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Anterior Cruciate Ligament Reconstruction

The anterior cruciate ligament (ACL) tear is a common injury to the knee with approximately 400,000 reconstructions performed annually. Most people who experience the injury report feeling a pop after making a sudden move to change directions or pivoting during sports play. Soon after the sprain (tear) occurs you experience pain and swelling around the knee.

Knee anatomy

With its multiple structures and capsular attachments, the knee joint tends to be one of the most mobile joints in the body allowing for rotation, flexion (bending), and extension (straightening) during movement. The largest joint in the body, the knee is made up of the lower end of the femur (thighbone) and the upper end of the tibia, or shinbone (Fig. 1). The patella (kneecap) slides in a groove at the end of the femur. Furthermore, the knee is a diarthrodial joint, which is characterized by the presence of a layer of cartilage that lines the ends of the bony surfaces of the femur and tibia. Cartilage inside the joint helps to cushion and absorb shock providing stability to the knee, and tendons connect the muscles to the bones. Ligaments of the knee are tough, flexible, fibrous connective tissues at the end of the femur, tibia, and fibula that connect the bones, which also help stabilize and support the knee.

Fig. 1. Normal knee anatomy (front view)

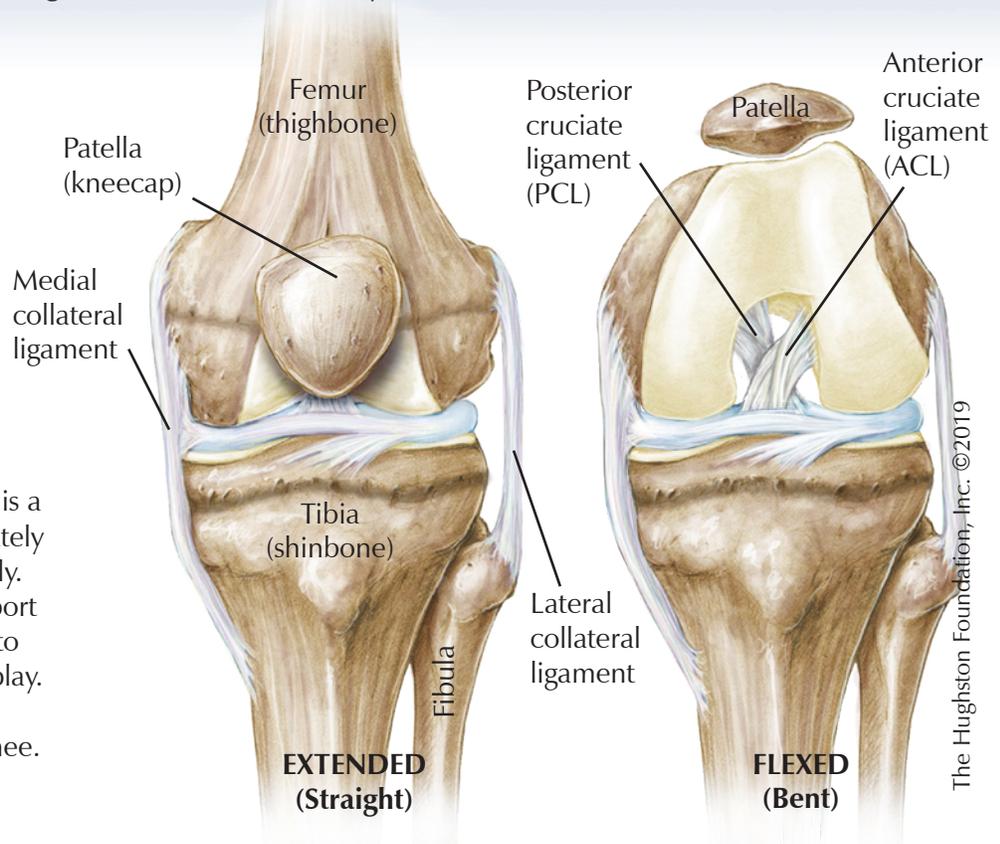


Fig. 2. Injured anterior cruciate ligament (ACL)

