

# *Guidebook for Common Orthopedic Injuries*

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# I. Rotator Cuff Injuries

## **Overview**

The rotator cuff is a group of muscles and tendons that surround the shoulder joint, keeping the head of your upper arm bone firmly within the shallow socket of the shoulder. A rotator cuff injury can cause a dull ache in the shoulder, which often worsens when you try to sleep on the involved side.

Rotator cuff injuries occur most often in people who repeatedly perform overhead motions in their jobs or sports. Examples include painters, carpenters, and people who play baseball or tennis. The risk of rotator cuff injury also increases with age.

Many people recover from rotator cuff disease with physical therapy exercises that improve flexibility and strength of the muscles surrounding the shoulder joint.

Sometimes, rotator cuff tears may occur as a result of a single injury. In those circumstances, medical care should be provided as soon as possible. Extensive rotator cuff tears may require surgical repair, transfer of alternative tendons or joint replacement. Rotator cuff injuries can range in severity from simple inflammation to complete tears

## **Symptoms**

The pain associated with a rotator cuff injury may:

- Be described as a dull ache deep in the shoulder
- Disturb sleep, particularly if you lie on the affected shoulder
- Make it difficult to comb your hair or reach behind your back
- Be accompanied by arm weakness

## **Causes**

Rotator cuff disease may be the result of either a substantial injury to the shoulder or to progressive degeneration or wear and tear of the tendon tissue. Repetitive overhead activity, heavy lifting over a prolonged period of time, and the development of bone spurs in the bones around the shoulder may irritate or damage the tendon.

The following factors may increase your risk of having a rotator cuff injury:

- Age. As you get older, your risk of a rotator cuff injury increases. Rotator cuff tears are most common in people older than 40.
- Certain sports. Athletes who regularly use repetitive arm motions, such as baseball pitchers, archers and tennis players, have a greater risk of having a rotator cuff injury.
- Construction jobs. Occupations such as carpentry or house painting require repetitive arm motions, often overhead, that can damage the rotator cuff over time.
- Family history. There may be a genetic component involved with rotator cuff injuries as they appear to occur more commonly in certain families.

## Complications:

Without treatment, rotator cuff disease may lead to permanent stiffness or weakness and may result in progressive degeneration of the shoulder joint.

Although resting your shoulder is necessary for your recovery, keeping your shoulder immobilized for a prolonged time can cause the connective tissue enclosing the joint to become thickened and tight (frozen shoulder).

## Treatment

**Conservative treatments** — such as rest, ice and physical therapy — sometimes are all that's needed to recover from a rotator cuff injury. If your injury is severe and involves a complete tear of the muscle or tendon, you might need surgery.

**Injections:** If conservative treatments haven't reduced your pain, your doctor might recommend a steroid injection into your shoulder joint, especially if the pain is interfering with your sleep, daily activities or exercise. While such shots are often helpful, they should be used judiciously, as they can contribute to weakening of the tendon.

**Therapy:** Physical therapy exercises can help restore flexibility and strength to your shoulder after a rotator cuff injury. Sometimes it is possible to eliminate pain and restore function without surgery.

**Surgery:** Many different types of surgeries are available for rotator cuff injuries, including arthroscopic tendon repair, open tendon repair, bone spur removal, tendon transfer and shoulder replacement.

## Rotator Cuff Physical Examinations

### Range of Motion

The supraspinatus assists in elevation (abduction) of the arm; infraspinatus and teres minor in external rotation, and; subscapularis in internal rotation. Active and passive range of motion is assessed. If time is a constraint, the authors recommend limiting the assessment to active range of motion only since rotator cuff tears lead to loss of active range of motion and passive range of motion is often preserved. Passive motion is typically limited in glenohumeral articular disorders.

Range of motion is measured in degrees and best assessed with a goniometer. Goniometers are commercially available via numerous vendors. If range of motion cannot be assessed with a goniometer due to time constraints, subjective assessment of range of motion and comparison with the contralateral shoulder is recommended.

The protocol outlined below for range of motion measurement is modified from prior studies and performed in the standing position.

### Forward Flexion

Flexion is performed by asking the patient to raise the arm straight up in front of them as high as the patient can with the thumb pointing upwards. The flexion angle is formed by aligning the goniometer with the lateral epicondyle of the humerus, the middle of the glenoid fossa, and a vertical line in the coronal plane ([Figure 3a](#)).



[Figure 3](#)

### Range of motion testing

#### Isolated Abduction

Abduction is performed by asking the patient to raise the arm at the side as high as they can with the examiner stabilizing the scapula by holding it down. The abduction angle is formed by aligning the goniometer with the lateral epicondyle of the humerus, the middle of the posterior glenohumeral joint line, and a vertical line in the sagittal plane ([Figure 3b](#)).

#### External Rotation at 0 Degrees (in neutral)

This is performed with the patient in 0 degrees of glenohumeral joint abduction, 90 degrees of elbow flexion, and neutral supination/pronation forearm position. The patient is then asked to keep his elbow to his/ her waist and rotate the arm outwards. The external rotation angle is formed by aligning the goniometer with the ulna styloid process, the olecranon process of the ulna, and a horizontal line in the transverse plane ([Figure 3c](#)).

#### External/ Internal Rotation at 90 Degrees (in abduction)

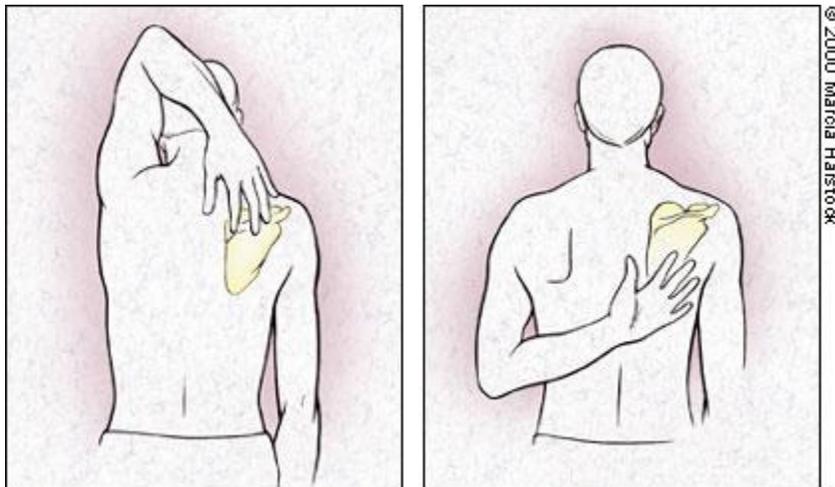
The patient is in 90 degrees of glenohumeral abduction, 90 degrees of elbow flexion, and neutral supination/pronation of forearm. The patient is then asked to keep the elbow at 90 degrees and move the forearm upwards as high as they can and then downwards as low as they can. The external rotation and internal rotation angles in 90 degrees of abduction are formed by aligning the goniometer with the ulnar styloid process, the olecranon process of the ulna, and a horizontal line in the horizontal plane ([Figure 3d](#)).

#### Highest Posterior Anatomy Reached with Thumb

The patient is asked to reach his back with the dorsum (back) of his/ her thumb. The patient is then asked to reach as high as they can along the spine. The highest level that the patient can reach is marked. The bony landmarks adapted from Malanga et al. are the inferior border of the scapula that corresponds to the T7 level and the top of the iliac crests that corresponds to the L4 level. Follow up the spinous processes from L4 to mark the L1 level. The highest point is noted as follows: above T7; between T7 and above L1; between L1 and above L4; L4 and below; and to the body (if the patient cannot reach their back).

### **Apley Scratch Test**

The Apley scratch test is another useful maneuver to assess shoulder range of motion. In this test, abduction and external rotation are measured by having the patient reach behind the head and touch the superior aspect of the opposite scapula. Conversely, internal rotation and adduction of the shoulder are tested by having the patient reach behind the back and touch the inferior aspect of the opposite scapula. External rotation should be measured with the patient's arms at the side and elbows flexed to 90 degrees.



Apley scratch test. The patient attempts to touch the opposite scapula to test range of motion of the shoulder. (Left) Testing abduction and external rotation. (Right) Testing adduction and internal rotation.

### **Strength Testing**

Strength testing is performed using a portable hand-held dynamometer. Numerous devices are commercially available for this purpose and measure strength in kilograms or pounds. After positioning the shoulder for each of the maneuvers (described below), the patient is told, "This part of the test requires me to match your resistance. Now, please to push into the dynamometer as hard as you can." Once the examiner feels that they have matched the subject's resistance so that the muscle contraction is truly isometric the patient is asked to continue pushing into the dynamometer, while the tester resists the force exerted by the subject, maintaining positional equilibrium throughout the 5 second period of exertion. The examiner lets them know when the 5 seconds time is up. The examiner disregards the muscle performance measurement if it is determined that the patient inappropriately used other musculature to complete the desired task. All maneuvers are performed twice on each arm with a 10 second rest between repetitions. The scores are then averaged for each arm and evaluated for symmetry. The protocol below is modified from prior studies and our experience.

**External Rotation** (measures force predominately exerted by infraspinatus muscle)

The patient is instructed to sit with their arm in neutral rotation while holding their elbow and forearm at 90 degrees of flexion. The forearm is in midrange of motion between supination and pronation with the thumb directed upward. The tester places the dynamometer on the lateral surface of the distal forearm just proximal to the ulnar styloid process ([Figure 4a](#)).



[Figure 4](#)

Strength testing using a dynamometer

**Abduction** (measures force predominately exerted by supraspinatus muscles)

The patient sits with both shoulders in approximately 90 degrees abduction and approximately 45 degrees of horizontal abduction (elbows are fully extended with palms facing down). The tester places dynamometers on each distal arm at the lateral humeral epicondyle ([Figure 4b](#)).

**Internal Rotation** (measures force predominantly exerted by subscapularis muscle)

The subject sits with their arm at approximately 90 degrees of forward flexion and their elbow at 90 degrees of flexion. The tester places the dynamometer under the subject's hand. The tester places one finger tip of the hand not holding the dynamometer on the subject's olecranon process to ensure the patient is producing an internal rotation moment and not an adduction moment ([Figure 4c](#)).

### Special Tests

Over twenty-five special tests are described for examination of the rotator cuff. It is not feasible to perform all of these tests in clinical practice. Therefore, we present selected special tests for each of the rotator cuff tendons that have been more rigorously assessed for sensitivity and specificity and are useful in clinical practice to diagnose rotator cuff tears. A positive test of the rotator cuff below implies that the respective tendon is torn. A positive test for the biceps tendon implies biceps tendonitis/tenosynovitis.

### Tests for Subscapularis:

#### Lift-off Test

The examiner assists the patient to get in a position where he/ she touches their lower back with the arm fully extended and internally rotated ([Figure 5a](#)). A test is judged positive if the patient is unable to lift the dorsum of his hand off his/her back reflecting weakness of the subscapularis.



## [Figure 5](#)

### Special tests for subscapularis

#### **Passive Lift Off (Lag Sign)**

The examiner passively brings the patient's arm behind the body into maximal internal rotation (around the lower back region and pull it backwards away from the back). The result of this test is considered normal if the patient maintains maximum internal rotation after the examiner releases the patient's hand. The test is positive if the patient cannot maintain this position due to weakness of the subscapularis.

#### **Belly Press Test**

The examiner instructs the patient to press the abdomen with the hand flat and attempts to keep the arm in maximum internal rotation. The test result is normal when the elbow does not drop backward, meaning that it remains in front of the trunk ([Figure 5b](#)). A positive test, sign of subscapularis weakness, is when the elbow drops back behind the trunk.

#### **Belly-Off Sign**

The examiner assesses the subscapularis in this test by passively bringing the shoulder of the patient into flexion and maximum internal rotation with the elbow 90° flexed. The elbow of the patient is supported by one hand of the examiner while the other hand brings the arm into maximum internal rotation placing the palm of the hand on the abdomen. The patient is then asked to keep the wrist straight and actively maintain the position of internal rotation as the examiner releases the wrist ([Figure 5c](#)). If the patient cannot maintain the above position, lag occurs and the hand lifts off the abdomen resulting in a positive belly-off sign. Otherwise, the test is negative.

#### **Bear Hug Test**

The examiner instructs the patient to place the palm of the involved side on the opposite shoulder, extend the fingers (so that the patient could not resist by grabbing the shoulder), and position the elbow anterior to the body. The examiner then asks the patient to hold that position (resisted internal rotation) as the examiner tries to pull the patient's hand from the shoulder with an external rotation force applied perpendicular to the forearm ([Figure 5d](#)). The test is considered positive indicating subscapularis weakness if the patient cannot hold the hand against the shoulder or if he or she shows weakness of resisted internal rotation of greater than 20% compared with the opposite side. If the strength is comparable to that of the opposite side, without any pain, the test is negative.

