CONDITION

# Anterior cruciate ligament (ACL) injury

Learn how ACL injuries affect knee stability, how they are diagnosed, and how rehabilitation, bracing, or surgery may support recovery.

**WHAT IT IS**
Stretching or tearing of the knee ACL

**BODY SYSTEM**
Bones, joints and muscles

**MAIN SYMPTOMS**
Rapid knee swelling, pain, reduced movement, knee instability

**WHAT CAUSES IT**
Knee twisting, overextension or trauma

**HOW IT IS DIAGNOSED**
Knee stability tests and MRI

**MAIN TREATMENT**
Rehabilitation, bracing or surgery

**CAN IT BE CURED?**
Sometimes - treatment can restore knee stability

**IS IT AN EMERGENCY?**
Sometimes - cold, pale or numb foot

**LONG-TERM OUTLOOK**
Recovery takes many months, with reinjury and osteoarthritis risks

## Overview

The anterior cruciate ligament, or ACL, is a strong band of tissue inside the knee. It connects the thighbone to the shinbone and helps keep the shinbone from moving too far forward. It also helps control twisting and changing direction.

An ACL injury happens when the ligament is stretched beyond its normal range. A mild injury may involve small tears in the ligament fibers. A complete tear separates the ligament into two parts or pulls it away from the bone. Clinicians often describe ligament injuries as grade 1, 2, or 3 sprains, with grade 3 generally meaning a complete tear.

ACL injuries often occur during sports, but they can also result from falls, vehicle crashes, or other accidents. Some happen without direct contact. For example, the knee may twist while the foot stays planted during a sudden stop or change of direction.

The injury matters because the ACL helps stabilize the knee during daily activities and sports. A torn ACL can make the knee feel as though it will buckle. ACL injuries may also occur with damage to the meniscus, cartilage, other ligaments, or bone. The meniscus is a rubbery pad that cushions the knee.

Not every ACL tear requires surgery. Treatment depends on knee stability, other injuries, activity goals, age and overall health. Rehabilitation is important whether treatment is surgical or nonsurgical.

## Symptoms

Symptoms often begin at the time of injury. Some people hear or feel a "pop," although this does not happen in every case.

Common symptoms include:

Swelling may make the knee stiff and hard to fully straighten. After the initial pain improves, instability may become the main concern. The knee may buckle during turning, stepping off a curb, or walking on uneven ground.

Symptoms alone cannot confirm an ACL tear. Meniscus tears, kneecap dislocations, fractures, and injuries to other ligaments can cause similar pain or swelling.

Most suspected ACL injuries can be assessed through routine or prompt outpatient care. Arrange a medical evaluation if the knee swells soon after an injury, cannot move normally, repeatedly gives way, or remains painful.

Seek urgent care after an injury if you cannot put weight on the leg, the knee is locked in one position, or there is marked swelling or an obvious change in shape.

Seek emergency care if the leg or foot becomes cold, pale, blue, very numb, or weak, particularly after a major injury or knee deformity. These signs can indicate damage to blood vessels or nerves and require immediate assessment.

- Rapid knee swelling, often developing within several hours
- Pain, especially when trying to stand, walk, or change direction
- Loss of normal knee movement
- A feeling that the knee is unstable, loose, or likely to give way
- Tenderness around the knee joint
- Difficulty returning to an activity after the injury

## Causes and risk factors

ACL injuries commonly occur when the knee twists or changes direction while the foot remains planted. Sudden slowing, landing awkwardly from a jump, or overextending the knee can also injure the ligament. A direct blow to the side of the knee may tear the ACL along with other structures.

Activities involving cutting, pivoting, jumping, or rapid stops place greater demands on the ACL. Examples include soccer, basketball, football, skiing, and gymnastics. However, an injury can occur during any activity that forces the knee beyond its usual limits.

Several factors may influence risk. These include movement technique, muscle strength, balance, playing surface, footwear, and the type or intensity of activity. Previous ACL injury also raises the risk of another ACL injury, either in the same knee or the other knee.

Female athletes have a higher rate of ACL injury than male athletes in several comparable sports. The reasons are complex and may include differences in anatomy, muscle control, landing mechanics, and hormonal influences. This does not mean that an injury is inevitable.

Neuromuscular training programs can lower ACL injury risk in some athletes. These programs teach safer landing and cutting techniques while improving strength, balance, and body control. They are most useful when performed regularly and supervised by someone trained in the program.

## Diagnosis

A clinician will ask how the injury happened, when swelling began, whether a pop was felt, and whether the knee has buckled since the injury. Information about sports, work, previous knee injuries, and future activity goals also helps guide assessment.

The physical examination compares the injured and uninjured knees. The clinician checks swelling, tenderness, motion, and stability. Tests such as the Lachman test or anterior drawer test assess whether the shinbone moves farther forward than expected. A pivot-shift test may be used to evaluate rotational instability.

