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Diagnostic Clinical Tests in Rotator Cuff Tear: Which and Why?

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Abstract

Rotator cuff tear is a leading cause of shoulder pain resulting in varying degree of disability to perform activities of daily living. A methodical history taking and focussed clinical examination helps in establishing the clinical diagnosis. A number of tests are mentioned in the literature to test the integrity of rotator cuff. This narrative review will focus upon methodology of each test, and their diagnostic accuracy.

Keywords: Rotator cuff tear; Impingement; Clinical tests; Diagnosis.

Introduction

Shoulder pain is the third most common musculoskeletal condition requiring medical attention [1]. Among various painful conditions of the shoulder, rotator cuff tear remains one of the most significant problems resulting in pain, difficulty in moving the shoulder, and loss of strength affecting the activities of daily living [2]. Four muscles viz; Subscapularis (SSC), Supraspinatus (SS), Infraspinatus (IS), and Teres Minor (TM) form rotator cuff and are inserted over the tuberosity of the Humerus. The Subscapularis is an internal rotator and adductor; Supraspinatus is an abductor while Infraspinatus and Teres Minor are external rotators. Apart from individual movements performed by each muscle, another vital function of the rotator cuff is to keep the head of the Humerus depressed and centered into the glenoid fossa permitting a single center of rotation while allowing efficient abduction or forward elevation of the arm by the Deltoid [3, 4]. Any tear in the rotator cuff (single tendon or more) may results in minor or major dysfunction of the shoulder. Despite having recent advances in imaging that can quite accurately diagnose the pathology in the rotator cuff, the importance of clinical examination cannot be undermined. Although, clinical diagnosis of rotator cuff tear often matches with the findings of imaging, the assessment of local tenderness, range of motion (both active and passive), crepitus, and strength cannot be determined by any imaging modalities. A limited range of motion could suggest underlying frozen shoulder or glenohumeral arthritis. A full-thickness tear on an MRI or ultrasound could be well compensated clinically with a full range of motion and good strength, which may not require any surgical intervention. Therefore, a thorough history and clinical examination with a variety of tests have been quite useful in establishing the diagnosis of the rotator cuff tear. These tests can help in differentiating pain and dysfunction due to rotator cuff tear from other causes of the painful shoulder, such as glenohumeral arthritis, frozen shoulder, and acromioclavicular arthritis. This narrative review will present and discuss various tests utilized in the diagnosis of rotator cuff tear and their utility in clinical practice.

Clinical Presentation

The common clinical presentation of rotator cuff tear is a gradual onset of pain and or weakness in the affected shoulder. The pain often radiates to the tip of the deltoid and increases with attempted elevation, trying to grab objects from the shelf or reaching back. Further, the pain usually increases at night while lying on the affected side, disturbing the sleep. Sometimes, the patient may give a history of activity related mild jerk to the shoulder or fall over the tip of the shoulder or on the outstretched hand, and that may result in pain and or pseudoparalysis.

Examination of the shoulder reveals wasting of Supraspinatus and Infraspinatus in suprascapular and infrascapular fossae, respectively. There may be tenderness over the long head of the Biceps tendon in the bicipital groove depending upon the health of biceps tendon. In patients with full-thickness rotator cuff tear, passive range of motion (ROM) is usually well preserved unless there is concomitant stiffness. However, the active range of motion might be less due to loss of power.

While testing individual four rotator cuff muscles, there are three types of tests: 'Pain provocative or impingement tests,' 'specific tendon strength tests,' and 'composite tests for pain and weakness.' The latter two categories are tendon specific tests, whereas the former category is a non-specific test. There are over twenty-five special tests described for the examination of the rotator cuff [5, 6]. However, all of them are not required to be tested in routine clinical practice. In this review, we are going to discuss only selected tests for detection of the cuff pathology and their diagnostic accuracy using sensitivity, specificity, and likelihood ratios (positive and negative), enabling us to understand the utility of each test and its clinical importance. Before we embark upon the journey of description and diagnostic accuracy of clinical tests, it is essential to understand the meaning of various statistical terms such as sensitivity, specificity, and likelihood ratios, which will be frequently used in this review. The higher the sensitivity of a test, the better is its capability to rule out a condition if the test is negative. If a test carries high specificity, it implies that a positive test helps in confirming the presence of the disease. The likelihood ratios (LR) give estimate