### **Tests for Supraspinatus and Infraspinatus:**

#### **External Rotation Lag Sign at 0 Degrees**

The patient is seated with his or her back to the physician. The elbow is passively flexed to 90°, and the shoulder is held at 20° elevation (in the scapular plane) and near maximum external rotation (i.e., maximum external rotation minus 5° to avoid elastic recoil in the shoulder) by the physician. The patient is then asked to actively maintain the position of external rotation as the

physician releases the wrist while maintaining support of the limb at the elbow. The sign is positive when a lag, or angular drop, occurs. The magnitude of the lag is recorded to the nearest 5°. A positive test indicates postero-superior cuff (supraspinatus and infraspinatus) deficiency.



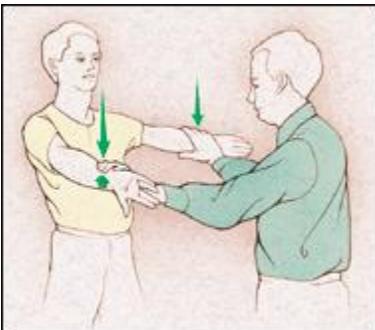
### **External Rotation Lag Sign at 90 Degrees (Drop Sign)**

The patient is seated with his or her back to the physician, who holds the affected arm at 90° of elevation (in the scapular plane) and at almost full external rotation, with the elbow flexed at 90°. In this position the maintenance of the position of external rotation of the shoulder is a function mainly of the infraspinatus. The patient is asked to actively maintain this position as the physician releases the wrist while supporting the elbow. The sign is positive if a lag or 'drop' occurs. The magnitude of the lag is recorded to the nearest 5°. A positive test indicates postero-inferior cuff deficiency.



### **Jobe's Test (Empty Can Test)**

This test is performed by first assessing the deltoid with the arm at 90° of abduction and neutral rotation. The shoulder is then internally rotated and angled forward 30°; the thumbs should be pointing toward the floor. Manual muscle testing against resistance is performed with the examiner pushing down at the distal forearm. This test is regarded as positive when there is weakness to resistance with arm in 90° of abduction as compared with when it is angled forward 30°, and is indicative of supraspinatus pathology.



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### **Drop Arm Test**

This test assesses the supraspinatus and is performed by passively abducting the patient's shoulder to 180 degrees and then observing as the patient slowly lowers the arm to the waist. This test is positive when the arm drops to the side. The patient may be able to lower the arm slowly to 90 degrees (because this is a function mostly of the deltoid muscle as opposed to the supraspinatus) but will be unable to continue the maneuver as far as the waist. In this case, too, the test is positive.

### **Test for Teres Minor:**

#### **Hornblower's Sign**

The examiner supports the patient's arm at 90 degrees of abduction in the scapular plane with elbow flexed at 90 degrees. The patient then attempts external rotation of the forearm against resistance of the examiner's hand. If the patient cannot externally rotate, they assume a position characteristic of a positive hornblower's sign.



### **Test for Biceps Tendon:**

#### **Speed's Test**

The patient is asked to flex his shoulder (elevate it anteriorly) against resistance (from the examiner) while the elbow is extended and the forearm supinated. The test is positive when pain is localized to the bicipital groove for biceps tendon pathology.

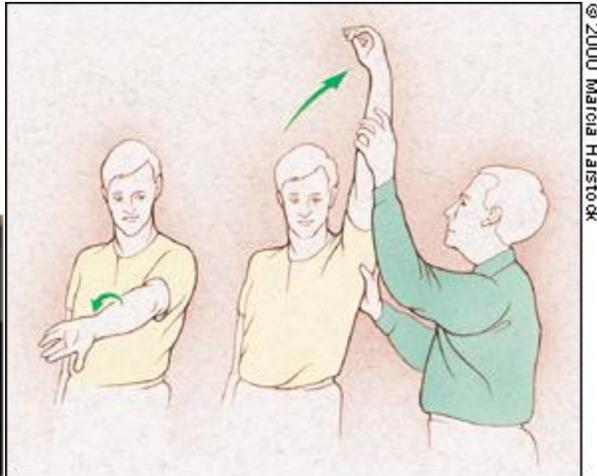


### **Impingement Signs:**

Impingement: Shoulder impingement is defined as a "pinching" of the rotator cuff under the end of the collar bone during overhead motion.

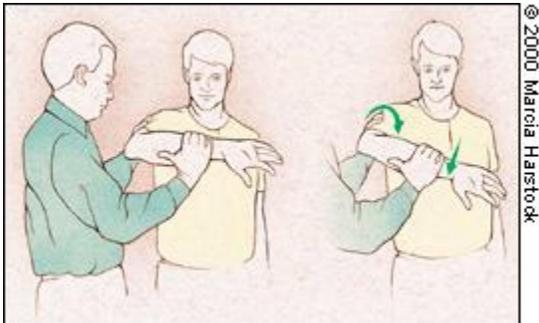
#### **Neer's Sign**

The impingement sign is elicited with the patient seated and the examiner standing. Scapular rotation is prevented with one hand while the other hand raises the arm in forced forward elevation, causing the greater tuberosity to impinge against the acromion. A positive test is if the maneuver produces pain.



### Hawkin's Sign

The examiner forward flexes the humerus to 90° and forcibly internally rotates the shoulder. This maneuver drives the greater tuberosity farther under the coracoacromial ligament. Pain with this maneuver is considered positive for impingement.



## Provocative Testing

Provocative tests provide a more focused evaluation for specific problems and are typically performed after the history and general examination have been completed ([Table 1](#)).

TABLE 1

### Tests Used in Shoulder Evaluation and Significance of Positive Findings

<i>TEST</i>	<i>MANEUVER</i>	<i>DIAGNOSIS SUGGESTED BY POSITIVE RESULT</i>
Apley scratch test	Patient touches superior and inferior aspects of opposite scapula	Loss of range of motion: rotator cuff problem
Neer's sign	Arm in full flexion	Subacromial impingement
Hawkins' test	Forward flexion of the shoulder to 90 degrees and internal rotation	Supraspinatus tendon impingement
Drop-arm test	Arm lowered slowly to waist	Rotator cuff tear
Cross-arm test	Forward elevation to 90 degrees and active adduction	Acromioclavicular joint arthritis
Spurling's test	Spine extended with head rotated to affected shoulder while axially loaded	Cervical nerve root disorder
Apprehension test	Anterior pressure on the humerus with external rotation	Anterior glenohumeral instability

Relocation test	Posterior force on humerus while externally rotating the arm	Anterior glenohumeral instability
Sulcus sign	Pulling downward on elbow or wrist	Inferior glenohumeral instability
Yergason test	Elbow flexed to 90 degrees with forearm pronated	Biceps tendon instability or tendonitis
Speed's maneuver	Elbow flexed 20 to 30 degrees and forearm supinated	Biceps tendon instability or tendonitis
“Clunk” sign	Rotation of loaded shoulder from extension to forward flexion	Labral disorder

## II. Clinical Shoulder Injuries

### **Shoulder Joint Tear (Glenoid Labrum Tear):**

#### **Risk Factors/Prevention**

Injuries to the tissue rim surrounding the shoulder socket can occur from acute trauma or repetitive shoulder motion. Examples of traumatic injury include:

- Falling on an outstretched arm
- A direct blow to the shoulder
- A sudden pull, such as when trying to lift a heavy object
- A violent overhead reach, such as when trying to stop a fall or slide

Throwing athletes or weightlifters can experience glenoid labrum tears as a result of repetitive shoulder motion.

#### **Symptoms**

The symptoms of a tear in the shoulder socket rim are very similar to those of other shoulder injuries. Symptoms include

- Pain, usually with overhead activities
- Catching, locking, popping, or grinding
- Occasional night pain or pain with daily activities
- A sense of instability in the shoulder
- Decreased range of motion
- Loss of strength

#### **Treatment**

Until the final diagnosis is made, your physician may prescribe anti-inflammatory medication and rest to relieve symptoms. Rehabilitation exercises to strengthen the rotator cuff muscles may also be recommended. If these conservative measures are insufficient, your physician may recommend arthroscopic surgery.

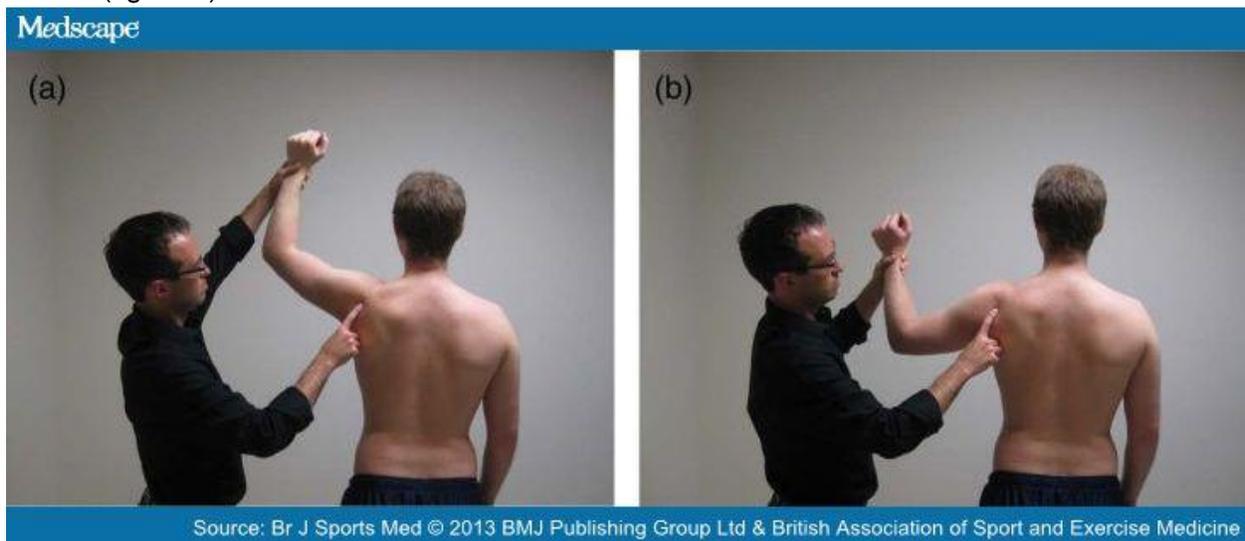
During arthroscopic surgery, the doctor will examine the rim and the biceps tendon. If the injury is confined to the rim itself, without involving the tendon, the shoulder is still stable. The surgeon will remove the torn flap and correct any other associated problems. If the tear extends into the biceps tendon or if the tendon is detached, the shoulder is unstable. The surgeon will need to repair and reattach the tendon using absorbable tacks, wires, or sutures.

Tears below the middle of the socket are also associated with shoulder instability. The surgeon will reattach the ligament and tighten the shoulder socket by folding over and "pleating" the tissues.

## Physical Examination for Glenoid Labrum Tear:

### Labral Tear Test- Dynamic Labral Shear Test

- Patient position: standing with arm flexed 90° at the elbow, abducted in the scapular plane >120° and externally rotated to tightness.
- Test: examiner standing behind patient, guiding involved upper extremity into maximal horizontal abduction and applying a shear load to the joint by maintaining external rotation and horizontal abduction and lowering arm from 120° to 60° of abduction.
- Confirmatory findings: reproduction of pain and/or painful click or catch in the posterior joint line between 120° and 90° abduction.
- Test rationale: arm position and load application are ideal for reproducing the peel-back phenomenon and motion of the biceps, and to reproduce the shearing mechanism of the posterior rotator cuff against the posterosuperior labrum. The modified version of this test did not place the arm into maximal horizontal abduction until the arm was abducted above 120°. This was intended to decrease pain provocation throughout the entire ROM (figure 1).

