content 9, <http://links.lww.com/JAAOS/A233>).¹⁷⁻¹⁹ Some have also described internally rotating the arm during forward elevation to decrease the subacromial space thus impinging the rotator cuff and greater tuberosity against the inferior surface of the acromion.²⁰ The Neer test involves injecting local anesthetic under the anterior acromion, which is considered positive if there is a reduction in or elimination of pain.¹⁷

Hawkins

This test is performed by combining forward elevation of the shoulder

to 90° with internal rotation of the arm.¹⁷⁻²⁰ A positive test occurs with pain located at the anterior edge of the acromion (Video Hawkins, Supplemental Digital Content 10, <http://links.lww.com/JAAOS/A234>).¹⁷

Painful Arc

This test is performed by having the patient maximally elevate their arm in the scapular plane and then lower the arm in the same plane.¹⁷⁻¹⁹ Maximal pain between 70° and 120° is considered a positive test (Video Painful Arc, Supplemental Digital Content 11, <http://links.lww.com/JAAOS/A235>).¹⁷

Subacromial Impingement Summary

When evaluating for either subacromial bursitis or rotator cuff tears, all three tests have greater sensitivity than specificity and thus are useful screening tests in ruling out these conditions if they are negative.¹⁷⁻²⁰ However, if these tests are positive, the possibility of other pathology in the shoulder still exists. The Neer sign is the only test to reliably predict

subacromial bursitis alone or partial thickness rotator cuff tears.¹⁷

Supraspinatus

Jobe

This test is performed with the patient placing his or her arm in 90° of abduction, 30° of horizontal adduction, and full internal rotation and resisting downward force from the examiner's hand^{3,18,19,21} (Figure 4). A positive test result has been described as pain and/or weakness (Video Jobe's, Supplemental Digital Content 12, <http://links.lww.com/JAAOS/A236>).

Full Can

This test is performed similarly as Jobe test except that the humerus is externally rotated 45°, simulating the position a person would hold a full can (Video Full Can, Supplemental Digital Content 13, <http://links.lww.com/JAAOS/A237>).^{18,19,22-24} Internal rotation of the humerus with Jobe test places the arm into more of an impingement position, and such positional pain may decrease the specificity of the test.²³ However, both sensitivity and specificity were similar to the reported values for the Jobe's test.^{18,19,23,24}

Drop Arm

This test is performed by having the patient actively abduct his or her shoulder to 90° and then to slowly lower the arm.²⁵ A positive test occurs when the patient cannot lower the arm slowly and instead drops the arm immediately because of pain (Video Drop arm, Supplemental Digital Content 14, <http://links.lww.com/JAAOS/A238>).²⁵

Painful Arc

This test is performed by passively elevating the patient's arm to 180° and then letting the patient actively lower the arm in the abduction plane.^{16,19} A positive test result occurs when the

Figure 5



External rotation test.

pain is minimal at full elevation but increases as the arm lowers to 90° and is maximal when the arm is between 70° and 120° of abduction (Video Painful Arc, Supplemental Digital Content 11, <http://links.lww.com/JAAOS/A235>).¹⁶

Infraspinatus/Teres Minor

External Rotation

This is performed with the patient's elbow in 90° of flexion with the arm by his or her side internally rotated 45° and then externally rotating the arm against resistance by the examiner (Figure 5) (Video ER, Supple-

mental Digital Content 15, <http://links.lww.com/JAAOS/A239>).²⁶

Patte (Hornblower)

This test is performed by having the examiner support the patient's elbow in 90° of flexion with the arm abducted in the scapular plane while the patient is asked to externally rotate the arm against resistance^{19,27} (Figure 6). A positive test result is indicated by the inability to externally rotate against resistance (Video Hornblower, Supplemental Digital Content 16, <http://links.lww.com/JAAOS/A240>).¹⁹

Figure 6



Patte or Hornblower test.

External Rotation Lag Sign (Dropping Sign)

This test is performed by placing the patient's elbow in 90° of flexion with the arm by the patient's side and then externally rotating the arm 45°. ²⁷ A positive test result occurs when the patient is not able to hold the externally rotated position after the examiner lets go of the forearm and the arm lags back to neutral external rotation (Video ER Lag Sign, Supplemental Digital Content 17, <http://links.lww.com/JAAOS/A241>).

Subscapularis

Belly Press (Napoleon)

This test is performed with the affected arm at the side and the elbow flexed to 90° and having the patient press the palm into his or her abdomen while keeping the arm maximally internally rotated so that the elbow is in front of the trunk²⁸ (Figure 7). This test is graded negative if the patient can push the hand against the stomach with the wrist fully extended but positive if the elbow or shoulder extends or if the wrist flexes because this indicates subscapularis deficiency with compensation from the posterior deltoid

Figure 7



Belly press or Napoleon test.

(Video Belly Press, Supplemental Digital Content 18, <http://links.lww.com/JAAOS/A242>).^{28,29} An advantage of the belly press test over the liftoff test is that it permits testing of the subscapularis even in relatively stiff and painful shoulders because the position of internal rotation behind the back used in the liftoff test can be quite painful and compromise testing.