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whether the condition is present or absent if the test is positive or negative. The test with positive LR (+LR) greater than 10 is quite conclusive about the presence of the condition, while +LR between 5-10 suggests a moderate increase in the likelihood of the condition. The test with negative LR (-LR) less than 0.1 is quite conclusive about the absence of the condition while -LR between 0.1-0.2 suggests a moderate decrease in the likelihood of the condition.

A. Pain provocative or impingement tests There are two frequently performed pain provocative or impingement tests during the assessment of the rotator cuff tear; Neer's impingement sign and Hawkins-Kennedy test.

1. Neer's Impingement sign [7]: With the patient sitting or standing, the examiner stabilizes the scapula with one hand while the other hand of the examiner passively raises the arm of the patient in gradual forward flexion. A positive test is if the maneuver produces pain which is usually felt after 140°-150° of flexion.

2. Hawkin's Kennedy test [8]: The examiner forward flexes the patient's shoulder to 90°, elbow is flexed to 90° and then shoulder is forcibly internally rotated by holding the forearm. This maneuver drives the greater tuberosity and subacromial bursa under the acromion and coracoacromial arch. Pain with this maneuver is considered positive for impingement, and more so for inflamed subacromial bursa.

B. Test for Supraspinatus

In a typical clinical setting, two commonly performed test for Supraspinatus tendon integrity are the Empty can test (Jobe) and the Full can test. Both are composite tests designed to assess strength and pain, and both are done similarly with only difference in shoulder rotation. The empty can is done in full internal rotation (thumb pointing downwards) while the full can is performed in 45° external rotation with the thumb pointing upwards.

1. Empty can (Jobe's test) [9, 10]: This test is done with the patient sitting or standing. Both the arms are abducted by 90° in the scapular plane, elbow extended, forearm pronated, and shoulders are completely internally rotated so that the thumb points downwards as if the patient is attempting to empty a can full of liquid. Now, the clinician applies a downward pressure over both the wrist or elbow and the patient is asked to resist this maneuver without shrugging his shoulders (Figure 1A). The test is considered positive if the patient experiences any pain or weakness, and that should be compared with other 'normal' side.

2. Full can test [11]: This test is done with the patient sitting or standing. Both the arms are abducted by 90° in the scapular plane; elbow extended, forearm mid-pronated, and shoulders are 45° externally rotated so that the thumb points upwards as if the patient is holding a can full of liquid. This maneuver is said to isolate supraspinatus in the best possible manner [11]. Now, the clinician applies a downward pressure over both the wrist or elbow and the patient is asked to resist this maneuver without shrugging his shoulders (Figure 1B). The test is considered positive if the patient experiences any pain or weakness, and that should be compared with other 'normal' side.

Although there is no statistical difference between the two tests considering four diagnostic parameters (sensitivity, specificity, +LR, and -LR), the full can test is more accurate (75%) than the empty can (70%) as the former considers muscle strength as the main parameter [12, 13]. Further, an empty can is a more painful test (50%) than a full can (43%) though the difference is not significant [12]. A recent recommendation is to consider muscle strength as the gold standard while diagnosing a full-thickness supraspinatus tear, and so full can test is more appropriate than the empty can test in establishing the diagnosis of supraspinatus tear as the latter is more pain provocative than the former [14].

3. Drop arm test [15]: In this test, the patient's shoulder is passively abducted to 90°, and then he/she is asked to lower it gradually. In case of a positive test, he/she is unable to lower the shoulder progressively and instead drops the arm suddenly because of pain.

While testing Infraspinatus and Teres Minor, most of the tests (External rotation lag test, resisted external rotation test (RERT), Patte's, Hornblower, and drop sign) performed are similar in principles as both muscles are external rotator of the shoulder. Hence, it is important to isolate these muscles while testing them individually. In experimental studies, it is proven that Infraspinatus works best as an external rotator when the arm is in 0° while Teres Minor works best when the shoulder is in 90° abduction [16]. Nevertheless, complete separation between the two is not possible, and some overlap does exists. Furthermore, TM's contribution is only 20% of external rotation strength in any degree of abduction [17].