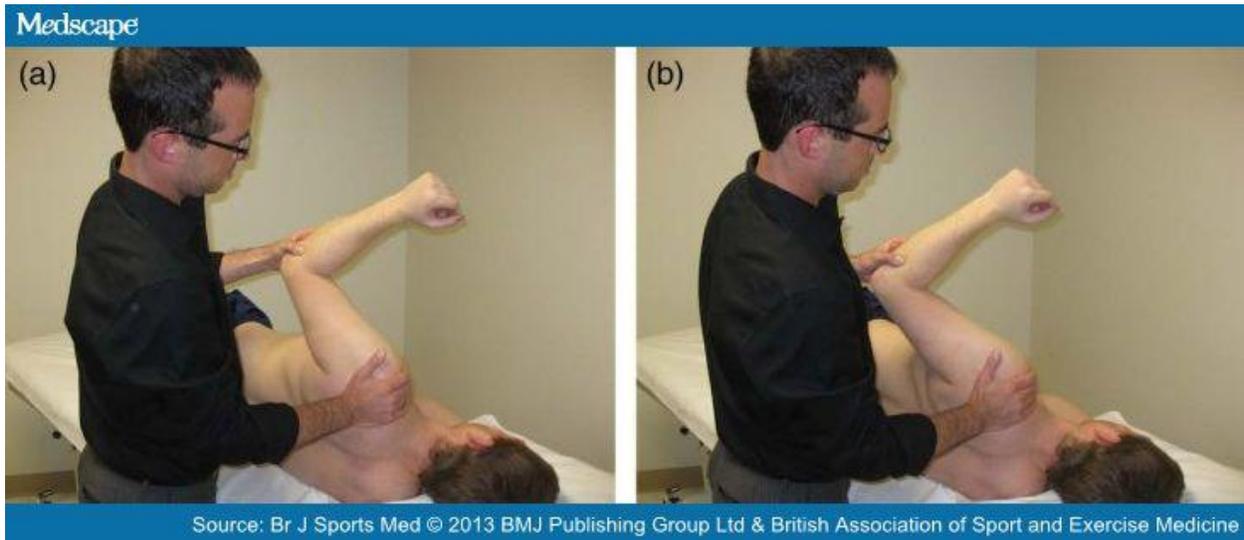


## Superior Labrum Anterior to Posterior Lesion Tests (SLAP tears)

### Passive compression test

- Patient position: lateral decubitus position with affected side up.
- Test: examiner standing behind patient, stabilising the affected shoulder by holding the acromioclavicular (AC) joint with one hand and the elbow with the other. The examiner externally rotates the shoulder in 30° of abduction and then pushes the arm proximally while extending the shoulder (figure 2).
- Confirmatory findings: pain or a painful click in the glenohumeral joint.
- Test rationale: with glenohumeral external rotation and extension (late cocking phase), the long head of the biceps tendon is placed under tensile forces while wrapping around

the lesser tuberosity and ultimately shifting the superior labrum from the superior glenoid rim. Proximal migration of the humerus aggravates the displacement of the unstable labrum and passively displaces the superior labrum.



### Passive distraction test

- Patient position: supine.
- Test: examiner standing on the affected side of the patient and positions the extremity off the edge of the table, into 150° elevation in the coronal plane, the elbow extended, the forearm supinated, and the upper arm stabilised to prevent humeral rotation. The examiner pronates the forearm while maintaining steady position of the humerus (figure 3).
- Confirmatory findings: pain reported deep inside the glenohumeral joint either anteriorly or posteriorly.
- Test rationale: peel-back phenomenon of the superior labrum.



The passive distraction test may be used for ruling in a SLAP lesion while the passive compression test may be used for both ruling in and ruling out a SLAP lesion.

**O'Brien's Test-** see rotator cuff section

**Speed's Test-** see rotator cuff section

**Neer Test-** see rotator cuff section

**Anterior Slide Test**- anterior slide test to help diagnose anterior SLAP lesions. The patient is instructed to place both hands on the hips. The examiner stabilizes the scapula of the affected side with one hand over the acromion. The other hand is used to axially load the humerus in the anterior and superior direction. Pain with this motion is considered to be a positive result for an anterior-based SLAP lesion.

**Bicep's Load Test II**- With the patient supine, the affected arm is flexed to 120° and maximally externally rotated, with the elbow at 90° of flexion. If pain is elicited with resisted elbow flexion, the test finding is positive.

### III. Lateral Epicondylitis (Tennis Elbow)

#### Overview

Tennis elbow is a painful condition that occurs when tendons in your elbow are overworked, usually by repetitive motions of the wrist and arm.

Despite its name, most cases of tennis elbow occur in people who don't play tennis. People whose jobs feature the types of motions that can lead to tennis elbow include plumbers, painters, carpenters and butchers.

The pain of tennis elbow occurs primarily where the tendons of your forearm muscles attach to a bony bump on the outside of your elbow. Pain can also spread into your forearm and wrist.

#### Causes

Tennis elbow is an overuse and muscle strain injury. The cause is repeated contraction of the forearm muscles that you use to straighten and raise your hand and wrist. The repeated motions and stress to the tissue may result in a series of tiny tears in the tendons that attach the forearm muscles to the bony prominence at the outside of your elbow.

As the name suggests, playing tennis — especially repeated use of the backhand stroke with poor technique — is one possible cause of tennis elbow. However, many other common arm motions can cause tennis elbow, including:

- Using plumbing tools
- Painting
- Driving screws
- Cutting up cooking ingredients, particularly meat

#### Symptoms

Tennis elbow usually begins with mild pain and can worsen over time. The pain is worsened by pressing on the affected area, by lifting objects particularly with extension of the wrist. Using a screwdriver can worsen the injury and cause pain. In advanced cases, even simple movements of the elbow joint can produce pain.

The pain associated with tennis elbow may radiate from the outside of your elbow into your forearm and wrist. Pain and weakness may make it difficult to:

- Shake hands
- Turn a doorknob
- Hold a coffee cup

## **Risk Factors**

Factors that may increase your risk of tennis elbow include:

- **Age.** While tennis elbow affects people of all ages, it's most common in adults between the ages of 30 and 50.
- **Occupation.** People who have jobs that involve repetitive motions of the wrist and arm are more likely to develop tennis elbow. Examples include plumbers, painters, carpenters, butchers and cooks.
- **Certain sports.** Participating in racket sports increases your risk of tennis elbow, especially if you employ poor stroke technique.

## **Treatment**

Tennis elbow often gets better on its own. But if over-the-counter pain medications and other self-care measures aren't helping, your doctor may suggest physical therapy. Severe cases of tennis elbow may require surgery.

Therapy

*Learn proper form.* Your doctor may suggest that experts evaluate your tennis technique or the movements involved with your job tasks to determine the best steps to reduce stress on your injured tissue.

*Exercises.* Your doctor or a physical therapist may suggest exercises to gradually stretch and strengthen your muscles, especially the muscles of your forearm.

*Braces.* Your doctor may also suggest you wear a forearm strap or brace to reduce stress on the injured tissue.

*Surgery.* If your symptoms haven't improved after six to 12 months of extensive conservative therapy, you may be a candidate for surgery to remove damaged tissue. These types of procedures can be performed through a large incision or through several small incisions.

Rehabilitation exercises are crucial to recovery.

## **Physical Examination of Tennis Elbow:**

### **Lateral Epicondylitis Test/Resistive Tennis Elbow Test/Cozen's Test**

#### **Steps**

- Athlete is sitting
- Examiner stabilizes the involved elbow while palpating along the lateral epicondyle
- With closed fist, the athlete pronates and radially deviates the forearm and extends the wrist against the examiner's resistance
- Positive Test: Pain along the lateral epicondyle region of the humerus or objective muscle weakness as a result of complaints of discomfort
- Positive Test Implications: Lateral epicondylitis

## **Lateral Epicondylitis Test/Passive Tennis Elbow Test**

### **Steps**

- Athlete is sitting with elbow in relaxed position supported by table
- Examiner stabilizes involved elbow with one hand and places the palm of the other hand on the dorsal aspect of the patient's hand just distal to the proximal interphalangeal joint of the third digit
- Positive Test: Pain along the lateral epicondyle region of the humerus or objective muscle weakness
- Positive Test Implications- Lateral epicondylitis

## **IV. Medial Epicondylitis (Golfer's Elbow)**

### **Overview**

Golfer's elbow is a condition that causes pain where the tendons of your forearm muscles attach to the bony bump on the inside of your elbow. The pain might spread into your forearm and wrist.

Golfer's elbow is similar to tennis elbow, which occurs on the outside of the elbow.

### **Causes**

Golfer's elbow is caused by damage to the muscles and tendons that control your wrist and fingers. The damage is typically related to excess or repeated stress — especially forceful wrist and finger motions. Improper lifting, throwing or hitting, as well as too little warm-up or poor conditioning, also can contribute to golfer's elbow.

Many activities can lead to golfer's elbow, including:

- Golf. Gripping or swinging clubs incorrectly or too forcefully can take a toll on your muscles and tendons.
- Racket sports. Excessive topspin can hurt your elbow. Using a racket that's too small or heavy also can lead to injury.
- Throwing sports. Improper pitching technique in baseball or softball can be another culprit. Football, archery and javelin throwing also can cause golfer's elbow.
- Weight training. Lifting weights using improper technique, such as curling the wrists during a biceps exercise, can overload the elbow muscles and tendons.

In addition, any activity that requires repeatedly bending and straightening your elbow can cause golfer's elbow. This includes painting, raking, hammering, chopping wood, using a computer, doing assembly-line work and cooking. A day or two of yardwork or cooking for company usually won't cause golfer's elbow, though. The activity generally needs to be done for more than an hour a day on many days to cause a problem.

### **Symptoms**

Golfer's elbow is characterized by:

- Pain and tenderness on the inner side of your elbow. Sometimes the pain extends along the inner side of your forearm. Pain typically worsens with certain movements.
- Stiffness. Your elbow may feel stiff, and it may hurt to make a fist.

- Weakness. You may have weakness in your hands and wrists.
- Numbness or tingling. These sensations might radiate into one or more fingers — usually the ring and little fingers.

The pain of golfer's elbow can come on suddenly or gradually. The pain might worsen when you:

- Swing a golf club or racket
- Squeeze or pitch a ball
- Shake hands
- Turn a doorknob
- Lift weights
- Pick up something with your palm down
- Flex your wrist

### **Physical Examination for Golfer's Elbow:**

#### **Medial Epicondylitis Test/Golfer's Elbow Test**

##### **Steps**

- Athlete is sitting or standing and makes a fist with the involved side
- Examiner faces the athlete and palpates along the medial epicondyle with one hand and grasps the athlete's wrist with the other hand
- Examiner passively supinates the forearm and extends the elbow, wrist and fingers
- Positive Test: Complaints of discomfort along the medial aspect of the elbow
- Positive Test Implications: Medial epicondylitis

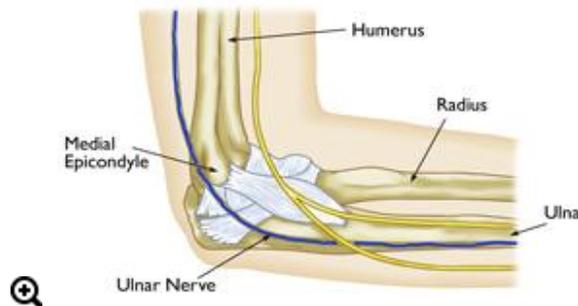
## **V. Cubital Tunnel Syndrome (Ulnar Nerve Entrapment at the Elbow)**

### **Overview**

Cubital Tunnel Syndrome is a condition that involves pressure or stretching of the ulnar nerve (also known as the “funny bone” nerve), which can cause numbness or tingling in the ring and small fingers, pain in the forearm, and/or weakness in the hand. The ulnar nerve runs in a groove on the inner side of the elbow.

### **Causes**

In many cases of cubital tunnel syndrome, the exact cause is not known. The ulnar nerve is especially vulnerable to compression at the elbow because it must travel through a narrow space with very little soft tissue to protect it.



The ulnar nerve runs behind the medial epicondyle on the inside of the elbow.

There are several things that can cause pressure on the nerve at the elbow:

- When you bend your elbow, the ulnar nerve must stretch around the bony ridge of the medial epicondyle. Because this stretching can irritate the nerve, keeping your elbow bent for long periods or repeatedly bending your elbow can cause painful symptoms. For example, many people sleep with their elbows bent. This can aggravate symptoms of ulnar nerve compression and cause you to wake up at night with your fingers asleep.
- In some people, the nerve slides out from behind the medial epicondyle when the elbow is bent. Over time, this sliding back and forth may irritate the nerve.
- Leaning on your elbow for long periods of time can put pressure on the nerve.
- Fluid buildup in the elbow can cause swelling that may compress the nerve.
- A direct blow to the inside of the elbow can cause pain, electric shock sensation, and numbness in the little and ring fingers. This is commonly called "hitting your funny bone."



Sleeping with your elbow bent can aggravate symptoms.

### Symptoms

Cubital tunnel syndrome can cause pain, loss of sensation, tingling and/or weakness. "Pins and needles" usually are felt in the ring and small fingers. These symptoms are often felt when the elbow is bent for a long period of time, such as while holding a phone or while sleeping. Some people feel weak or clumsy.

## **Risk Factors**

Some factors put you more at risk for developing cubital tunnel syndrome. These include:

- Prior fracture or dislocations of the elbow
- Bone spurs/ arthritis of the elbow
- Swelling of the elbow joint
- Cysts near the elbow joint
- Repetitive or prolonged activities that require the elbow to be bent or flexed

## **Treatment**

Unless your nerve compression has caused a lot of muscle wasting, your doctor will most likely first recommend nonsurgical treatment.