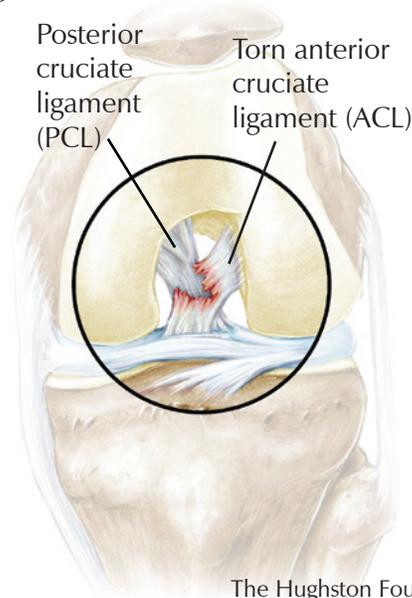
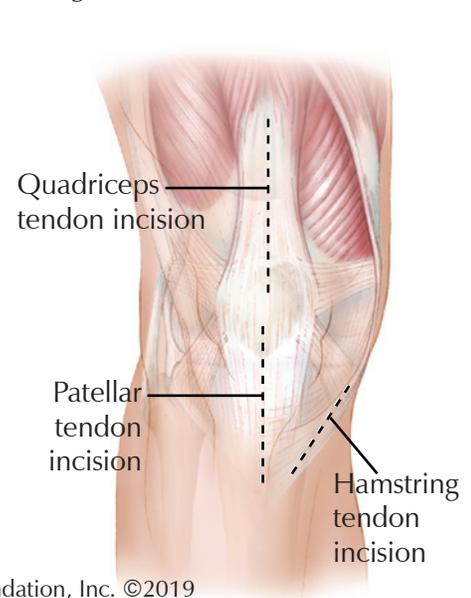


Fig. 3. Right knee anatomy with surgical incision sites





Knee ligaments

Four main ligaments help stabilize the knee; the medial (inner side) and lateral (outer side) collateral ligaments resist side-to-side motion, and the anterior (front) and posterior (back) cruciate ligaments resist forward and backward motion, respectively (**Fig. 1**). These 2 ligaments form a cross shape with their orientation in the center portion of the knee, which is why they are termed “cruciate” ligaments. The ACL provides most of the support that prevents the tibia from slipping forward against the femur. The ligaments work together with the medial and lateral menisci (crescent-shaped cartilage) and the leg muscles to stabilize the joint and allow the knee to generate and deliver the large quantities of power required for activities.

Ligament tear

During an injury to the knee, 1 or multiple ligaments may be disrupted or torn; however a tear of the ACL is one of the most common ligament injuries (**Fig. 2**). Partial tears are rare, so when an ACL injury does occur it is usually a complete tear. The patient often describes a feeling of a “pop” and there is usually immediate swelling of the knee. This is commonly associated with a noncontact pivoting injury during a sporting event. Once an injury has occurred, it is essential to get a thorough examination, most preferably at the time of injury or soon thereafter to determine which structures have been damaged.

With today’s technology, nearly all patients with suspected knee ligament injuries undergo magnetic resonance imaging (MRI, a scan that shows the bones, muscles, tendons, and ligaments) to fully evaluate all the soft tissue structures as well as bony anatomy to determine the extent of the injury. Once the physician has determined what structures are injured, treatment options to restore normal function can be discussed with the patient.

Nonsurgical treatment

Nonsurgical treatment can be an option for low-demand patients with decreased flexibility and those who have no feeling of instability about the knee. This treatment plan involves physical therapy, bracing, and lifestyle modifications. On the other hand, for young, active patients, or patients who continue to have episodes of instability where they complain that their knee “buckles” or “gives way” or they “do not trust their knee”, surgery is the best solution.