C. Test for Infraspinatus

Many tests are described for Infraspinatus, such as the Resisted External rotation test, External rotation lag test at 20° and 90° (drop sign), and Patte's test.

1. Resisted external rotation test (RERT) [11]: With the patient

Figure 1:
(A) Empty can test;
(B) Full can test

Figure 2: (A) Resisted external rotation test in 0° abduction; (B) External rotation lag test in 20° abduction; (C) External rotation lag test in 90° abduction or Drop sign

sitting or standing, the clinician keeps the arm in 0° abduction and neutral rotation at the shoulder while the elbow is held at 90° flexion. The patient is asked to externally rotate his arm against resistance applied at the wrist and forearm (Figure 2A). The clinician must assess both strength and pain in RERT as former carries more weightage in the diagnosis of the Infraspinatus tear [18].

2. External rotation lag test at 20° [19]: With the patient standing or seated, the elbow is passively flexed to 90° and held with one hand of the clinician, and the affected shoulder is moved in 20° abduction in scapular plane and near maximum external rotation (maximum external rotation minus 5° to avoid elastic recoil of the shoulder) by holding near the wrist with another hand (Figure 2B). The patient is then asked to maintain the position of external rotation for a minimum of 10 seconds as the clinician releases the wrist. The sign is positive if the arm falls back by more than 10° into internal rotation.

3. External rotation lag test at 90° (drop sign) [19]: This test was designed to test the integrity of the Infraspinatus [19]. With the patient standing or seated, the elbow is passively flexed to 90° and supported by one hand of the clinician. At the same time, the shoulder is moved in 90° abduction in scapular plane and near maximum external rotation (maximum external minus 5° to avoid elastic recoil of the shoulder) by holding near the wrist with another hand (Figure 2C). The patient is then asked to maintain the position of external rotation for a minimum of 10 seconds as the clinician releases the wrist. The sign is positive if the arm fell back by more than 10° into internal rotation.

In a study of 54 patients, Walch et al. concluded that drop sign had 100% sensitivity and 100% specificity of a degenerated or torn Infraspinatus [20].

4. Patte's test [21]: This test was originally designed to test Teres Minor. However, some authors use it to test Infraspinatus too, as the sensitivity of this test for Infraspinatus tear is high (93%), and if negative, it rules out Infraspinatus tear. With the patient standing or seated, the elbow is passively flexed to 90° and supported by one hand of the clinician. At the same time, the shoulder is moved in 90° abduction in scapular plane and maximum external rotation. Now, the patient is asked to externally rotate the arm against the resistance offered by the clinician against the wrist (Figure 3).

D. Test for Teres Minor

The tests for Teres Minor are almost similar to Infraspinatus except for Hornblower's test. However, an increasing amount of lag or weakness while performing the test pushes the interpretation of the test more in favor of the tear of Teres Minor.

1. External rotation lag test at 20° [19]: It is performed similarly as described above for Infraspinatus. The sign is positive if the arm fell back by more than 10° into internal rotation. However, in a study of 10° patients, Collin et al. confirmed that the external rotation lag test at 20° is the most sensitive (100%) and specific (92%) test for Teres Minor, especially if the lag is more than 40° [22].

2. External rotation lag test at 90° (drop sign) [19]: It is performed similarly as described above for Infraspinatus. The sign is positive if the arm fell back by more than 10° into internal rotation.

3. Patte's sign [21]: This test was designed to detect tear of the Teres Minor in the presence of an Infraspinatus tear. It is performed similarly as described above for Infraspinatus.

4. Hornblower's sign [23]: It was first reported by Arthuis et al. in brachial plexus palsy, and indicates the difficulty in reaching to the mouth in case of deficient external rotators of the shoulder [23]. With the patient sitting or standing, the patient is asked to bring both the hands to the mouth. He can do it, but only with the elbow in a high position and the wrist in extension on the affected (index) side as if trying to blow a horn. On the intact side, the patient can reach the mouth without bringing the elbow high (Figure 4).