### *Nonsurgical Treatment*

Non-steroidal anti-inflammatory medicines. If your symptoms have just started, your doctor may recommend an anti-inflammatory medicine, such as ibuprofen, to help reduce swelling around the nerve.

Although steroids, such as cortisone, are very effective anti-inflammatory medicines, steroid injections are generally not used because there is a risk of damage to the nerve.

*Bracing or splinting.* Your doctor may prescribe a padded brace or splint to wear at night to keep your elbow in a straight position.

*Nerve gliding exercises.* Some doctors think that exercises to help the ulnar nerve slide through the cubital tunnel at the elbow and the Guyon's canal at the wrist can improve symptoms. These exercises may also help prevent stiffness in the arm and wrist.

## **Physical Examinations of Cubital Tunnel Syndrome**

### **Elbow Flexion Test**

#### **Steps**

- Athlete is sitting or standing
- Athlete maximally flexes the elbow and holds the position for 3 to 5 minutes
- Positive Test: Radiating pain into the median nerve distribution in the athlete's arm and/or hand
- Positive Test Implications: Cubital tunnel syndrome

### **Varus Stress Test**

#### **Steps**

- Athlete is sitting with elbow flexed to 20 to 30 degrees
- Examiner stands with the distal hand around the athlete's wrist (laterally) and the proximal hand over the athlete's elbow joint (medially)
- Examiner stabilizes the wrist and applies a varus stress to the elbow with the proximal hand

- Positive Test: Lateral elbow pain and/or increased varus movement with diminished or absent endpoint
- Positive Test Implications: Radial (lateral) collateral ligament sprain

### **Valgus Stress Test**

#### **Steps**

- Athlete is sitting with the elbow flexed to 20 to 30 degrees
- Examiner stands with distal hand around the athlete's wrist (medially) and the proximal hand over the athlete's elbow joint (laterally)
- Examiner stabilizes the wrist and applies a valgus stress to the elbow with the proximal hand
- Positive Test: Medial elbow pain and/or increased valgus movement with a diminished or absent endpoint
- Positive Test Implications: Ulnar (medial) collateral ligament sprain

### **Tinel's Sign Test**

#### **Steps**

- Athlete is sitting with the elbow in slight flexion
- Examiner grasps athlete's wrist (laterally) with distal hand
- Examiner stabilizes the wrist and taps on the ulnar nerve in the ulnar notch with the index finger
- Positive Test: Tingling along the ulnar distribution of the forearm, hand and fingers
- Positive Test Implications: Ulnar nerve compromise

### **Pinch Grip Test**

#### **Steps**

- Athlete is sitting or standing
- Examiner instructs athlete to pinch the tips of the thumb and index finger together
- Positive Test: Inability to touch the tips of the thumb and index finger together or touching the pads of the thumb and index finger together
- Positive Test Implications: Pathology of the anterior interosseous nerve between the two heads of the pronator muscle

### **Additional Exams for Cubital Tunnel Syndrome:**

- Your physician will feel around the bony bump on the outside of your elbow to see if you have tenderness there. Physicians may use a series of physical tests to determine the extent of your tennis elbow pain:
- Coffee cup test - you lift a coffee cup or a textbook gripped as you would a coffee cup.
- Chair test - while standing with the elbow straight, you are asked to lift a chair off the ground.

- Resisted finger extension - with your arm extended in front of you, your elbow straight and your palm down, your physician asks you to push up with your middle finger as it is held steady.
- Resisted wrist extension - with an extended arm and palm down, your physician asks you to bend your wrist backwards as resistance is applied to the back of your hand.
- Your doctor also may test the flexibility of the tendon that connects the forearm muscles to the outside of your elbow by lifting your arm and bending your elbow.

## VI. Carpal Tunnel Syndrome

### Overview

Carpal tunnel syndrome is a hand and arm condition that causes numbness, tingling and other symptoms. Carpal tunnel syndrome is caused by a pinched nerve in your wrist.

A number of factors can contribute to carpal tunnel syndrome, including the anatomy of your wrist, certain underlying health problems and possibly patterns of hand use.

Bound by bones and ligaments, the carpal tunnel is a narrow passageway located on the palm side of your wrist. This tunnel protects a main nerve to your hand and the nine tendons that bend your fingers.

Compression of the nerve produces the numbness, tingling and, eventually, hand weakness that characterize carpal tunnel syndrome.

Fortunately, for most people who develop carpal tunnel syndrome, proper treatment usually can relieve the tingling and numbness and restore wrist and hand function.

### Causes

Carpal tunnel syndrome occurs as a result of compression of the median nerve.

The median nerve runs from your forearm through a passageway in your wrist (carpal tunnel) to your hand. It provides sensation to the palm side of your thumb and fingers, with the exception of your little finger. It also provides nerve signals to move the muscles around the base of your thumb (motor function).

In general, anything that crowds, irritates or compresses the median nerve in the carpal tunnel space can lead to carpal tunnel syndrome. For example, a wrist fracture can narrow the carpal tunnel and irritate the nerve, as can the swelling and inflammation resulting from rheumatoid arthritis.

In many cases, no single cause can be identified. It may be that a combination of risk factors contributes to the development of the condition.

### Symptoms

Carpal tunnel syndrome usually starts gradually with numbness or tingling in your thumb, index and middle fingers that comes and goes. This may be associated with discomfort in your wrist and hand. Common carpal tunnel syndrome symptoms include:

- Tingling or numbness. You may experience tingling and numbness in your fingers or hand, especially your thumb and index, middle or ring fingers, but not your little finger.

This sensation often occurs while holding a steering wheel, phone or newspaper or, commonly, waking you from sleeping. The sensation may extend from your wrist up your arm.

- Many people "shake out" their hands to try to relieve their symptoms. As the disorder progresses, the numb feeling may become constant.
- Weakness. You may experience weakness in your hand and a tendency to drop objects. This may be due to the numbness in your hand or weakness of the thumb's pinching muscles, which are controlled by the median nerve.

### **Risk Factors**

A number of factors have been associated with carpal tunnel syndrome. Although by themselves they don't cause carpal tunnel syndrome, they may increase your chances of developing or aggravating median nerve damage. These include:

- Anatomic factors. A wrist fracture or dislocation that alters the space within the carpal tunnel can create extraneous pressure on the median nerve.
- People with smaller carpal tunnels may be more likely to have carpal tunnel syndrome.
- Sex. Carpal tunnel syndrome is generally more common in women. This may be because the carpal tunnel area is relatively smaller than in men, and there may be less room for error. Women who have carpal tunnel syndrome may also have smaller carpal tunnels than women who don't have the condition.
- Nerve-damaging conditions. Some chronic illnesses, such as diabetes, increase your risk of nerve damage, including damage to your median nerve.
- Inflammatory conditions. Illnesses that are characterized by inflammation, such as rheumatoid arthritis, can affect the tendons in your wrist, exerting pressure on your median nerve.
- Alterations in the balance of body fluids. Fluid retention, common during pregnancy or menopause, may increase the pressure within your carpal tunnel, irritating the median nerve. Carpal tunnel syndrome associated with pregnancy generally resolves on its own after pregnancy.
- Other medical conditions. Certain conditions, such as menopause, obesity, thyroid disorders and kidney failure, may increase your chances of carpal tunnel syndrome.
- Workplace factors. It's possible that working with vibrating tools or on an assembly line that requires prolonged or repetitive flexing of the wrist may create harmful pressure on the median nerve or worsen existing nerve damage.
- However, the scientific evidence is conflicting and these factors haven't been established as direct causes of carpal tunnel syndrome.
- Several studies have evaluated whether there is an association between computer use and carpal tunnel syndrome. However, there has not been enough quality and consistent evidence to support extensive computer use as a risk factor for carpal tunnel syndrome, although it may cause a different form of hand pain.

## Treatment

Carpal tunnel syndrome should be treated as early as possible after you begin to experience symptoms. Some people with mild symptoms of carpal tunnel syndrome can ease their discomfort by *taking more frequent breaks to rest their hands, avoiding activities that worsen symptoms and applying cold packs to reduce occasional swelling.*

If these techniques don't offer relief within a few weeks, additional treatment options include *wrist splinting, medications and surgery.* Splinting and other conservative treatments are more likely to help you if you've had only mild to moderate symptoms for less than 10 months.

### *Nonsurgical therapy*

If the condition is diagnosed early, nonsurgical methods may help improve carpal tunnel syndrome. Methods may include:

**Wrist splinting.** A splint that holds your wrist still while you sleep can help relieve nighttime symptoms of tingling and numbness. Nocturnal splinting may be a good option if you're pregnant and have carpal tunnel syndrome.

**Nonsteroidal anti-inflammatory drugs (NSAIDs).** NSAIDs such as ibuprofen (Advil, Motrin IB, others) may help relieve pain from carpal tunnel syndrome in the short term.

There isn't evidence, however, that these drugs improve carpal tunnel syndrome.

**Corticosteroids.** Your doctor may inject your carpal tunnel with a corticosteroid such as cortisone to relieve your pain. Corticosteroids decrease inflammation and swelling, which relieves pressure on the median nerve. Oral corticosteroids aren't considered as effective as corticosteroid injections for treating carpal tunnel syndrome.

If carpal tunnel syndrome results from an inflammatory arthritis, such as rheumatoid arthritis, then treating the arthritis may reduce symptoms of carpal tunnel syndrome, but this hasn't been proved.

### *Surgery*

If your symptoms are severe or persist after trying nonsurgical therapy, surgery may be the most appropriate option. The goal of carpal tunnel surgery is to relieve pressure on your median nerve by cutting the ligament pressing on the nerve.

The surgery may be performed with two different techniques. Discuss the risks and benefits of each technique with your surgeon before surgery. Surgery risks may include incomplete release of the ligament, wound infections, scar formation, and nerve or vascular injuries. The final results of endoscopic and open surgery are similar.

1. **Endoscopic surgery.** In endoscopic surgery, your surgeon uses a telescope-like device with a tiny camera attached to it (endoscope) to see inside your carpal tunnel and cut the ligament through one or two small incisions in your hand or wrist. Endoscopic surgery may result in less pain than does open surgery in the first few days or weeks after surgery.
2. **Open surgery.** In open surgery, your surgeon makes a larger incision in the palm of your hand over the carpal tunnel and cuts through the ligament to free the nerve. This procedure may also be conducted using a smaller incision, which may reduce the risk of complications.

During the healing process after the surgery, the ligament tissues gradually grow back together while allowing more room for the nerve than existed before.

In general, your doctor will encourage you to use your hand after surgery, gradually working back to normal use of your hand while avoiding forceful hand motions or extreme wrist positions.

Soreness or weakness may take from several weeks to a few months to resolve after surgery. If your symptoms were very severe before surgery, symptoms may not go away completely after surgery.

## **Physical Examinations for Carpal Tunnel Syndrome:**

### **Carpal Tunnel Syndrome Physical Examination**

- **Sensory examination**
  - Abnormalities in sensory modalities may be present on the palmar aspect of the first 3 digits and radial one half of the fourth digit.
  - Sensory examination is most useful in confirming that areas outside the distal median nerve territory are normal (eg, thenar eminence, hypothenar eminence, dorsum of first web space).
- **Motor examination** - Wasting and weakness of the median-innervated hand muscles (LOAF muscles) may be detectable.
  - L - First and second lumbricals
  - O - Opponens pollicis
  - A - Abductor pollicis brevis
  - F - Flexor pollicis brevis
- **Hoffmann-Tinel sign**
  - Gentle tapping over the median nerve in the carpal tunnel region elicits tingling in the nerve's distribution.
  - This sign still is commonly looked for, despite the low sensitivity and specificity.
- **Phalen Sign**
  - Tingling in the median nerve distribution is induced by full flexion (or full extension for reverse Phalen) of the wrists for up to 60 seconds
  - This test has 80% specificity but lower sensitivity.
- **The Carpal Compression Test**
  - This test involves applying firm pressure directly over the carpal tunnel, usually with the thumbs, for up to 30 seconds to reproduce symptoms.
  - Reports indicate that this test has a sensitivity of up to 89% and a specificity of 96%.
- **Palpatory diagnosis**
  - This test involves examining the soft tissues directly overlying the median nerve at the wrist for mechanical restriction.
  - This palpatory test has been noted to have a sensitivity of over 90% and a specificity of 75% or greater.

- **The square wrist sign**
  - Positive if the ratio of the wrist thickness to the wrist width is greater than 0.7.
  - This test has a modest sensitivity/specificity of 70%.

## VII. De Quervain's Tenosynovitis

### Overview

De Quervain's tenosynovitis is a painful condition affecting the tendons on the thumb side of your wrist. If you have de Quervain's tenosynovitis, it will probably hurt when you turn your wrist, grasp anything or make a fist. Although the exact cause of de Quervain's tenosynovitis isn't known, any activity that relies on repetitive hand or wrist movement — such as working in the garden, playing golf or racket sports, or lifting your baby — can make it worse.