Weighing the pros and cons of surgery

Deciding to have surgery can be a difficult decision, especially since patients must not only weigh the risks, they must also consider the time it takes for recovery. As with any surgery, ACL reconstruction has risks and possible complications and the outcome is not guaranteed to be 100% successful. For patients who live an active lifestyle, ACL reconstruction is a good option, especially if they want an early return to sport. Additionally, the surgery helps prevent future damage to the knee cartilage and provides the best option to regain a normal functioning knee.

ACL reconstruction surgery

There have been many techniques to “repair” the ligament back to bone with sutures; unfortunately, repair of the anterior cruciate has had a high failure rate. There have also been attempts at making a synthetic ligament out of Gore-Tex, carbon fiber, and modified silk scaffolds. None of these techniques have performed well over time; therefore, the gold-standard for the treatment of an ACL tear in skeletally-mature (the bones are no longer growing) patients remains reconstruction. Especially in young active patients with persistent instability, it is recommended that they undergo reconstruction of the ACL.

Reconstruction involves using a tendon graft, which is a piece of healthy tendon that is transplanted surgically to

replace the torn ACL. The tendon graft can come from the patient (autograft) or from an organ donor (allograft). Autografts are primarily used in younger more active patients, while allografts are reserved for older patients. The graft can come from many different tendon donor sites to include the hamstring tendons, the quadriceps tendon, or the patellar tendon (**Fig. 3**); however, the decision is often determined by the surgeon's preference and experience. Most ACL reconstructions are performed arthroscopically (a tiny camera and instruments inserted into the joint through small portals). The new ACL graft is secured into tunnels or sockets placed into the anatomic position on the tibia and the femur using a variety of techniques and devices, such as metal screws, bio-absorbable screws, suspensory fixation devices, and others with the goal to recreate a new ACL and restore stability to the knee.

After surgery

Postoperatively, patients are allowed to weight bear as tolerated on the reconstructed knee with the aid of a hinged type knee brace that provides stability while enabling early range of motion. Early physical therapy focuses on exercises that do not place excess stress on the graft. The goals during the first 4 to 6 weeks are to minimize pain and swelling, restore patellar mobility, restore quadriceps activation, and to normalize motion and gait pattern. During the 6 to 12 week postoperative phase, the emphasis is focused on developing strength, stability, and endurance with expected full clearance for return to sport at 6 months or beyond.

A good option for active people

ACL reconstruction using a tendon graft is a reliable and proven way to restore stability to the knee and return patients to their pre-injury activity level. If you have torn your ACL and are facing the decision on whether or not to undergo reconstruction, you should discuss your options with an orthopaedic surgeon who is experienced in the surgery. Depending on your activity goals, ACL reconstruction may be the best decision for your active lifestyle.

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Ice Skating Injuries

Recreational ice skating and related sports, such as hockey, are popular winter activities. Regular participation in ice skating has shown to help individuals maintain balance as they age, but the activity is not without risk. About 1 in every 700 ice skaters will experience an injury,¹ and the average age of those injured is 33 years old.² Most incidents occur during falls on the ice, with inexperience and the slippery surface adding to the risks. Before you head to the rink, you should be aware of common injuries, how they occur, and understand what treatments are available.

Concussion

Head trauma only accounts for about 0.5% of ice skating injuries,¹ but the rate increases significantly with participation in ice hockey. Concussion is a traumatic injury to the brain that can occur after a blow to the head, face, or neck (**Fig. 1**). When you experience a concussion, your motor skills, coordination, balance, and cognitive abilities may be impaired. Concussions range in severity; which means it can be so slight you may not know that you have a concussion or it can be so severe you are rendered unconscious. In addition to the severity, more than 1 concussion can cause serious effects. If you have sustained multiple concussions, you have an increased risk of another and the cumulative effect can be permanently damaging or deadly. After a blow to the head, you should seek immediate medical attention if there has been a loss of consciousness, continued confusion, worsening symptoms, weakness, numbness, slurred speech, vomiting, seizure, or blood or clear fluid coming from the nose or ears.