Figure 3: Patte sign

Figure 4: Hornblower sign

Figure 5: (A) Gerber's Lift off test; (B) Internal rotation lag test

Figure 6: (A) Belly press test; (B) Belly off test; (C) Bear Hug test

E. Test for Subscapularis tear

1. Gerber's Lift off test [24]: With the patient seated or standing, the clinician asks the patient to bring his/her hand behind the back at the level of the mid-lumbar spine with shoulder extended and internally rotated, and keep it away from the back as much as possible. The test is concluded positive if the patient is unable to keep it away from the back and is unable to resist the clinician's push towards the back applied over the palm of the patient (Figure 5A).

2. Passive Lift off (Internal rotation Lag sign) [25]: With the patient seated or standing, the clinician holds the wrist-hand of patient by one hand and passively brings the hand of the patient behind the back at the level of the mid-lumbar spine with shoulder extended and maximally internally rotated with the elbow supported by one hand, keeping the hand away from the back as much as possible. The patient is asked to hold the hand in the same position while the clinician releases the hand while the elbow is kept supported. The test is concluded positive if the patient is unable to hold it in the same position and hand drops over the mid-lumbar spine (Figure 5B).

3. Belly press (Napoleon) test [25]: The patient is asked to keep his/her hand over the belly with the shoulder in maximal internal rotation so that the elbow comes in the line of the wrist-hand plane or ahead of the trunk. The test is considered positive if the elbow falls behind the wrist-hand plane or trunk. In the modified belly press test described by Burkhart et al. and Scheibel et al., the patient is asked to keep his wrist-hand over the belly, bring the elbow in front of the trunk, and wrist palmar flexion angle (angle between palm and forearm) is measured (Figure 6A). 0^0 wrist flexion angle is suggestive of a Negative Napoleon test with normal Subscapularis, 30-60^0 wrist flexion angle is suggestive of an Intermediate napoleon test suggestive of a partial tear of SSC, while the angle of 90^0 is suggestive of a positive Napoleon test indicating non-functional Subscapularis [26, 27].

4. Belly off test [28]: 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. 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 (Figure 6B).

5. Bear hug test [29]: The clinician asks the patient to keep his hand over the opposite shoulder with extended fingers and elbow anterior to the body. The clinician then asks the patient to hold it in the same position as the clinician tries to pull the patient's hand away from the shoulder with external rotation force applied (Figure 6C).

Discussion

Various test described for the assessment of the cuff tear have different diagnostic precision (Table1). A single or combination of tests often provides a precise idea of identity of the torn tendon.

Two pain provoking impingement tests, namely the Neer's and Hawkins Kennedy test, were used to diagnose the presence of full-thickness tears. Both these tests have high sensitivity (SN) and low specificity (SP) (Table 1) [13, 30]. Nevertheless, even if the SP and SP of these two tests are combined, it marginally improves to 78% and 50%, respectively [31]. Further, LR (both positive and negative) of these two tests is not significant enough to give any superior diagnostic predictability about the presence or absence of the cuff tear [32, 33]. The area under the curve (ROC; receiver operative curve) is 0.74 and 0.76 for Neer's and Hawkins test, respectively, confirming limited usefulness even in the diagnosis of impingement [34]. They, therefore, individually have little value in establishing the diagnosis of posterosuperior rotator cuff tears. Furthermore, they can also be positive in almost all other painful conditions of the shoulder, such as frozen shoulder, glenohumeral arthritis, and calcific tendinitis, therefore undermining the utility of these test in the diagnosis of rotator cuff tear. Hence, they must be used in combination with other clinical examinations.