### Causes

Chronic overuse of your wrist is commonly associated with de Quervain's tenosynovitis. Tendons are rope-like structures that attach muscle to bone. When you grip, grasp, clench, pinch or wring anything in your hand, two tendons in your wrist and lower thumb normally glide smoothly through the small tunnel that connects them to the base of the thumb. Repeating a particular motion day after day may irritate the sheath around the two tendons, causing thickening and swelling that restricts their movement.

Other causes of de Quervain's tenosynovitis include:

- Direct injury to your wrist or tendon; scar tissue can restrict movement of the tendons
- Inflammatory arthritis, such as rheumatoid arthritis

### Symptoms

Symptoms of de Quervain's tenosynovitis include:

- Pain near the base of your thumb
- Swelling near the base of your thumb
- Difficulty moving your thumb and wrist when you're doing something that involves grasping or pinching
- A "sticking" or "stop-and-go" sensation in your thumb when moving it

If the condition goes too long without treatment, the pain may spread further into your thumb, back into your forearm or both. Pinching, grasping and other movements of your thumb and wrist aggravate the pain.

### Risk factors

Risk factors for de Quervain's tenosynovitis include:

- Age. If you're between the ages of 30 and 50, you have a higher risk of developing de Quervain's tenosynovitis than do other age groups, including children.

- Sex. The condition is more common in women.
- Being pregnant. The condition may be associated with pregnancy.
- Baby care. Lifting your child repeatedly involves using your thumbs as leverage and may also be associated with the condition.
- Jobs or hobbies that involve repetitive hand and wrist motions. These may contribute to de Quervain's tenosynovitis.

## **Treatment**

Treatment for de Quervain's tenosynovitis is aimed at reducing inflammation, preserving movement in the thumb and preventing recurrence. If you start treatment early, your symptoms should improve within four to six weeks. If your de Quervain's tenosynovitis starts during pregnancy, symptoms are likely to end around the end of either pregnancy or breast-feeding.

### *Medications*

To reduce pain and swelling, your doctor may recommend using over-the-counter pain relievers, such as ibuprofen (Advil, Motrin IB, others) and naproxen (Aleve).

Your doctor may also recommend injections of corticosteroid medications into the tendon sheath to reduce swelling. If treatment begins within the first six months of symptoms, most people recover completely after receiving corticosteroid injections, often after just one injection.

### *Therapy*

Initial treatment of de Quervain's tenosynovitis may include:

- Immobilizing your thumb and wrist, keeping them straight with a splint or brace to help rest your tendons
- Avoiding repetitive thumb movements as much as possible
- Avoiding pinching with your thumb when moving your wrist from side to side
- Applying ice to the affected area
- You may also see a physical or occupational therapist. These therapists may review how you use your wrist and give suggestions on how to make adjustments to relieve stress on your wrists. Your therapist can also teach you exercises for your wrist, hand and arm to strengthen your muscles, reduce pain and limit tendon irritation.

### *Surgery*

If your case is more serious, your doctor may recommend outpatient surgery. Surgery involves a procedure in which your doctor inspects the sheath surrounding the involved tendon or tendons, and then opens the sheath to release the pressure so your tendons can glide freely. Your doctor will talk to you about how to rest, strengthen and rehabilitate your body after surgery. A physical or occupational therapist may meet with you after surgery to teach you new strengthening exercises and help you adjust your daily routine to prevent future problems.

## **Physical Examinations for de Quervain's tenosynovitis:**

To diagnose de Quervain's tenosynovitis, your doctor will examine your hand to see if you feel pain when pressure is applied on the thumb side of the wrist.

Your doctor will also perform a **Finkelstein test**, in which you bend your thumb across the palm of your hand and bend your fingers down over your thumb. Then you bend your wrist toward your little finger. If this causes pain on the thumb side of your wrist, you likely have de Quervain's tenosynovitis.

# VIII. Neck Injuries- Strains & Sprains

## **Overview**

Neck strain is injury to the muscles and tendons that support and move the head and neck. The neck is susceptible to injury because it is capable of extensive range of motion. It is, as a result, less stable than many other body areas. In addition, the neck muscles are affected by the motion of nearly all other areas of the body.

*Injuries of tissues that contract and move, such as muscles and tendons, are termed strains. Similar injuries to nonmoving structures, such as ligaments, joint capsules, nerves, bursae, blood vessels, and cartilage, are termed sprains.* Both strains and sprains of the neck may involve tears to ligaments covering the cervical vertebrae of the spine, the many muscles of the neck (which move the head), and many other associated structures. They may also result in injury to cervical nerves caused by stretching or compression.

## **Neck Strain Symptoms**

Pain varies from person to person and is hard to measure. The doctor will rely on one's description of symptoms to better quantify the pain. Although difficult to generalize, the following types of symptoms usually predict the types of anatomic structures injured:

- Cramping, dull, aching pain may indicate that muscles may be injured.
- Sharp, shooting pain could be injury to a nerve root.
- Sharp, lightning-like pain may indicate that a nerve is injured.
- Burning, stinging pressure may indicate nerve injury.
- Deep, nagging, dull pain could be injury to a bone.
- Sharp, intolerable, severe pain could indicate a fracture.
- Throbbing, diffuse pain may be injury to blood vessels.

## **Physical Examinations for Neck Strains**

Physical evaluation for neck strain may be divided into the phases of observation, touching the muscles and other structures in the neck (palpation), examination of the blood vessels in the neck, nerve testing and, finally, an assessment of the ability to move. In most cases of trauma involving a significant mechanism of action, a complete examination is usually not completed until a set of preliminary X-rays has confirmed the lack of fractures (broken bones) and dislocations of the cervical spine.

- Observation
  - The doctor may wish to see the patient walk into and around the examination room.
  - Typically, the patient's posture, gait, facial expression, willingness to move for examination, and ease of movement will be assessed.
  - The doctor will be interested to see whether the patient's head is rotated to one side. This usually indicates muscle spasm of the neck (called torticollis).
  - The position of the patient's chin and head will be noted as well as his/her habitual posture and the symmetry of the neck contour formed by the trapezius muscle.
  - The posture of the patient's head and neck may also be checked while the patient sits and then stands. Any differences will be noted.
  - The patient's shoulders will be checked to see if they are level when relaxed. Asymmetry often indicates muscle spasm.
- Doctor observation is often also sufficient to lead to a suspicion of a problem causing an inadequate blood supply (ischemia) in one of the upper limbs. A doctor will examine the blood vessels in the neck by feeling the pulses to assess for briskness of upstroke and fullness, and the presence of any abnormal sounds heard with a stethoscope placed over the blood vessel (auscultation). The doctor will also look for any evidence of any increased pressure in the neck veins (distended or bulging jugular veins). The doctor will check the patient's trachea, particularly if there are any symptoms of hoarseness.
- The doctor will also palpate the patient's head, neck, shoulders, and possibly other areas. Palpation is useful in detecting differences in tissue tension, texture, and thickness, tenderness, and abnormal sensation. In addition, differences in temperature and dryness (or excessive moisture) become readily apparent. Tremor (shaking) and muscle twitches may also be checked in this manner.
- The doctor will perform neuromuscular testing to determine whether the patient has any injuries to the nerves and joints in the neck. These tests typically involve moving the body both passively (with assistance) and actively, to assess for strength, range of motion, and any loss of sensation.

The combination of a detailed history, physical examination, and one or more imaging procedures should enable the doctor to exclude, or identify, any serious injury to the neck and thereby plan a course of treatment.

### **Neck Sprain Symptoms**

A person with a neck sprain may experience a wide range of possible symptoms.

- Pain, especially in the back of the neck, that worsens with movement
- Pain that peaks a day or so after the injury, instead of immediately
- Muscle spasms and pain in the upper shoulder
- Headache in the back of the head
- Sore throat
- Increased irritability, fatigue, difficulty sleeping, and difficulty concentrating
- Numbness in the arm or hand
- Neck stiffness or decreased range of motion (side to side, up and down, circular)

- Tingling or weakness in the arms

Other symptoms that may happen with a neck sprain include:

- Dizziness
- Ringing in the ears
- Fatigue
- Patchy numbness in the hands or arms

### **Physical Examinations for Neck Sprains**

A physical examination will review your posture, ability to move, and the position of your head and chin. The doctor will inspect the blood vessels in your neck and may listen to them with a stethoscope. He or she also may check:

- The range of motion of your neck
- The muscle strength in your arms
- Your reflexes
- Whether or not you can detect sensations

### **Treatment for Neck Strains & Sprains**

All sprains or strains, no matter where they are located in the body, are treated in a similar manner. Neck sprains, like other sprains, will usually heal gradually, given time and appropriate treatment. You may have to wear a soft collar around your neck to help support the head and relieve pressure on the ligaments so they have time to heal.

Pain relievers such as aspirin or ibuprofen can help reduce the pain and any swelling. Muscle relaxants can help ease spasms. You can apply an ice pack for 15 to 30 minutes at a time, several times a day for the first 2 or 3 days after the injury. This will help reduce inflammation and discomfort. Although heat, particularly moist heat, can help loosen cramped muscles, it should not be applied too quickly.

Other treatment options include:

- Massaging the tender area
- Ultrasound
- Cervical (neck) traction
- Aerobic and isometric exercise

# IX. Herniated Disk

## Overview

A herniated disk refers to a problem with one of the rubbery cushions (disks) between the individual bones (vertebrae) that stack up to make your spine.

A spinal disk is a little like a jelly donut, with a softer center encased within a tougher exterior. Sometimes called a slipped disk or a ruptured disk, a herniated disk occurs when some of the softer "jelly" pushes out through a crack in the tougher exterior.

A herniated disk can irritate nearby nerves and result in pain, numbness or weakness in an arm or leg. On the other hand, many people experience no symptoms from a herniated disk. Most people who have a herniated disk don't need surgery to correct the problem.

## Causes

Disk herniation is most often the result of a gradual, aging-related wear and tear called disk degeneration. As you age, your spinal disks lose some of their water content. That makes them less flexible and more prone to tearing or rupturing with even a minor strain or twist.

Most people can't pinpoint the exact cause of their herniated disk. Sometimes, using your back muscles instead of your leg and thigh muscles to lift large, heavy objects can lead to a herniated disk, as can twisting and turning while lifting. Rarely, a traumatic event such as a fall or a blow to the back can cause a herniated disk.

## Symptoms

You can have a herniated disk without knowing it — herniated disks sometimes show up on spinal images of people who have no symptoms of a disk problem. But some herniated disks can be painful. Most herniated disks occur in your lower back (lumbar spine), although they can also occur in your neck (cervical spine).

The most common signs and symptoms of a herniated disk are:

- Arm or leg pain. If your herniated disk is in your lower back, you'll typically feel the most intense pain in your buttocks, thigh and calf. It may also involve part of the foot. If your herniated disk is in your neck, the pain will typically be most intense in the shoulder and arm. This pain may shoot into your arm or leg when you cough, sneeze or move your spine into certain positions.
- A herniated disc at lumbar segment 4 and 5 (L4-L5) usually causes L5 nerve impingement. In addition to sciatica pain, this type of herniated disc can lead to weakness when raising the big toe and possibly in the ankle, also known as [foot drop](#). Numbness and pain can also be felt on top of the foot.
- A herniated disc at lumbar segment 5 and sacral segment 1 (L5-S1) usually causes S1 nerve impingement. In addition to [sciatica](#), this type of herniated disc can lead to weakness when standing on the toes. Numbness and pain can radiate down into the sole of the foot and the outside of the foot.
- Numbness or tingling. People who have a herniated disk often experience numbness or tingling in the body part served by the affected nerves.
- Weakness. Muscles served by the affected nerves tend to weaken. This may cause you to stumble, or impair your ability to lift or hold items.

## **Risk Factors**

Factors that increase your risk of a herniated disk may include:

- **Weight.** Excess body weight causes extra stress on the disks in your lower back.
- **Occupation.** People with physically demanding jobs have a greater risk of back problems. Repetitive lifting, pulling, pushing, bending sideways and twisting also may increase your risk of a herniated disk.
- **Genetics.** Some people inherit a predisposition to developing a herniated disk.

## **Physical Examination for Herniated Disk:**

- Spine examination may reveal a loss of normal spinal curvature and decreased range of motion due to muscle spasm. A **Lasegue test**, also known as straight-leg raise test, is performed. Raising the leg stretches the nerve roots, which may aggravate sciatic pain in the presence of a disc herniation.
- Individual muscle groups are tested for strength to determine any signs of weakness. Reflexes are tested at the knees and ankles. Sensation to pin is tested in both legs.
- A Lasegue test is performed to examine if any lumbar nerve roots are involved. The patient lies down, the knee is extended, and the hip is flexed. If pain is aggravated or produced, it is an indication the lower lumbosacral nerve roots are inflamed.
- If the history and physical examination suggest a disc herniation, the diagnostic test of choice is an MRI (magnetic resonance imaging) study. If the patient is unable to get an MRI, CT scan or CT myelography may be performed.