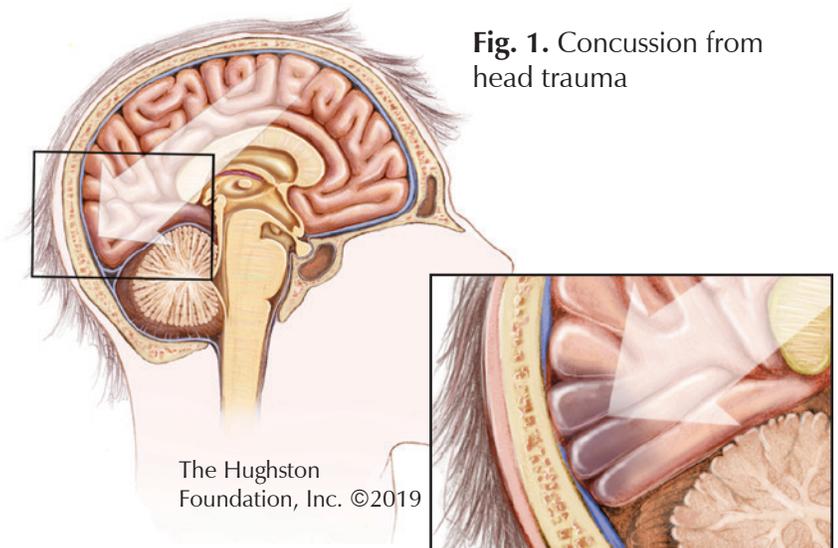
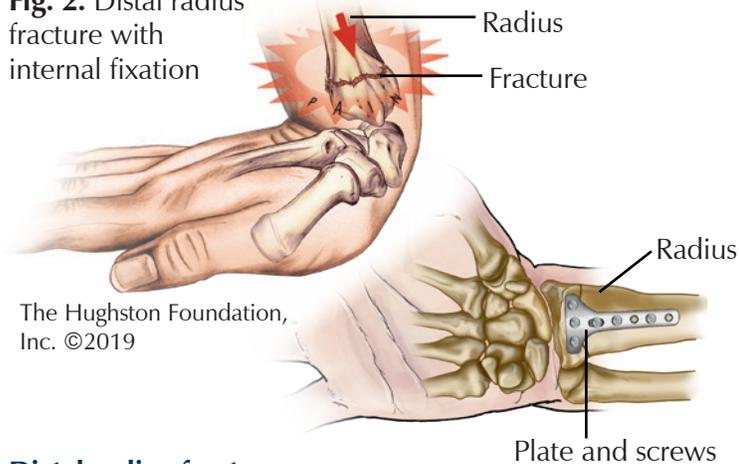


Fig. 1. Concussion from head trauma

Symptoms from concussion can last from a few days to several months, and include: headache, dizziness, nausea, trouble paying attention, memory problems, irritability and depression. If you have sustained a concussion, you should stop sports participation immediately and avoid further at-risk activities until all symptoms have resolved. While recovering from a concussion, stimulation should be minimal, which means reducing screen time, avoiding loud music and noise, and limiting cognitive tasks.

Fig. 2. Distal radius fracture with internal fixation

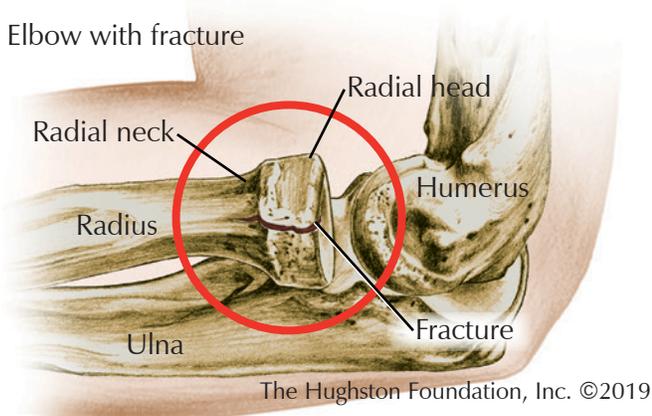


Distal radius fracture

Almost all fractures sustained in ice skating occur in the upper extremity, with fractures of the distal radius (wrist) being the most common of these.^{1,2} Wrist fractures often occur during a fall on an outstretched hand, resulting in immediate pain and deformity at the injury site (**Fig. 2**). Once you present to an emergency department, doctors will often reduce (align the fracture) and place a splint to hold the bones in place.