Regarding supraspinatus tear, namely, two composite tests assessing pain and strength are performed, i.e., Empty can (Jobe's) and Full can test. Although the SN and SP and LR ratios (positive and negative) of each test are similar with no statistical difference, the Full can test is slightly more accurate (75%) than the empty can test (70%). Further, it is concluded that strength assessment in full can test has more weightage in establishing the diagnosis of the supraspinatus tear than pain [14]. Besides, it has been shown that while performing Jobe's test, the internal rotation attitude of the shoulder would typically aggravate any inflamed structure between the greater tuberosity and coracoacromial arch such as subacromial bursitis, partial cuff tear, calcific tendinitis, acromial osteophytes causing pain induced weakness which makes a Jobe's test more of a pain provocation test than a strength test. Nevetheless, Jobe's utility is better with large tear of supraspinatus [34, 35]. Therefore, a Full can test is more reliable than the Empty can test in making a diagnosis of full-thickness supraspinatus tear. The drop arm test has a very high specificity (98%) and LR+ of 5 (moderate strength), suggesting that the presence of this test is quite diagnostic of a posterosuperior tear, if present [36]. A commonly observed painful arc sign in patients with rotator cuff tear has low SN (67-98%), SP (10-62%), and low LR+ ratio (1.2-1.9), undermining the diagnostic value of this test in the diagnosis of rotator cuff tear [37].

Table 1: Summary of Sensitivity, Specificity, Likelihood ratios (LR) of various tests for Rotator Cuff Integrity CI, Confidence Interval

	% (95% CI)		LR (95% CI)	
Test	**Sensitivity**	**Specificity**	**Positive LR**	**Negative LR**
Impingement tests [15, 32-34]				
Neer's Sign	64-68	30-61	0.98-1.6	0.6-1.1
Hawkins-Kennedy sign	76 (56-89)	48 (23-74)	1.5 (1.1-2.0)	0.51 (0.39-0.66)
Combined Neer's and Hawkins	78 (66-90)	50 (22-78)	1.6 (0.87-2.8)	0.43 (0.2-0.96)
Test for supraspinatus [16, 34, 35, 36]				
Empty can test (Jobe's)	71 (49-86)	49 (42-56)	1.3 (0.97-1.6)	0.64 (0.33-1.3)
Full can test	75 (64-85)	68 (54-83)	2.4 (1.5-3.8)	0.37 (0.23-0.6)
Drop arm test	24 (13-34)	93 (85-100)	3.3 (1.0-11)	0.82 (0.7-0.97)
Test for Infraspinatus [20, 38]				
External rotation resistance test	63 (49-77)	75 (69-82)	2.6 (1.8-3.6)	0.49 (0.33-0.72)
External rotation lag sign at 20^0	47 (21-71)	94 (85-100)	7.2 (1.7-31)	0.57 (0.35-0.92)
$> 10^0$ recoil				
External rotation lag sign at 90^0 - *Drop sign*	73 (51-95)	77 (62-92)	3.2 (1.6-6.5)	0.35 (0.15-0.83)
Patte test	58 (36-80)	60 (30-90)	1.4 (0.62-3.4)	0.70 (0.34-1.5)
Test for Teres Minor [22, 24, 33]				
External rotation lag sign at 20^0	100 (80-100)	51 (41-60)	--	--
$> 10^0$ recoil				
External rotation lag sign at 20^0	100 (80-100)	92 (84-86)	7.2 (1.7-31)	0.57 (0.35-0.92)
$> 40^0$ recoil				
External rotation lag sign at 90^0 - *Drop sign*	87 (62-96)	88 (80-93)	--	--
Patte test	93 (70-99)	72 (61-80)	--	--
Hornblower sign	100 (16-53)	98 (91-100)	22.15 (2.9-166)	0.66 (0.5-0.88)
Test for Subscapularis [33]				
Gerber's Lift off	34-68	50-77	1.4-1.5	0.63-.85
Passive lift off (Internal rotation lag) test	20-32	93-97	NA	NA
Belly press (Napoleon) test	28-50	96-99	12.2-20	0.61
Belly off test	86	91	9.67	0.14
Bear hug test	19-60	81-92	7.5	0.32

Regarding the assessment of Infraspinatus and Teres Minor integrity, the tests performed are similar except the Hornblower test, which is chiefly performed to assess the strength of the Teres minor. The external rotation lag test is most specific (94%) and has a high positive likelihood ratio (7.2), suggesting that presence of this sign would be highly likely of infraspinatus tear [38, 18]. If the lag exceeds more than 40^0, it would indicate the presence of Teres Minor tear [20, 22]. The resisted external rotation test (RERT) is more sensitive than lag test for the Infraspinatus suggesting that it is a better screening test [18]. Of note, assessment of strength during RERT carries more weightage with higher sensitivity (82%) than assessment of pain (36%) [18]. However, no single test for Infraspinatus can differentiate between partial and full-thickness tear, and combination of two tests improve the diagnostic precision [18]. Drop sign and Patte test also has a high specificity in the diagnosis of Infraspinatus but lower than ERLS.