## **Treatments and drugs**

- **Conservative treatment** — mainly avoiding painful positions and following a planned exercise and pain-medication regimen — relieves symptoms in 9 out of 10 people with a herniated disk.
- **Over-the-counter pain medications.** If your pain is mild to moderate, your doctor may tell you to take an over-the-counter pain medication, such as ibuprofen (Advil, Motrin IB, others) or naproxen (Aleve, others).
- **Narcotics.** If your pain doesn't improve with over-the-counter medications, your doctor may prescribe narcotics, such as codeine or an oxycodone-acetaminophen combination (Percocet, Oxycontin, others), for a short time. Sedation, nausea, confusion and constipation are possible side effects from these drugs.
- **Nerve pain medications.** Drugs such as gabapentin (Neurontin, Gralise, Horizant), pregabalin (Lyrica), duloxetine (Cymbalta), tramadol (Ultram) and amitriptyline often help relieve nerve-damage pain. Because these drugs have a milder set of side effects than do narcotic medications, they're increasingly being used as first line prescription medications for people who have herniated disks.
- **Muscle relaxers.** Muscle relaxants may be prescribed if you have muscle spasms. Sedation and dizziness are common side effects of these medications.

- Cortisone injections. Inflammation-suppressing corticosteroids may be given by injection directly into the area around the spinal nerves. Spinal imaging can help guide the needle more safely. Occasionally a course of oral steroids may be tried to reduce swelling and inflammation.

### **Therapy**

Physical therapists can show you positions and exercises designed to minimize the pain of a herniated disk. A physical therapist may also recommend:

- Heat or ice
- Traction
- Ultrasound
- Electrical stimulation
- Short-term bracing for the neck or lower back

### **Surgery**

A very small number of people with herniated disks eventually need surgery. Your doctor may suggest surgery if conservative treatments fail to improve your symptoms after six weeks, especially if you continue to experience:

- Numbness or weakness
- Difficulty standing or walking
- Loss of bladder or bowel control

In many cases, surgeons can remove just the protruding portion of the disk. Rarely, however, the entire disk must be removed. In these cases, the vertebrae may need to be fused together with metal hardware to provide spinal stability. Rarely, your surgeon may suggest the implantation of an artificial disk.

# X. Sciatica

## Definition

Sciatica refers to pain that radiates along the path of the sciatic nerve, which branches from your lower back through your hips and buttocks and down each leg. Typically, sciatica affects only one side of your body.

Sciatica most commonly occurs when a herniated disk, bone spur on the spine or narrowing of the spine (spinal stenosis) compresses part of the nerve. This causes inflammation, pain and often some numbness in the affected leg.

Although the pain associated with sciatica can be severe, most cases resolve with non-operative treatments in a few weeks. People who have severe sciatica that's associated with significant leg weakness or bowel or bladder changes might be candidates for surgery.

## Causes

Sciatica occurs when the sciatic nerve becomes pinched, usually by a herniated disk in your spine or by an overgrowth of bone (bone spur) on your vertebrae. More rarely, the nerve can be compressed by a tumor or damaged by a disease such as diabetes.

Additional Causes:

- Spinal stenosis, a narrowing of the canal that contains the spinal cord: As we age, the bone can overgrow and put pressure on the sciatic nerve. Many people with spinal stenosis have sciatica on both sides of the back.
- Spondylolisthesis, a condition in which one backbone has slipped forward or backward over another backbone, results in pressure on the sciatic nerve.
- A pinched or stretched sciatic nerve
- Piriformis syndrome causes the sciatic nerve to become trapped deep in the buttock by the piriformis muscle. The symptoms are the same as those of sciatica.
- Sciatica can also be caused by other effects of aging, such as osteoarthritis and fractures due to osteoporosis.
- Many women experience sciatica during pregnancy.

## Symptoms

Pain that radiates from your lower (lumbar) spine to your buttock and down the back of your leg is the hallmark of sciatica. You might feel the discomfort almost anywhere along the nerve pathway, but it's especially likely to follow a path from your low back to your buttock and the back of your thigh and calf.

The pain can vary widely, from a mild ache to a sharp, burning sensation or excruciating pain. Sometimes it can feel like a jolt or electric shock. It can be worse when you cough or sneeze, and prolonged sitting can aggravate symptoms. Usually only one side of your body is affected. Some people also have numbness, tingling or muscle weakness in the affected leg or foot. You might have pain in one part of your leg and numbness in another part.

## **Risk Factors**

Risk factors for sciatica include:

- Age. Age-related changes in the spine, such as herniated disks and bone spurs, are the most common causes of sciatica.
- Obesity. By increasing the stress on your spine, excess body weight can contribute to the spinal changes that trigger sciatica.
- Occupation. A job that requires you to twist your back, carry heavy loads or drive a motor vehicle for long periods might play a role in sciatica, but there's no conclusive evidence of this link.
- Prolonged sitting. People who sit for prolonged periods or have a sedentary lifestyle are more likely to develop sciatica than active people are.
- Diabetes. This condition, which affects the way your body uses blood sugar, increases your risk of nerve damage

## **Treatment**

### *Medications*

The types of drugs that might be prescribed for sciatica pain include:

- Anti-inflammatories
- Muscle relaxants
- Narcotics
- Tricyclic antidepressants
- Anti-seizure medications

### *Physical therapy*

Once your acute pain improves, your doctor or a physical therapist can design a rehabilitation program to help you prevent future injuries. This typically includes exercises to correct your posture, strengthen the muscles supporting your back and improve your flexibility.

### *Steroid injections*

In some cases, your doctor might recommend injection of a corticosteroid medication into the area around the involved nerve root. Corticosteroids help reduce pain by suppressing inflammation around the irritated nerve. The effects usually wear off in a few months. The number of steroid injections you can receive is limited because the risk of serious side effects increases when the injections occur too frequently.

### **Physical Examination for Sciatica:**

During the physical exam, your doctor may check your muscle strength and reflexes. For example, you may be asked to walk on your toes or heels, rise from a squatting position and, while lying on your back, lift your legs one at a time. Pain that results from sciatica will usually worsen during these activities.

### **Slump Test**

- Description: To begin the test, have the patient seated with hands behind back to achieve a neutral spine. The first step is to have the patient slump forward at the thoracic and lumbar spine. If this position does not cause pain, have the patient flex the neck by placing the chin on the chest and then extending one knee as much as possible.
- If extending the knee causes pain, have the patient extend the neck into neutral. If the patient is still unable to extend the knee due to pain, the test is considered positive.
- If extending the knee does not cause pain, ask the patient to actively dorsiflex the ankle. If dorsiflexion causes pain, have the patient slightly flex the knee while still dorsiflexing. If the pain is reproduced, the test is considered positive.
- Repeat test on opposite side.
- Over-pressure can be applied during any of the test positions.

# XI. Common Knee Injuries

The most common knee injuries include fractures around the knee, dislocation, and sprains and tears of soft tissues, like ligaments. In many cases, injuries involve more than one structure in the knee.

Pain and swelling are the most common signs of knee injury. In addition, your knee may catch or lock up. Many knee injuries cause instability — the feeling that your knee is giving way.

## A. Fractures

The most common bone broken around the knee is the patella. The ends of the femur and tibia where they meet to form the knee joint can also be fractured. Many fractures around the knee are caused by high energy trauma, such as falls from significant heights and motor vehicle collisions.



Patellar fracture.

## B. Dislocation

A dislocation occurs when the bones of the knee are out of place, either completely or partially. For example, the femur and tibia can be forced out of alignment, and the patella can also slip out of place. Dislocations can be caused by an abnormality in the structure of a person's knee. In people who have normal knee structure, dislocations are most often caused by high energy trauma, such as falls, motor vehicle crashes, and sports-related contact.



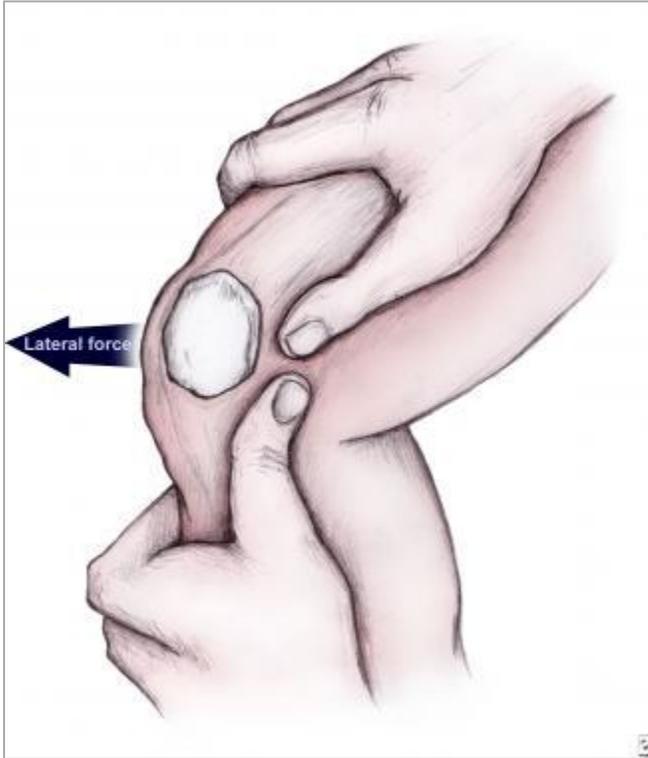
Patellar dislocation.

*Reproduced with permission from The Body Almanac. © American Academy of Orthopaedic Surgeons, 2003.*

## Physical Examination for Possible Patellar Dislocation:

### The Apprehension Test

The apprehension test can be used to evaluate a patient for possible previous dislocation or subluxation and is performed as follows (see the image below):



Apprehension sign. The knee is placed at 30° flexion, and lateral pressure is applied. Medial instability results in apprehension by the patient.

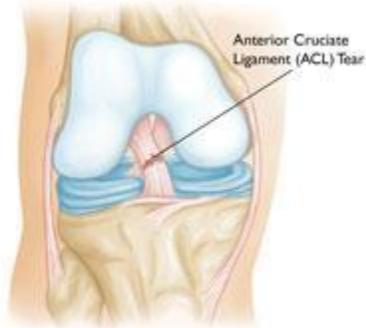
- This test involves applying a laterally directed force to the medial patella with the knee flexed 30°.
- In patients with a previous dislocation or subluxation, this is very distressing. Patients often resist this test and become very apprehensive. Many times, the patient grabs the examiner's hand to prevent further pain and relieve apprehension.
- With no previous patellar dislocation, the apprehension test is tolerated well.

Assessing lateral patellar tracking with knee motion is an important part of the examination for patellofemoral dysfunction.

- A positive J sign indicates lateral patellar tracking. A positive J sign is observed as the patella tracking laterally when the patient brings the knee from flexion to extension (ie, the patella moves notably laterally at terminal knee extension). This can be visualized well if the examiner places a digit on both the medial and lateral aspects of the superior patella.
- A healthy patella moves mostly superiorly and slightly laterally at terminal knee extension.

## C. Anterior Cruciate Ligament (ACL) Injuries

The anterior cruciate ligament is often injured during sports activities. Athletes who participate in high demand sports like soccer, football, and basketball are more likely to injure their anterior cruciate ligaments. Changing direction rapidly or landing from a jump incorrectly can tear the ACL. About half of all injuries to the anterior cruciate ligament occur along with damage to other structures in the knee, such as articular cartilage, meniscus, or other ligaments.

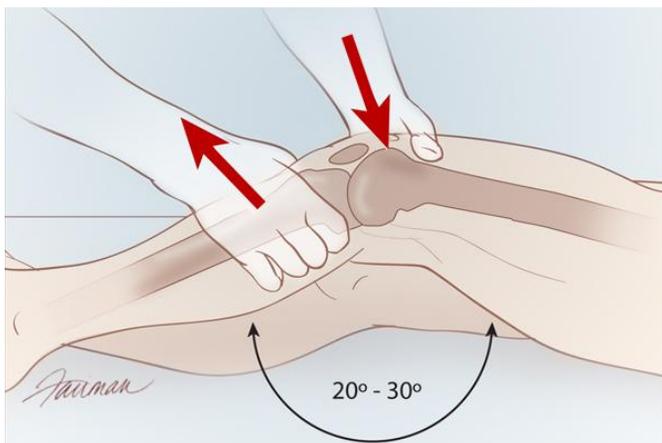


Anterior cruciate ligament tear.