Further treatment will be determined with your orthopaedist and depends on many factors such as: if the break includes the wrist joint, how many fracture lines you have, or if a splint can hold the bone fragments in the correct position. Closed reduction and percutaneous pinning or CRPP, (a procedure to align the bone using metal pins through the skin to hold the fracture while the bone heals), or open reduction with internal fixation (ORIF, a procedure to hold the fracture with metal plates and screws under the skin) are 2 treatment options that offer good results. Particularly in women, a distal radius fracture can be a sign of decreased bone mineral density;³ therefore, you should ask your doctor if further testing, such as a DEXA (dual energy x-ray absorptiometry, a type of bone scan) scan is needed.

Fig. 3. Elbow with fracture



Radial head and neck fractures

Another injury that can occur from a fall on an outstretched hand—radial head and neck fractures—occur about 10% less often than distal radius fractures.² The radial head is the portion of the radius that helps form the elbow

joint, with the radial neck located just below it. Unlike distal radius fractures, these injuries rarely result in a noticeable deformity, with patients mainly complaining of severe elbow pain, swelling, and reduced elbow motion.

The majority of these fractures can be treated without surgery, with an emphasis on regaining elbow motion early to avoid permanent stiffness. You may need surgery if the fracture involves multiple fragments or if the fragments have moved. Surgical treatments often involve holding the bone in position with metal plates and screws while the fracture heals, or replacement of the radial head with a metal prosthesis for more severe injuries.

Ice hockey

Ice hockey is a much more physical and high-risk activity than recreational ice skating. Hockey resulted in the highest injury rate at the 2010 Olympics, with up to 35% of participants experiencing some amount of missed playing time.⁴ Since there is an increased risk of contact, common injuries in ice hockey involve the shoulder, hip, thigh, and knee rather than the elbow and wrist. Many of these injuries can be treated nonsurgically, with immobilization, rest, compression, and therapy. If the injury is severe or recurrent, surgery is sometimes needed.

Your best chance at avoiding an injury is to wear properly-fitted equipment, such as helmets, shoulder pads, hip pads and hockey pants, and skates. You should also properly maintain the equipment and replace it as it becomes worn or damaged. Furthermore, emphasis on playing “heads up” hockey with attention paid to surroundings and avoiding hard contact with another player can help reduce injury rates in this sport.

Protect yourself

Ice skating is a popular activity that has numerous health benefits, but the sport is not without risks. Understanding common injuries and taking proper precautions to avoid them can help you enjoy these activities without incident. You can reduce the risk or avoid trauma all together by wearing snug-fitting skates with a straight back over the blade, and by using commercial wrist protectors. You can purchase affordable protective gear at most sporting goods stores.

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Complex Regional Pain Syndrome

In the 16th century, King Charles IX experienced endless pain and contractures after he underwent a surgical procedure. Ambroise Pare (known as the father of modern surgery) recorded the King's treatment, which is thought to be the earliest documented description of complex regional pain syndrome (CRPS).¹ Formerly known as reflex sympathetic dystrophy (disorder of the sympathetic nervous system) and causalgia (affecting a peripheral nerve), it was not until 1994 that the International Association for the Study of Pain renamed these pain syndromes as CRPS Type 1 and CRPS Type 2, respectively.²

Who does it affect?

CRPS is a rare and debilitating disease that affects less than 2% of individuals in the United States. Race is not a factor, but females are affected more than males, and the peak age of patients is 40 to 49 years. Additionally, the upper extremities are affected more often than the lower extremities.²

What are the symptoms?

CRPS patients experience chronic pain with sensory and motor symptoms in their limbs. With CRPS, there is usually a damaging or inciting event that causes injury, such as trauma, surgery, or a period of immobilization.