The presence of the Hornblower sign indicates severe degeneration of Teres Minor or complete tear [20, 34]. In a study of 54 patients, Walch et al. found that Hornblower's sign is 100% sensitive and 93% specific for irreparable degeneration of Teres Minor [20]. Therefore, a positive Hornblower sign and ERLS sign > 40^0 must guard a surgeon about the possibility of severe degeneration or an irreparable TM along with damage to the IS. If ERLS is less than 40^0, once can proceed to check the Patte test and drop sign. However, the Patte test and drop sign and offers less accuracy over ERLS [22]. The Patte test and drop sign have acceptable accuracy and likelihood ratio in the diagnosis of TM tear, with the drop sign being slightly better [22].

While evaluating Subscapularis, the Belly-off test offers an excellent screening and confirmatory capabilities with high SN (86%), SP (91%), excellent accuracy of 90% along with a positive likelihood ratio of 9.67 and negative LR of 0.14 [39, 40]. The remaining tests like the belly press test, Passive lift-off test, and bear hug test have high specificity and LR+, and have good confirmatory value but less superior than the Belly-off test. In addition, Barth et al. concluded that the Bear hug test has superior sensitivity (29%) over the Belly press test in detecting partial tears of Subscapularis [29]. Of note, although Gerber's Lift-off test and internal rotation lag test has high specificity, it is difficult to perform in case of a painful shoulder with associated stiffness as both the test require maximal internal rotation.

Conclusion

Shoulder pain could occur due to a wide variety of pathologies, and a comprehensive clinical examination would help in near accurate clinical diagnosis of rotator cuff tear. The combination of the various test described for the cuff tear increase the post-test probabilities and likelihood ratios of the condition of interest. A test with high sensitivity and low negative likelihood ratio is a useful screening test, whereas a test with high specificity and positive likelihood ratio is an excellent confirmatory test. Hence, not all tests are required to be performed in a patient, and the clinician can choose the optimal screening and confirmatory tests to establish the diagnosis of rotator cuff tear.

References

1. *Bot SD, van der Waal JM, Terwee CB, van der Windt DA, Schellevis FG, Bouter LM et al. (2005) Incidence and prevalence of complaints of the neck and upper extremity in general practice. Ann Rheum Dis 64 (1):118-23. doi:10.1136/ard.2003.019349.*

2. *Oh LS, Wolf BR, Hall MP, Levy BA, Marx RG (2007) Indications for rotator cuff repair: a systematic review. Clin Orthop Relat Res 455:52-63. doi:10.1097/BLO.0b013e31802fc175.*

3. *Saha AK (1971) Dynamic stability of the glenohumeral joint. Acta Orthop Scand 42 (6):491-505. doi:10.3109/17453677108989066.*

4. *Hess SA (2000) Functional stability of the glenohumeral joint. Man Ther 5 (2):63-71. doi:10.1054/math.2000.0241.*

5. *Jain NB, Wilcox RB, 3rd, Katz JN, Higgins LD (2013) Clinical examination of the rotator cuff. PM R 5 (1):45-56. doi:10.1016/j.pmrj.2012.08.019.*

6. *Lädermann A, Meynard T, Denard PJ, Ibrahim M, Saffarini M, Collin P (2020) Reliable diagnosis of posterosuperior rotator cuff tears requires a combination of clinical tests. Knee Surg Sports Traumatol Arthrosc. doi:10.1007/s00167-020-06136-9.*

