"Clinical Orthopaedic tests relevant to MSK Radiology - what every MSK radiologist must know".

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Learning objectives

The aim of this poster is to revisit the most common orthopaedic manoeuvres for various joints in the upper and lower extremities, to get an idea how they are performed and how to correlate them for interpretation of imaging.

This poster provides a quick algorithm to establish a clinical examination road map and rapidly review the clinico-radiological use of a particular test. The specialized tests that allow differentiation of various joint diseases are discussed and some are demonstrated in pictures along with some relevant ultrasound/MR images.
Background

The internal derangement of joints throughout the musculoskeletal system can be assessed via multiple orthopaedic maneuvers. Given there are so many tests for each joint, it can be confusing at times, but an understanding of these tests provides valuable information to the radiologist responsible for interpreting the findings of studies ordered to evaluate the joints when an orthopedic test result is found to be abnormal. The ability to clinically correlate the radiologic findings on their own, particularly those found at magnetic resonance (MR) and ultrasound imaging examinations, is important for a musculoskeletal radiologist because it enhances the communication between the radiologist and orthopedic surgeon, helps avoid diagnostic errors, and also helps focus the radiology report to the clinical question. Review of the diagnostic accuracy and differential diagnoses on the basis of the orthopedic tests and the imaging examinations provides insight into the usefulness of the tests.
Findings and procedure details

Shoulder joint common orthopaedic manoeuvres

Assessment of Shoulder Pain

Range of motion:

Apley scratch test (figs 1, 2) - A quick test of mobility in the shoulder is to ask the patient to place the hand behind his or her head and touch the contralateral scapula. In a second movement, the patient places the hand behind his or her back, reaching upward from the buttocks to touch the inferior margin of the scapula. Restricted mobility during this test, the quick test of combined motion, suggests a shoulder disorder. This is a nonspecific test because limited mobility and associated pain may be present in multiple conditions, including disorders of the rotator cuff or adhesive capsulitis.

Shoulder Impingement:

Rotator cuff impingement may be secondary to nonoutlet impingement or outlet impingement, the latter of which is the focus here. Clinically, impingement is assessed with the Neer sign and Hawkins sign. Both signs test for pain when the rotator cuff or subacromial bursa contacts the coracoacromial arch, specifically the coracoacromial ligament and anterior acromion.

Neer test (fig 3): A positive Neer test is pain provoked by passive forward elevation of the internally rotated arm, with maximal pain usually elicited between 90° and 130° of elevation, although the patient may not have pain until maximal forward elevation is reached at 150°-170°. It is important to note that stabilization of the scapula during the examination is critical to prevent a false-negative result. A positive Neer sign occurs in subacromial bursitis, calcific tendinitis, osseous lesions, and rotator cuff tears.

Hawkin's test (fig 4): A positive Hawkins sign is pain produced during horizontal adduction and forced internal rotation of the shoulder and occurs in supraspinatus tendinopathy or outlet impingement.
MR imaging is 98% sensitive and 36% specific in diagnosis of subacromial impingement syndrome. While MR imaging is excellent for identifying some of the predisposing factors, shoulder impingement is a clinical diagnosis.

Rotator cuff tear:

Jobe test (figs 5, 6)- this is performed by placing the arm into 90° of elevation in the scapular plane and asking the patient to hold that position, first against gravity and then against resistance. It is a two-part test. The first part is performed with the shoulder in internal rotation (thumbs-down position) and the second part with the shoulder in external rotation (thumbs-up position). The test result may be positive for pain or weakness. Occasionally, the patient may be unable to hold the arm against gravity, suggesting significant weakness of the supraspinatus. The Jobe sign may also be positive in suprascapular neuropathy. Typically, in patients with subacromial bursitis or a supraspinatus tear, the pain decreases in the thumbs-up position as the external rotation position rotates the supraspinatus away from the coracoacromial arch. The sensitivity, specificity, and accuracy of this test are better for full-thickness tears than for partial-thickness tears.

Drop arm test - A possible rotator cuff tear can be evaluated with the drop-arm test. This test is performed by passively abducting the patient’s shoulder, then observing as the patient slowly lowers the arm to the waist. Often, the arm will drop to the side if the patient has a rotator cuff tear or supraspinatus dysfunction. The patient may be able to lower the arm slowly to 90 degrees (because this is a function mostly of the deltoid muscle) but will be unable to continue the maneuver as far as the waist.

AC Joint arthritis:

Cross-arm test (fig 7)- Patients with acromioclavicular joint dysfunction often have shoulder pain that is mistaken for impingement syndrome. The cross-arm test isolates the acromioclavicular joint. The patient raises the affected arm to 90 degrees. Active adduction of the arm forces the acromion into the distal end of the clavicle. Pain in the area of the acromioclavicular joint suggests a disorder in this region.

Wrist Joint
Tenosynovitis:

Finkelstein test (figs 10,11) - This is positive if pain and crepitation are elicited above the radial styloid. A positive test is suggestive of tenosynovitis of the first compartment, also known as De-Quervain disease. Possible mimics include carpometacarpal arthritis, intersection syndrome, and scaphoid fractures.

Nerve lesions and compression neuropathies:

Most common compression neuropathy affecting wrist is the median nerve neuropathy. Following tests are usually performed for evaluation of median nerve compressive neuropathy:

The Phalen test (fig 12)- A positive Phalen test occurs when there is paresthesia in the median nerve distribution and is indicative of carpal tunnel syndrome. The differential diagnosis includes tenosynovitis and pronator syndrome. It has the overall highest accuracy for diagnosis of a median nerve lesion involving the carpal tunnel.