### **Physical Examinations to Assess ACL Injuries:**

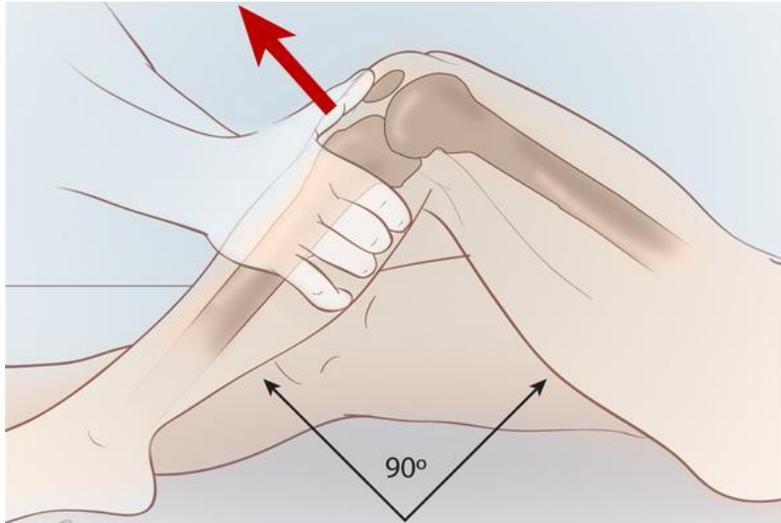
#### **Lachman Test**

With the patient lying in the supine position, flex the knee 20° to 30° while the heel rests on the end of the exam table. Grasp the femur with the nondominant hand to prevent movement of the upper leg. Then, grasp the lower leg at the proximal tibia and apply a forward tug. This movement should produce a firm endpoint. If the endpoint is not firm or there is increased anterior translation of the tibia, the Lachman test is positive.



### Anterior Drawer Test

With the patient lying in the supine position, place the knee in 90° of flexion without rotation. Place both hands on the proximal tibia, and pull the upper part of the calf forward. An anterior drawer test is positive when the tibia moves anteriorly without an abrupt, hard endpoint.



### Pivot Shift Test

When the lower leg is stabilized in near full extension. With increasing flexion, a palpable springlike reduction should be observed. A positive pivot shift test usually produces a thud or jerk around 10° to 20° of flexion. During a positive exam, the force created by the examiner will cause the knee joint to slip, giving a positive visual for identifying rotational knee instability.



## D. Posterior Cruciate Ligament Injuries

The posterior cruciate ligament is often injured from a blow to the front of the knee while the knee is bent. This often occurs in motor vehicle crashes and sports-related contact. Posterior cruciate ligament tears tend to be partial tears with the potential to heal on their own.



Posterior cruciate ligament tear (shown from back of knee).

### Symptoms

Signs and symptoms of a posterior cruciate ligament injury may include:

- Pain. Mild to moderate pain in the knee can cause a slight limp or difficulty walking.
- Swelling. Knee swelling occurs rapidly, within hours of the injury.
- Instability. Your knee may feel loose, as if it's going to give way.

Signs and symptoms can be so mild that you might not even notice anything wrong. Over time, the pain may worsen and your knee may feel more unstable. If other parts of the knee have also been injured, your signs and symptoms will likely be more severe.

### Physical Examination for Posterior Cruciate Ligament Injuries:

In the acute stage of isolated PCL injuries, symptoms usually are vague and minimal. The following physical examination findings are common in individuals who have sustained PCL injuries:

- Minimal to no pain
- Minimal hemarthrosis
- Usually full or functional range of motion (ROM)
- Contusion over the anterior tibia
- Posterior tibial sag

**Posterior tibial sag:** To observe **posterior tibial sag** (seen in the images below), place patient supine and put 90° of flexion at the knee and hip. In such a position, gravity pulls posteriorly on the tibia, and in the case of PCL disruption, the tibia falls even or behind the femoral condyles. Comparison should be made to the opposite knee.



○ The posterior tibial sag sign. The photo on the left demonstrates the clinical finding of the posterior tibial sag sign. A line drawn parallel to the patella accentuates the posterior tibial sag. The photo on the right demonstrates the quadriceps **active drawer test**. With the knee in 70-90° of flexion, the extensor mechanism is contracted, pulling the tibia anteriorly into a reduced position.

### **Quadriceps active test**

- During the quadriceps active test, the patient is placed supine with the knee flexed to 90 ° and the foot placed flat on the examining table.
- If an individual with an intact PCL is in such a position with the quadriceps relaxed, the tibia is 10 mm anterior to the femoral condyles. If there is a PCL disruption, gravity pulls the tibia even or behind the femoral condyles, with the quadriceps relaxed. The examiner restrains the ankle from moving, and the patient is asked to contract the quadriceps. In individuals who have a deficient PCL, the tibia moves forward; if the tibia moves forward more than 2 mm, the quadriceps active test is positive.

**External Rotation Recurvatum Test:** Findings of the external rotation recurvatum test: This test is the same as the posterior sag sign described above, except the examiner notices significant subluxation of the lateral tibial plateau.

### **Posterior Drawer Test**

- Description: The posterior drawer test is used to examine the Posterior Cruciate Ligament (PCL).
- Maneuver: Have the patient lying on their back with their knee bent as close to 90° as possible with their foot resting on the table. Place both hands behind the tibia, and push backwards on the proximal shin/tibia looking for instability backwards. Use a force between 15-20 lbs
- Positive Findings: Upon application of a posterior force to the upper shin, an increase in backwards motion (posterior translation of the tibia) in comparison to the other side is indicative of a positive test.

## E. Collateral Ligament Injuries

Injuries to the collateral ligaments are usually caused by a force that pushes the knee sideways. These are often contact injuries. Injuries to the MCL are usually caused by a direct blow to the outside of the knee, and are often sports-related. Blows to the inside of the knee that push the knee outwards may injure the lateral collateral ligament. Lateral collateral ligament tears occur less frequently than other knee injuries.



Tears of the medial and lateral collateral ligaments.

### a. MCL Knee Ligament Injury Signs & Symptoms

With a first degree sprain of the Medial ligament there will be pain when the site of the damage is touched. Stressing the ligament (when the knee is slightly bent and the shin is moved inwards in relation to the thigh) is painful - this action is reproduced when standing up from sitting in a chair.

In the case of a second degree sprain, the pain is more severe when touched and when the ligament is stressed. There will usually be a swelling of the knee joint, but this may take 24 hours to appear.

In the case of a third degree sprain, where the ligament is ruptured, the knee joint is unstable and activity cannot be continued. There will be a bleed and an inflow of fluid into the joint but, because the capsule that surrounds the joint is also damaged, this fluid may leak out and swelling may not be evident

### Physical Examination of Collateral Ligament Injuries

- Medial collateral ligament (MCL) injury
  - Palpate with the knee in 25-30 ° of flexion.
  - Tenderness may be noted anywhere along the course of the MCL.
  - Isolated tenderness at the proximal or distal insertion sites may indicate an avulsion-type injury.
  - Swelling often is present and should alert the examiner to possible intra-articular injury.

- Lateral collateral ligament (LCL) injury
  - Palpate with the knee in 20 ° of flexion.
  - Tenderness may be noted anywhere along the course of the LCL.
  - Isolated tenderness at the proximal or distal insertion sites may indicate an avulsion-type injury.
  - Swelling is common.
- **Testing of collateral ligaments**
  - **Valgus stress testing** of the MCL
    - The patient is in the supine position with the knee flexed 25-30 °. The examiner places one hand on the lateral knee and grasps the medial ankle with the other hand. Then the knee is abducted. Pain and excessive laxity indicate stretching or tearing of the MCL.
    - Perform the same technique as above with the knee extended. If excessive knee joint laxity and pain are still noted, injury to the anterior cruciate ligament also may be present.
  - **Varus stress testing** of the LCL
    - The patient is in the supine position with the knee flexed 20-25 °. The examiner places one hand on the medial knee and grasps the lateral ankle with other hand. The knee is adducted. Pain and excessive laxity indicate injury to the LCL.
    - Then perform the same technique as above with the knee extended. If pain and laxity are still present, injury to the posterior capsule may be present.
- Injury severity
  - Grade I - Less than 5 cm laxity (partial tear)
  - Grade II - 5-10 cm laxity
  - Grade III - More than 10 cm laxity (complete tear)

## F. Meniscal Tears

Sudden meniscal tears often happen during sports. Tears in the meniscus can occur when twisting, cutting, pivoting, or being tackled. Meniscal tears may also occur as a result of arthritis or aging. Just an awkward twist when getting up from a chair may be enough to cause a tear, if the menisci have weakened with age.



Meniscal tear.

### Symptoms of Meniscal Tears

The most common symptoms of meniscus tear are:

- Pain.
- Stiffness and swelling.
- Catching or locking of your knee.
- The sensation of your knee "giving way"
- You are not able to move your knee through its full range of motion.

### Physical Examination for Meniscal Tears:

#### McMurray's Test

Description: This test checks for meniscal tears and other internal derangement in the knee.

Maneuver: With the patient supine, and their hip and knee bent to 90°, grasp the heel in one hand. Place the other hand over the knee, with the thumb and fingers on the joint line. Gently rotate the tibia with the heel internally rotated with a mild valgus force (for the lateral compartment) and externally rotated with a mild varus force (for the medial compartment).

Alternate View:

Tip: The laterality of the test is non-specific, which means that the test can bother a meniscal tear on either side of the knee when rotation occurs.

Positive Findings: Painful clicking along the joint line, or any pain over the joint line that reproduces the patient's symptoms is considered to be a positive test.

## Thessaly's Test

Description: This functionally tests meniscus tears in the standing position. Since bending and twisting movements while weight bearing often reproduce pain from meniscus tears, this test recreates the exacerbating movements.

Maneuver: Have the patient stand on one foot with the foot flat on the floor. Hold the patients hand for support and have them initially bend on the standing knee to 5° of flexion. Ask the patient to twist at the knee, making sure they are internally and externally rotating at the knee rather than at the pelvis or back. Check for any reproduction of pain symptoms. Next, have the patient bend the knee deeper to 20°degrees and again actively twists on knee.

Deeper Bend:

Positive Findings: The twisting movement will reproduce pain of a meniscal injury. The pain is typically localized to joint line, and patients typically have more pain with the knee bent at 20° rather than 5°.

## G. Tendon Tears

The quadriceps and patellar tendons can be stretched and torn. Although anyone can injure these tendons, tears are more common among middle-aged people who play running or jumping sports. Falls, direct force to the front of the knee, and landing awkwardly from a jump are common causes of knee tendon injuries.



### Causes

- A very strong force is required to tear the patellar tendon.
- Falls. Direct impact to the front of the knee from a fall or other blow is a common cause of tears. Cuts are often associated with this type of injury.
- Jumping. The patellar tendon usually tears when the knee is bent and the foot planted, like when landing from a jump or jumping up.

## **Tendon Weakness**

A weakened patellar tendon is more likely to tear. Several things can lead to tendon weakness.

**Patellar tendinitis.** Inflammation of the patellar tendon, called patellar tendinitis, weakens the tendon. It may also cause small tears.

Patellar tendinitis is most common in people who participate in activities that require running or jumping. While it is more common in runners, it is sometimes referred to as "jumper's knee."

Corticosteroid injections to treat patellar tendinitis have been linked to increased tendon weakness and increased likelihood of tendon rupture. These injections are typically avoided in or around the patellar tendon.

**Chronic disease.** Weakened tendons can also be caused by diseases that disrupt blood supply. Chronic diseases which may weaken the tendon include:

- Chronic renal failure
- Hyper betalipoproteinemia
- Rheumatoid arthritis
- Systemic lupus erythmatosus (SLE)
- Diabetes mellitus
- Infection
- Metabolic disease

**Steroid use.** Using medications like corticosteroids and anabolic steroids has been linked to increased muscle and tendon weakness.

**Surgery.** Previous surgery around the tendon, such as a total knee replacement or anterior cruciate ligament reconstruction, might put you at greater risk for a tear.

## **H. General Treatment of Knee Injuries**

When you are first injured, the RICE method -- rest, ice, gentle compression and elevation - can help speed your recovery. Be sure to seek treatment as soon as possible, especially if you:

- Hear a popping noise and feel your knee give out at the time of injury
- Have severe pain
- Cannot move the knee
- Begin limping
- Have swelling at the injury site

The type of treatment your doctor recommends will depend on several factors, such as the severity of your injury, your age, general health, and activity level.