The difference between the 2 types is that Type 1 does not have a distinctive injury to a nerve, whereas patients with CRPS Type 2 have a known nerve injury. To help diagnose CRPS, the Budapest criteria (**Table**) were established in 2003. In patients who have continuing pain that is disproportionate to any inciting event, they must report 1 symptom in 3 of the 4 following categories: sensory, motor/trophic, vasomotor, sudomotor/edema.¹ The patient must also display at least 1 sign at the time of evaluation in 2 or more of the categories. Lastly, there cannot be another condition that would account for the degree of pain and dysfunction that the patient is experiencing.

There are 3 stages of CRPS: acute, subacute, and chronic.² The acute stage lasts 3 months. During this stage patients usually have a burning type pain, swelling, skin redness, increased sweating, and decreased range of motion. After 3 months, the patient enters the subacute stage. During this stage patients have continued severe pain, swelling, skin dryness, and paleness or bluish coloration of the skin. After 12 months, the patient progresses to the chronic stage that can last for multiple years or even become permanent. In the chronic stage, the patient's pain is variable and can continue to be severe or it may subside. The patient's skin is dry, shiny, and cool to the touch. Also, since the patient has not been using their extremity, the underlying bones can develop osteoporosis (a disease that weakens bones).³

Table. CRPS Symptoms and Signs

Diagnostic Category	Symptom	Sign
Sensory	<ul style="list-style-type: none"> • Continuous burning pain in the distal part of the affected extremity • Pain is disproportionate in intensity to the inciting event and usually increases when the extremity is in a dependent position • Sensory abnormalities are most pronounced distally, and have no consistent spatial relationship to individual nerve territories or to the site of the inciting lesion 	<ul style="list-style-type: none"> • Stimulus-evoked pains include mechanical and thermal allodynia and/or hyperalgesia, and deep somatic allodynia (pain due to touching the joints and movement of the joints)
Vasomotor	<ul style="list-style-type: none"> • Reports of temperature asymmetry • Reports of skin color changes/asymmetry 	<ul style="list-style-type: none"> • Evidence of temperature asymmetry • Evidence of skin color changes/asymmetry
Sudomotor/Edema	<ul style="list-style-type: none"> • Reports of edema • Reports of sweating changes and/or sweating asymmetry 	<ul style="list-style-type: none"> • Evidence of edema • Evidence of sweating changes and/or sweating asymmetry
Motor/Trophic	<ul style="list-style-type: none"> • Reports of decreased range of motion • Reports of motor dysfunction: weakness, tremor, dystonia, coordination deficits • Disturbed body perception of the affected extremity • Reports of trophic changes: hair, nails, skin 	<ul style="list-style-type: none"> • Evidence of decreased range of motion • Evidence of motor dysfunction: weakness, tremor, dystonia, coordination deficits • Evidence of trophic changes: hair, nails, skin, osteoporosis

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How is CRPS diagnosed?

There are no specific laboratory studies that make the diagnosis of CRPS; however, it is imperative to obtain laboratory studies so that other disease or disorders can be excluded as the cause of the patient's symptoms.² Imaging studies that are useful include radiographs (x-rays) and bone scans (an imaging test that helps diagnose bone disease). Since CRPS Type 2 involves a known nerve injury, a nerve conduction study can provide useful information as well.⁴

How is CRPS treated?

The best treatment for CRPS is to use a multidisciplinary team approach to alleviate the patient's pain and help the patient regain function of the extremity.¹ For example, a pain specialist helps control the patient's pain using medications and injections. A surgeon is needed for procedures that help control pain and regain extremity function. A primary care physician can help with the patient's pain control as well as helping with other symptoms, such as swelling, inflammation, and depression. Physical therapists and occupational therapists are critical in improving the functional outcome of the affected extremity with range of motion exercises and other modalities.⁵

Getting help

CRPS results in debilitating pain and significant loss of function in the extremities. In order to improve patient outcomes, CRPS should be recognized early on and treatment initiated as soon as possible. Pain specialists, surgeons, physical therapists, and other healthcare providers each play a role in helping the patient get back to a normal routine. If you are experiencing chronic pain, talk to your doctor, getting help is the first step toward a pain-free life.