7. *Neer CS, 2nd (1983) Impingement lesions. Clin Orthop Relat Res (173):70-7.*

8. *Hawkins RJ, Kennedy JC (1980) Impingement syndrome in athletes. Am J Sports Med 8 (3):151-8. doi:10.1177/036354658000800302.*

9. *Jobe FW, Jobe CM (1983) Painful athletic injuries of the shoulder. Clin Orthop Relat Res (173):117-24.*

10. *Jobe FW, Moynes DR (1982) Delineation of diagnostic criteria and a rehabilitation program for rotator cuff injuries. Am J Sports Med 10 (6):336-9. doi:10.1177/036354658201000602.*

11. *Kelly BT, Kadrmas WR, Speer KP (1996) The manual muscle examination for rotator cuff strength. An electromyographic investigation. Am J Sports Med 24 (5):581-8. doi:10.1177/036354659602400504.*

12. *Itoi E, Kido T, Sano A, Urayama M, Sato K (1999) Which is more useful, the "full can test" or the "empty can test," in detecting the torn supraspinatus tendon? Am J Sports Med 27 (1):*

    65-8. doi:10.1177/03635465990270011901.

13. *Chew K PY, Chin J, ClarkeM,Wong YS. (2010) Clinical predictors for the diagnosis of supraspinatus pathology. Physiother Singap 13 (2):12-18.*

14. *Sgroi M, Loitsch T, Reichel H, Kappe T (2018) Diagnostic Value of Clinical Tests for Supraspinatus Tendon Tears. Arthroscopy 34 (8):2326-33. doi:10.1016/j.arthro.2018.03.030.*

15. *EA C (1934) The shoulder: rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa. In. G Miller & Co Medi Publishers, Brooklyn, New York, USA.*

16. *Kurokawa D, Sano H, Nagamoto H, Omi R, Shinozaki N, Watanuki S et al. (2014) Muscle activity pattern of the shoulder external rotators differs in adduction and abduction: an analysis using positron emission tomography. J Shoulder Elbow Surg 23 (5):658-64. doi:10.1016/j.jse.2013.12.021.*

17. *Gerber C, Blumenthal S, Curt A, Werner CM (2007) Effect of selective experimental suprascapular nerve block on abduction and external rotation strength of the shoulder. J Shoulder Elbow Surg 16 (6):815-20. doi:10.1016/j.jse.2007.02.120.*

18. *Sgroi M, Loitsch T, Reichel H, Kappe T (2019) Diagnostic Value of Clinical Tests for Infraspinatus Tendon Tears. Arthroscopy 35 (5):1339-47. doi:10.1016/j.arthro.2018.12.003.*

19. *Hertel R, Ballmer FT, Lombert SM, Gerber C (1996) Lag signs in the diagnosis of rotator cuff rupture. J Shoulder Elbow Surg 5 (4):307-13. doi:10.1016/s1058-2746(96)80058-9.*

20. Walch G, Boulahia A, Calderone S, Robinson AH (1998) The 'dropping' and 'hornblower's' signs in evaluation of rotator-cuff tears. J Bone Joint Surg Br 80 (4):624-8. doi:10.1302/0301-620x.80b4.8651.

21. Patte D, Goutallier D (1988) [Extensive anterior release in the painful shoulder caused by anterior impingement]. Rev Chir Orthop Reparatrice Appar Mot 74 (4):306-11.

22. Collin P, Treseder T, Denard PJ, Neyton L, Walch G, Lädermann A (2015) What is the Best Clinical Test for Assessment of the Teres Minor in Massive Rotator Cuff Tears? Clin Orthop Relat Res 473 (9):2959-66. doi:10.1007/s11999-015-4392-9.

23. Arthuis M (1972) [Obstetrical paralysis of the brachial plexus. I. Diagnosis. Clinical study of the initial period]. Rev Chir Orthop Reparatrice Appar Mot 58:Suppl 1:124-6.

24. Gerber C, Krushell RJ (1991) Isolated rupture of the tendon of the subscapularis muscle. Clinical features in 16 cases. J Bone Joint Surg Br 73 (3):389-94.

25. Gerber C, Hersche O, Farron A (1996) Isolated rupture of the subscapularis tendon. J Bone Joint Surg Am 78 (7):1015-23. doi:10.2106/00004623-199607000-00005.