The median nerve Tinel sign is positive if the patient experiences pain and paresthesia in the distribution of the median nerve in the hand and forearm. Tenosynovitis is the differential diagnostic consideration.

Hip Joint - common orthopaedic manoeuvres

Trendelenburg sign (fig 15): It is positive if, when standing on one leg (single-stance), the contralateral pelvis drops. This indicates weakness of the hip abductor muscles, specifically the gluteus medius and minimus, on the side of the stance leg. This sign has been shown to be 72% sensitive and 76% specific in diagnosis of gluteus medius tears. MR imaging has demonstrated 33%-100% sensitivity and 92%-100% specificity for diagnosis of gluteal tendon tears.

Knee joint
Meniscus pathology:

McMurray test (fig 17) - It is the most commonly used test to evaluate for meniscal disease. Pain with a palpable or audible pop in abduction and external rotation indicates a medial meniscal lesion. Pain with a palpable or audible pop in internal rotation indicates a lateral meniscal lesion. False-positive cases include cartilage lesions, synovial abnormalities, and ligamentous lesions.

Ligament pathology:

Lachman test: It demonstrates mobility of the tibia with respect to the femur without a hard stop in cases of an ACL tear. If there is a hard anterior end point within 3 mm, then the ACL is intact; however, if the end point exceeds 5 mm, then the ACL is lax or there is evidence of remote trauma. An ACL tear is diagnosed if there is a soft end point or no end point. A false-negative examination may occur in improper stabilization of the femur, meniscal lesion, intracondylar osteophytes, or medially rotated tibia.

Anterior drawer test (fig 18): This is also used in assessment of the ACL and is positive when there is anterior displacement of the tibia with a soft end point, indicative of chronic ACL insufficiency.

Posterior drawer test: Posterior translation of the knee is assessed in neutral, internal, and external rotation, similar to the anterior drawer test, and posterior translation of the tibial plateau on the femur indicates a positive posterior drawer test. PCL injury, dislocation, and posterolateral corner (PLC) injury make up the differential diagnosis.
Fig. 1: Apley scratch test (step 1)

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**Fig. 2:** Apley scratch test (step 2)

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Fig. 3: Neer test

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Fig. 4: Hawkin’s test

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Fig. 5: Jobe test (thumbs down/empty can position)

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Fig. 6: Jobe test (Thumbs up - full can position)

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Fig. 7: Cross Arm test

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Fig. 8: Shoulder impingement: Subacromial subdeltoid bursitis with thickening and excess fluid in the bursa

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Fig. 9: Supraspinatus-partial-tear-with-subacromial-impingement.jpg Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 42429

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**Fig. 10:** Wrist : Finklestein test (part 1)

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**Fig. 11:** Wrist : Finklestein test (part 2)

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**Fig. 12:** Wrist: Phalen test

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**Fig. 13:** De-Quervain’s tenosynovitis. Thickening of common synovial sheath of 1st extensor compartment is noted. There is a thickened vertical septum between two tendons of 1st extensor compartment. The abductor pollicis longus and extensor pollicis brevis tendons show thickening along with few tiny hypoechoic clefts. No tendon tear is detected. Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 21381

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Fig. 14: Carpal Tunnel Syndrome. Maximum cross sectional area of the median nerve, noted just proximal to the tunnel, is 16 mm (normal - up to 10 mm). Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 20409

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Fig. 15: Hip joint: Trendelenberg test © Foto H.-P.Haack

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Fig. 16: Gluteus medius tear seen as high T2 signal on STIR Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 7251

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Fig. 17: Knee examination: McMurray test Image courtesy FPnotebook.com

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Fig. 18: Knee: Anterior Drawer test

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Fig. 19: Sag T2 MRI images. MRI of the left knee demonstrates a full thickness bucket handle tear of medial meniscus, subchondral marrow edema, MCL strain and osteoarthritic changes at the tibiofemoral articulation. Case courtesy of Dr Nafisa Shakir Batta, Radiopaedia.org, rID: 29285

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Fig. 20: Coronal T2 fat sat MRI images. MRI of the left knee demonstrates a full thickness bucket handle tear of medial meniscus, subchondral marrow edema, MCL strain and osteoarthritic changes at the tibiofemoral articulation. Case courtesy of Dr Nafisa Shakir Batta, Radiopaedia.org, rID: 29285

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Fig. 21: Sag PD MRI sequences showing the complete tear of the anterior cruciate ligament Case courtesy of Dr Bruno Di Muzio, Radiopaedia.org, rID: 41380

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Fig. 22: Coronal PD SPAIR MRI sequences showing the complete tear of the anterior cruciate ligament Case courtesy of Dr Bruno Di Muzio, Radiopaedia.org, rID: 41380

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Conclusion

It is important for the consulting radiologist to understand the jargon of the various orthopedic tests. It is important to keep in mind that some tests are done only to localize disease and are not definitively diagnostic so as to not miss important abnormalities. Although many clinical histories in the requisition are nonspecific, when a specific test is mentioned, it is useful for the radiologist to have an understanding of the meaning of the test as well as the corresponding diagnostic utility of MR and ultrasond imaging. Familiarity with these tests, their implications, and their diagnostic utility is important and enables radiologists to hone their search pattern and better communicate with the orthopedic surgeon, both during daily interpretation of imaging studies as well as during interdisciplinary conferences, therefore contributing to optimal patient care.
References