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Rotator Cuff Tears

The rotator cuff is a group of muscles (supraspinatus, infraspinatus, teres minor, and subscapularis) and tendons (tissue connecting muscle to bone) that surrounds the shoulder joint. This group of muscles provides stabilization while also allowing movement, which is why the shoulder is one of the most flexible joints in the body. Interestingly enough, many patients with rotator cuff tears have no symptoms at all, while others complain of pain and weakness in the shoulder. A rotator cuff tear can range from small to large in size, it can be a partial tear in 1 of the muscles, or it can be a partial or complete tear of a tendon. Almost 1 out of 3 people over the age of 60, and 2 out of 3 people over the age of 70 have full thickness rotator cuff tears. Depending on the severity of the tear, there are various treatment options, which include nonoperative management and shoulder arthroscopic surgery.

What causes a tear?

The rotator cuff can become injured in a number of ways. Most commonly, the tear is due to chronic muscle and tendon degeneration that comes with aging. Additionally, they often occur in conjunction with a shoulder dislocation in patients over 40 years old. You can injure your rotator cuff by falling on an outstretched arm or develop an injury over time doing repetitive activities at work or while playing a sport. Another possible mechanism is from impingement (weakening and tearing at the tendons) of the rotator cuff on the acromion (the bone right above the shoulder joint). The acromion process can develop bone spurs that can rub on the rotator cuff tendons, causing impingement.

Risk factors

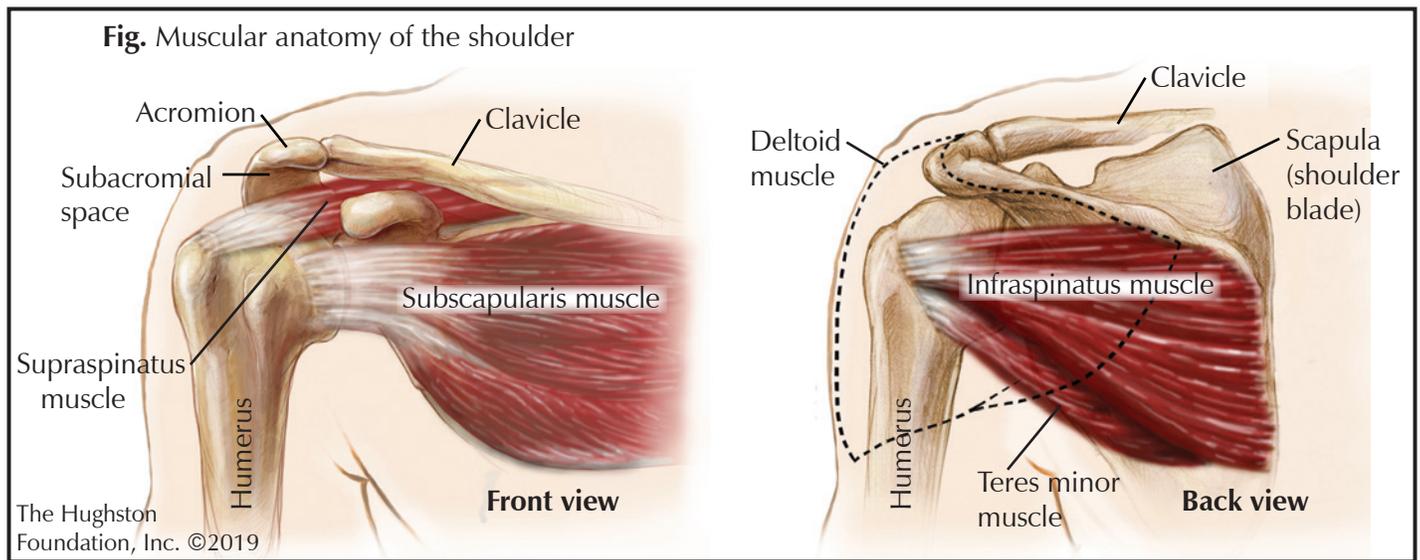
There are several risk factors associated with rotator cuff tears, but advanced age is one of the most significant. Others include having a rotator cuff tear on the other shoulder, smoking, family history, poor posture, high cholesterol, history of trauma, and occupations demanding heavy labor and repetitive movement.