Belly-off

This test is performed by placing the arm into the same position as the belly press test but then the elbow of the patient is supported by one hand of the examiner while the other hand brings the arm into maximum internal rotation with the palm of the patient on the abdomen.³⁰ If the patient cannot keep the wrist straight and actively maintain the position of internal rotation when the examiner releases the wrist as noticed by the wrist flexing or the hand lifting off the abdomen, this is a positive test (Video Belly-off Positive, Supplemental Digital Content 19, <http://links.lww.com/JAAOS/A243>).³¹

Liftoff

This test is performed by placing the hand of the affected arm on the back at the level of the midlumbar spine and having the patient internally rotate the arm to lift the hand off the back posteriorly²⁸ (Figure 8). The test is deemed positive if the patient cannot lift the arm off the back posteriorly or if he or she lifts the hand off the back by extending the elbow or shoulder (Video Liftoff, Supplemental Digital Content 20, <http://links.lww.com/JAAOS/A244>).²⁸

Bear Hug

This test is performed with the patient's palm of the affected shoulder placed onto the opposite shoulder with the elbow held in a position of maximal anterior translation and fingers extended, and the patient is asked to maintain this position as the examiner tries to pull the patient's hand off the shoulder using an external rotation force perpendicular to the patient's forearm²⁹ (Figure 9). A positive test result occurs if the patient cannot hold the hand against the shoulder or

Figure 8



Liftoff test.

demonstrates weakness of greater than 20% compared with the contralateral side (Video Bear Hug, Supplemental Digital Content 21, <http://links.lww.com/JAAOS/A245>).²⁹

Internal Rotation Lag Sign

This test is performed by having the affected arm of the patient held by the examiner behind the back and placed into maximum internal rotation by lifting the patient's hand away from the body before letting go of the patient's hand and asking them to hold this position.³² A positive test occurs when the patient cannot hold this position and the hand lags toward his or her back (Video internal rotation lag sign, Supplemental Digital Content 22, <http://links.lww.com/JAAOS/A246>).³²

Internal Rotation Resistance Test at Abduction and External Rotation

This is performed with the shoulder at 90° of abduction and external rotation and with the elbow at 90° of flexion.³² The patient resists an external rotation force applied perpendicular to the forearm by the

examiner, and the test is deemed positive if the patient shows weakness compared with the contralateral side (Video Internal Rotation Resistance Test at Abduction and External Rotation, Supplemental Digital Content 23, <http://links.lww.com/JAAOS/A247>).³²

Rotator Cuff Summary

Jobe test is useful as both a screening and confirmatory test for the supraspinatus with a LR+ of 2.93 and LR- of 0.17, but only if a large or massive full-thickness tear is present.^{3,18,19} The full can test has similar utility when weakness is used as a positive finding.^{18,19,23,24} The drop-arm test has a very high specificity and LR+ of 98% and 5.0, respectively, thus confirming its utility for detecting partial thickness or full-thickness rotator cuff tears when positive.^{18,19,33} The painful arc test is a valuable screening test given its high sensitivity of 67% to 98% and low LR- of 0.39 to 0.69.^{16,19}

Weakness in external rotation was noted to be a better screening test with a higher sensitivity and a low LR- of 0.3 than when pain was used with this test.^{16,19,24} Using arthroscopy or MRI with arthrogram as the reference standard, the external rotation lag sign was noted to have a specificity of 95% and LR+ of 6.33 for diagnosing full-thickness infraspinatus tears, making it an excellent confirmatory test if positive.³⁴

When evaluating the teres minor using CT arthrography as the reference standard, Patte test was found to be very sensitive and specific with a LR+ of 12 and LR- of 0.05 verifying its utility as both a screening and confirmatory test.^{18,27,35} Similarly, the external rotation lag sign was found to be highly sensitive and specific with a lag of greater than 40° being more specific than a lag of only 10°.^{27,35}

When evaluating the subscapularis using arthroscopy or MRI with ar-

throgram as the reference standard, the belly-off test is an excellent screening and confirmatory test with a sensitivity of 86% and specificity of 91% with a LR+ of 9.67 and LR- of 0.14.^{30,36} The belly press, liftoff, and bear hug tests were all found to be useful confirmatory tests with high specificities and LR+.^{18,29,34,37} In addition, the bear hug test was noted to have a 29% higher sensitivity than the belly press test when assessing partial tears of the subscapularis.²⁹ The liftoff test may be difficult to complete in the setting of pain and/or restricted range of motion because of the required position of the arm for proper evaluation. Similar to the other subscapularis examination tests, the Internal Rotation Lag Sign test had high specificity of 93% to 97%, but no likelihood ratios have been reported in the literature.^{32,37} Finally, the internal rotation resistance test at abduction and external rotation test was found to have a sensitivity of 77% and a specificity of 80%; but no likelihood ratios have been reported, and only the original article describing the examination maneuver has evaluated its diagnostic utility.³²

Combining positive test results can increase the likelihood ratios and posttest probabilities of having a partial thickness or full-thickness rotator cuff tear. Having weakness in external rotation and on Jobe test and having a positive Neer sign or Hawkins impingement test or having two of these positive tests in addition to being older than 60 years led to a 98% likelihood of having a rotator cuff tear.^{17,33} Another study found that having a positive result in painful arc and drop-arm tests and weakness in external rotation resulted in an LR+ of 15.6 and 91% probability of having a full-thickness rotator cuff tear.¹⁷ Conversely, if all three of these tests were negative, the LR- and probability were very low at 0.16 and 9%, respectively.¹⁷

Figure 9



Bear hug test.

Summary

Shoulder pain can be caused by a wide variety of pathology in or around the shoulder joint. Each test described above is not meant to be performed on every patient, but it should be considered if the history or the initial examination leads a clinician down a specific pathway toward potential diagnoses. Many of the physical examination tests with a high sensitivity and low LR- are excellent screening tests. But these can be positive with numerous shoulder pathologies and should be interpreted in conjunction with the clinical presentation. Although the literature reports on combinations of examination tests to help improve likelihood ratios and posttest probabilities of the conditions of interest, not every examination test described was evaluated. Thus, it is possible that inclusion of these tests in different combinations could alter the results reported in the literature.

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