26. Burkhart SS, Tehrany AM (2002) Arthroscopic subscapularis tendon repair: Technique and preliminary results. Arthroscopy 18 (5):454-63. doi:10.1053/jars.2002.30648.

27. Scheibel M, Tsynman A, Magosch P, Schroeder RJ, Habermeyer P (2006) Postoperative subscapularis muscle insufficiency after primary and revision open shoulder stabilization. Am J Sports Med 34 (10):1586-93. doi:10.1177/0363546506288852.

28. Scheibel M, Magosch P, Pritsch M, Lichtenberg S, Habermeyer P (2005) The belly-off sign: a new clinical diagnostic sign for subscapularis lesions. Arthroscopy 21 (10):1229-35. doi:10.1016/j.arthro.2005.06.021.

29. Barth JR, Burkhart SS, De Beer JF (2006) The bear-hug test: a new and sensitive test for diagnosing a subscapularis tear. Arthroscopy 22 (10):1076-84. doi:10.1016/j.arthro.2006.05.005.

30. Ardic F, Kahraman Y, Kacar M, Kahraman MC, Findikoglu G, Yorgancioglu ZR (2006) Shoulder impingement syndrome: relationships between clinical, functional, and radiologic findings. Am J Phys Med Rehabil 85 (1):53-60. doi:10.1097/01.phm.0000179518.85484.53.

31. Hermans J, Luime JJ, Meuffels DE, Reijman M, Simel DL, Bierma-Zeinstra SM (2013) Does this patient with shoulder pain have rotator cuff disease?: The Rational Clinical Examination systematic review. JAMA 310 (8):837-47. doi:10.1001/jama.2013.276187.

32. Salaffi F, Ciapetti A, Carotti M, Gasparini S, Filippucci E, Grassi W (2010) Clinical value of single versus composite provocative clinical tests in the assessment of painful shoulder. J Clin Rheumatol 16 (3):105-8. doi:10.1097/RHU.0b013e3181cf8392.

33. Silva L, Andréu JL, Muñoz P, Pastrana M, Millán I, Sanz J et al. (2008) Accuracy of physical examination in subacromial impingement syndrome. Rheumatology (Oxford) 47 (5):679-83. doi:10.1093/rheumatology/ken101.

34. Hegedus EJ, Goode A, Campbell S, Morin A, Tamaddoni M, Moorman CT, 3rd et al. (2008) Physical examination tests of the shoulder: a systematic review with meta-analysis of individual tests. Br J Sports Med 42 (2):80-92; discussion 92. doi:10.1136/bjsm.2007.038406.

35. Holtby R, Razmjou H (2004) Validity of the supraspinatus test as a single clinical test in diagnosing patients with rotator cuff pathology. J Orthop Sports Phys Ther 34 (4):194-200. doi:10.2519/jospt.2004.34.4.194

36. Murrell GA, Walton JR (2001) Diagnosis of rotator cuff tears. Lancet 357 (9258):769-70. doi:10.1016/s0140-6736(00)04161-1.

37. Hippensteel KJ, Brophy R, Smith MV, Wright RW (2019) A Comprehensive Review of Physical Examination Tests of the Cervical Spine, Scapula, and Rotator Cuff. J Am Acad Orthop Surg 27 (11):385-94. doi:10.5435/jaaos-d-17-00090.

38. Miller CA, Forrester GA, Lewis JS (2008) The validity of the lag signs in diagnosing full-thickness tears of the rotator cuff: a preliminary investigation. Arch Phys Med Rehabil 89 (6):1162-8. doi:10.1016/j.apmr.2007.10.046.

39. Bartsch M, Greiner S, Haas NP, Scheibel M (2010) Diagnostic values of clinical tests for subscapularis lesions. Knee Surg Sports Traumatol Arthrosc 18 (12):1712-7. doi:10.1007/s00167-010-1109-1.

40. Hegedus EJ, Goode AP, Cook CE, Michener L, Myer CA, Myer DM et al. (2012) Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med 46 (14):964-78. doi:10.1136/bjsports-2012-091066.

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