Seeking medical advice

When to seek medical advice can be a difficult question to answer since patients have a wide range of how much pain and dysfunction they can stand before it triggers a visit to the doctor's office. Where some patients develop a small discomfort in their shoulder and immediately see their doctor, others wait until their pain is unbearable and they have lost most of the function in their shoulder. Certainly, any amount of pain and discomfort, weakness, and loss of shoulder function should warrant a visit to a sports medicine or shoulder-trained orthopaedic physician.

Screening and diagnosis

Your physician will examine the shoulder, moving it through various positions and maneuvers in an attempt to localize the problem. Radiographs or x-rays, will also be obtained to evaluate for any bony involvement. Depending on the length of time the problem has been going on, or if there has been a



recent traumatic injury, the physician may decide to order magnetic resonance imaging (MRI, a scan that shows the bones, muscles, tendons, and ligaments) of the shoulder. Additionally, your physician may also decide to perform an injection into the subacromial space (the space between the rotator cuff muscles and the acromion). This is not only a treatment option, but it can also provide the physician with valuable information regarding your diagnosis by whether you experience pain relief or not.

Treatment

Most rotator cuff tears can be initially managed with nonoperative treatment. These include physical therapy, anti-inflammatory medications, and subacromial corticosteroid injections. It is important to consider patient expectations and symptom severity when deciding on nonoperative treatment as this is different for every patient.

If the injury is severe or an acute tear following some sort of traumatic episode, such as a fall or shoulder dislocation, or if nonoperative management is not working, the physician may recommend surgery. Surgery is performed arthroscopically (using a small camera to look inside the shoulder joint). This is typically done using 3 or 4 small incisions around the shoulder. The surgeon will examine the shoulder anatomy and clean up any loose and frayed tissue, remove any bone spurs, and then repair the tear depending on the appearance of the rotator cuff and the size of the tear.

The surgery usually takes an hour to an hour and a half depending on what needs to be done. After surgery, your shoulder will be placed in an abduction shoulder brace (a sling that holds the arm out to the side) and you will be given specific instructions that help the healing process and encourage a positive outcome.

Postoperative rehabilitation

Postoperative protocols for rehabilitation vary by physician; however, most exercise treatments follow the same general

principles. Initially the shoulder is kept immobilized. Then a period of passive range of motion exercises follows, which mean that your arm is moved without you exerting any effort. Then active range of motion begins, which will progress to a resistance-training program.

Outcomes and complications

A rotator cuff repair can offer predictable success with a long track record of pain relief and patient satisfaction. Medical literature shows excellent outcomes in patients with partial and full thickness tears.

Failure to heal is the most common cause of a failed rotator cuff repair. Patients at risk for failure include those who are 65 years of age and older, smokers, diabetics, and those who have large size tears, muscle atrophy (shrinking), and those who do not follow the surgeon's postoperative rehabilitation plan. More rare complications include injury to nerves in the shoulder, infection, and stiffness. Often, postoperative stiffness can be managed with physical therapy.

Don't shoulder the pain alone

Rotator cuff tears are common in the aging population and can debilitate patients with extreme pain and functional limitations. For most circumstances, conservative treatment should be attempted first as many patients will respond positively. Surgical treatment has shown to have excellent results and should be weighed between the patient's pain and function, as well as avoiding progression of the tear. If you have shoulder pain, see an orthopaedist who specializes in the shoulder. A speciality-trained shoulder physician will quickly and accurately diagnose your problems and get you on the road to recovery.

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