### **Nonsurgical Treatment**

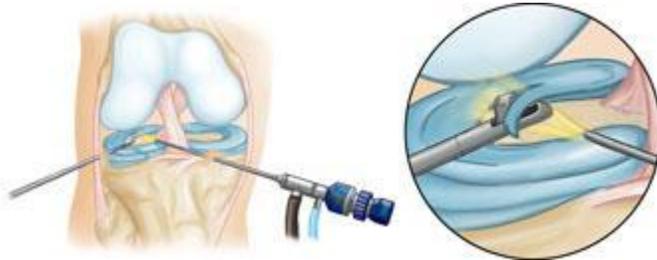
Many knee injuries can be treated with simple measures, such as:

- **Immobilization.** Your doctor may recommend a brace to prevent your knee from moving. If you have fractured a bone, a cast or brace may hold the bones in place while they heal. To further protect your knee, you may be given crutches to keep you from putting weight on your leg.

- Physical therapy. Specific exercises will restore function to your knee and strengthen the leg muscles that support it.
- Non-steroidal anti-inflammatory medicines. Drugs like aspirin and ibuprofen reduce pain and swelling.

### **Surgical Treatment**

Many fractures and injuries around the knee require surgery to fully restore function to your leg. In some cases - such as many ACL tears — surgery can be done arthroscopically using miniature instruments and small incisions. Many injuries require open surgery with a larger incision that provides your surgeon with a more direct view and easier access to the injured structures.

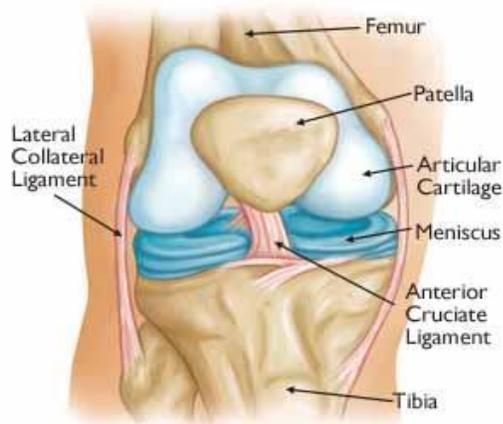


(Left) Knee arthroscopy. (Right) Close-up of an arthroscopic meniscal surgery.

## **I. Total Knee Replacements**

If your knee is severely damaged by arthritis or injury, it may be hard for you to perform simple activities, such as walking or climbing stairs. You may even begin to feel pain while you are sitting or lying down.

If nonsurgical treatments like medications and using walking supports are no longer helpful, you may want to consider total knee replacement surgery. Joint replacement surgery is a safe and effective procedure to relieve pain, correct leg deformity, and help you resume normal activities.



### Cause

The most common cause of chronic knee pain and disability is arthritis. Although there are many types of arthritis, most knee pain is caused by just three types: osteoarthritis, rheumatoid arthritis, and post-traumatic arthritis.

- Osteoarthritis. This is an age-related "wear and tear" type of arthritis. It usually occurs in people 50 years of age and older, but may occur in younger people, too. The cartilage that cushions the bones of the knee softens and wears away. The bones then rub against one another, causing knee pain and stiffness.
- Rheumatoid arthritis. This is a disease in which the synovial membrane that surrounds the joint becomes inflamed and thickened. This chronic inflammation can damage the cartilage and eventually cause cartilage loss, pain, and stiffness. Rheumatoid arthritis is the most common form of a group of disorders termed "inflammatory arthritis."
- Post-traumatic arthritis. This can follow a serious knee injury. Fractures of the bones surrounding the knee or tears of the knee ligaments may damage the articular cartilage over time, causing knee pain and limiting knee function.



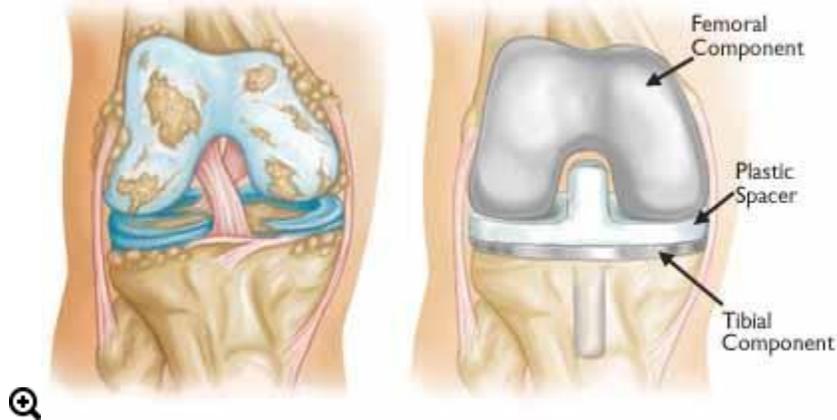
Osteoarthritis often results in bone rubbing on bone. Bone spurs are a common feature of this form of arthritis.

## Description

A knee replacement (also called knee arthroplasty) might be more accurately termed a knee "resurfacing" because only the surface of the bones are actually replaced.

There are four basic steps to a knee replacement procedure.

- Prepare the bone. The damaged cartilage surfaces at the ends of the femur and tibia are removed along with a small amount of underlying bone.
- Position the metal implants. The removed cartilage and bone is replaced with metal components that recreate the surface of the joint. These metal parts may be cemented or "press-fit" into the bone.
- Resurface the patella. The undersurface of the patella (kneecap) is cut and resurfaced with a plastic button. Some surgeons do not resurface the patella, depending upon the case.
- Insert a spacer. A medical-grade plastic spacer is inserted between the metal components to create a smooth gliding surface.



(Left) Severe osteoarthritis. (Right) The arthritic cartilage and underlying bone has been removed and resurfaced with metal implants on the femur and tibia. A plastic spacer has been placed in between the implants. The patellar component is not shown for clarity.

## When Surgery Is Recommended

There are several reasons why your doctor may recommend knee replacement surgery. People who benefit from total knee replacement often have:

A knee that has become bowed as a result of severe arthritis.

- Severe knee pain or stiffness that limits your everyday activities, including walking, climbing stairs, and getting in and out of chairs. You may find it hard to walk more than a few blocks without significant pain and you may need to use a cane or walker
- Moderate or severe knee pain while resting, either day or night
- Chronic knee inflammation and swelling that does not improve with rest or medications
- Knee deformity — a bowing in or out of your knee
- Failure to substantially improve with other treatments such as anti-inflammatory medications, cortisone injections, lubricating injections, physical therapy, or other surgeries

## XII. Achilles Tendinitis

### Definition

Achilles tendinitis is an overuse injury of the Achilles tendon, the band of tissue that connects calf muscles at the back of the lower leg to your heel bone.

Achilles tendinitis most commonly occurs in runners who have suddenly increased the intensity or duration of their runs. It's also common in middle-aged people who play sports, such as tennis or basketball, only on the weekends.

Most cases of Achilles tendinitis can be treated with relatively simple, at-home care under your doctor's supervision. Self-care strategies are usually necessary to prevent recurring episodes. More-serious cases of Achilles tendinitis can lead to tendon tears (ruptures) that may require surgical repair.

Simply defined, tendinitis is inflammation of a tendon. Inflammation is the body's natural response to injury or disease, and often causes swelling, pain, or irritation. There are two types of Achilles tendinitis, based upon which part of the tendon is inflamed



Noninsertional Achilles tendinitis

### 1. Noninsertional Achilles Tendinitis

In noninsertional Achilles tendinitis, fibers in the middle portion of the tendon have begun to break down with tiny tears (degenerate), swell, and thicken.

Tendinitis of the middle portion of the tendon more commonly affects younger, active people.

### 2. Insertional Achilles Tendinitis

Insertional Achilles tendinitis involves the lower portion of the heel, where the tendon attaches (inserts) to the heel bone.

In both noninsertional and insertional Achilles tendinitis, damaged tendon fibers may also calcify (harden). Bone spurs (extra bone growth) often form with insertional Achilles tendinitis. Tendinitis that affects the insertion of the tendon can occur at any time, even in patients who are not active.

## Cause

Achilles tendinitis is typically not related to a specific injury. The problem results from repetitive stress to the tendon. This often happens when we push our bodies to do too much, too soon, but other factors can make it more likely to develop tendinitis, including:



A bone spur that has developed where the tendon attaches to the heel bone.

- Sudden increase in the amount or intensity of exercise activity—for example, increasing the distance you run every day by a few miles without giving your body a chance to adjust to the new distance
- Tight calf muscles—Having tight calf muscles and suddenly starting an aggressive exercise program can put extra stress on the Achilles tendon
- Bone spur—Extra bone growth where the Achilles tendon attaches to the heel bone can rub against the tendon and cause pain

## Symptoms

Common symptoms of Achilles tendinitis include:

- Pain and stiffness along the Achilles tendon in the morning
- Pain along the tendon or back of the heel that worsens with activity
- Severe pain the day after exercising
- Thickening of the tendon
- Bone spur (insertional tendinitis)
- Swelling that is present all the time and gets worse throughout the day with activity

If you have experienced a sudden "pop" in the back of your calf or heel, you may have ruptured (torn) your Achilles tendon. See your doctor immediately if you think you may have torn your tendon.

## Doctor Examination

After you describe your symptoms and discuss your concerns, the doctor will examine your foot and ankle. The doctor will look for these signs:

- Swelling along the Achilles tendon or at the back of your heel
- Thickening or enlargement of the Achilles tendon
- Bony spurs at the lower part of the tendon at the back of your heel (insertional tendinitis)
- The point of maximum tenderness

- Pain in the middle of the tendon, (noninsertional tendinitis)
- Pain at the back of your heel at the lower part of the tendon (insertional tendinitis)
- Limited range of motion in your ankle—specifically, a decreased ability to flex your foot

### **Treatment**

Tendinitis usually responds well to self-care measures. But if your signs and symptoms are severe or persistent, your doctor might suggest other treatment options.

#### *Medications*

If over-the-counter pain medications — such as ibuprofen (Advil, Motrin IB, others) or naproxen (Aleve) — aren't enough, your doctor might prescribe stronger medications to reduce inflammation and relieve pain.

#### *Physical therapy*

A physical therapist might suggest some of the following treatment options:

**Exercises.** Therapists often prescribe specific stretching and strengthening exercises to promote healing and strengthening of the Achilles tendon and its supporting structures.

A special type of strengthening called "eccentric" strengthening, involving a slow let down of a weight after raising it, has been found to be especially helpful for persistent Achilles problems.

**Orthotic devices.** A shoe insert or wedge that slightly elevates your heel can relieve strain on the tendon and provide a cushion that lessens the amount of force exerted on your Achilles tendon.

#### *Surgery*

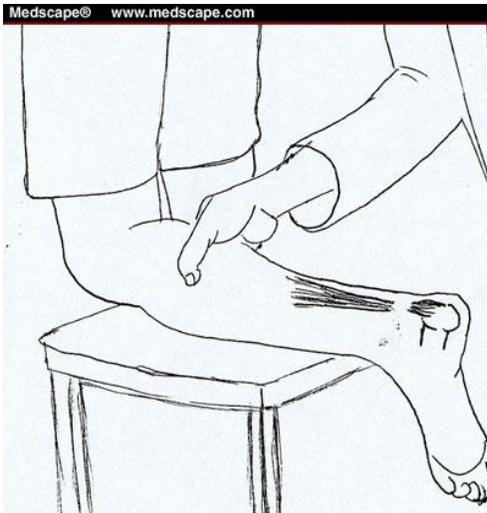
If several months of more-conservative treatments don't work or if the tendon has torn, your doctor may suggest surgery to repair your Achilles tendon.

### **Physical Examinations for Achilles Tendinitis:**

**Heel Rises:** First, the patient should be instructed to perform repetitive heel rises. Despite the other functioning plantar flexors, the patient with a torn Achilles tendon will be unsuccessful in this attempt

### **Thompson Test**

This is done by simply squeezing the midcalf of the affected leg, which is kneeling (90-degree angle) on a chair while the opposite leg remains standing. The absence of ankle plantarflexion is suggestive of a complete Achilles tendon rupture and is termed a "positive" Thompson test



### **Copeland Test**

The Copeland test involves having the patient lie prone while flexing his knee to ninety degrees. A sphygmomanometer cuff is then placed around the bulk of the calf and inflated to 100 mm Hg with the ankle plantar flexed. When the ankle is dorsiflexed, the calf pressure in normal controls increases to about 140 mm Hg. In contrast, the pressure in those with a torn Achilles tendon will change by merely a flicker. It should be noted that the opposite leg may be used as a control for comparison purposes.

### **O'Brien's Needle Test:**

- 25 gauge needle is inserted at right angle thru skin of calf muscle just medial to midline at point 10 cm proximal to superior border of calcaneus;
- needle tip should be just w/ in substance of the tendo calcaneus;
- motion of the hub of the needle in a direction opposite that of the tendon during passive dorsiflexion and plantarflexion of the
- foot confirms an intact tendon distal to the level of needle insertion