Pain and muscle tightening can make an examination less reliable soon after injury. The knee may be examined again after swelling and pain have improved.

X-rays do not show the ACL itself, but they can identify fractures, joint alignment problems, or pieces of bone pulled away with a ligament. This is especially important in children and adolescents because their growth plates are still developing.

Magnetic resonance imaging, or MRI, provides detailed pictures of ligaments, menisci,

cartilage, tendons, and bone. It can help confirm an ACL tear and identify associated injuries. MRI is not always required when the history and examination are clear, but it is often useful for treatment planning.

The clinician may describe the tear as partial or complete. A partial tear does not always mean that the knee is stable. The ligament's function, symptoms, and associated injuries are more important than the MRI wording alone.

## Treatment and management

Early care focuses on controlling pain and swelling while protecting the knee. Rest from activities that cause pain or instability is usually appropriate. Ice wrapped in cloth may be applied for short periods. Compression and raising the leg can also help with swelling.

Crutches may be used if walking is painful or unsafe. A knee brace may provide support in selected situations, but it does not replace rehabilitation or restore a torn ligament. A clinician or physical therapist can advise how long to use these aids.

Over-the-counter pain medicines may help some people. Acetaminophen and nonsteroidal anti-inflammatory drugs, such as ibuprofen or naproxen, have different benefits and risks. A pharmacist or clinician can help determine whether they are appropriate, especially for people with kidney disease, liver disease, stomach ulcers, bleeding problems, heart disease, or other health conditions.

Physical therapy aims to restore full knee movement, reduce swelling, rebuild leg and hip strength, and improve balance and movement control. Early recovery often emphasizes fully straightening the knee and activating the quadriceps, the large muscles at the front of the thigh.

Nonsurgical treatment may be reasonable when the knee remains stable during desired activities, activity demands do not involve frequent pivoting, or surgery is not preferred or medically suitable. It usually includes structured rehabilitation and changes to activities that trigger instability. Some people use a functional brace during certain activities.

ACL reconstruction may be considered when the knee remains unstable, the person plans to return to pivoting or high-demand activities, or other knee injuries would benefit from surgery. Reconstruction replaces the torn ligament with a graft rather than simply stitching the usual midsubstance tear together.

A graft may come from the person's patellar tendon, hamstring tendons, or quadriceps tendon. Donor tissue, called an allograft, is another option. Each graft has trade-offs involving recovery, pain at the tissue-removal site, graft strength, and risk of another tear. The surgeon and

patient should make this choice together.

Selected ACL tears near the ligament's attachment may be treated with repair techniques, but repair is not suitable for every tear. Long-term evidence and appropriate patient selection should be discussed with an orthopedic surgeon.

When reconstruction is planned, surgery is often performed after swelling has decreased and useful motion has returned. Operating on a very stiff, swollen knee may make postoperative stiffness more likely. However, repeated instability or certain associated injuries may affect timing.

Rehabilitation after surgery progresses in stages. It includes healing, motion, strength, balance, running, jumping, and sport-specific movement. Return to sport should not depend only on time since surgery. Strength, movement quality, confidence, knee stability, and functional testing are also important. Recovery commonly takes many months.

## Complications

An ACL injury can occur with a meniscus tear, cartilage injury, bone bruise, or damage to other knee ligaments. Some associated injuries may influence whether surgery is recommended and how quickly it should be performed.

Repeated episodes of the knee giving way can damage the meniscus or joint cartilage. Avoiding activities that cause instability is important while waiting for assessment or treatment.

Knee stiffness and loss of muscle strength can develop after either surgical or nonsurgical care. Following a structured rehabilitation plan helps reduce these problems. After surgery, possible complications include infection, blood clots, persistent pain, stiffness, numbness near an incision, graft failure, or continued instability.

A previous ACL injury increases the chance of osteoarthritis in the knee later in life. Osteoarthritis means gradual wear and change within the joint. Reconstruction can improve stability, but it does not guarantee that arthritis will be prevented. The original injury and damage to the meniscus or cartilage also affect long-term risk.

A second ACL injury can occur in the reconstructed knee or the opposite knee. Completing rehabilitation and meeting objective return-to-activity goals may help lower this risk.

## Follow up

Follow-up usually checks swelling, knee motion, walking, strength, and stability. A physical therapist may repeat strength, balance, hopping, or movement tests as recovery progresses. Keep scheduled visits even if pain improves, because strength and control can lag behind how the knee feels.

Contact the treating clinician sooner if the knee repeatedly gives way, becomes locked, develops increasing swelling, or loses motion. After surgery, prompt medical advice is appropriate for worsening wound redness, drainage, fever, new calf swelling, or pain that is not improving as expected.

Emergency assessment is needed for chest pain, sudden shortness of breath, coughing up blood, or a cold, pale, numb foot. These symptoms are uncommon but may indicate a blood clot, circulation problem, or another condition requiring immediate care.

Long-term follow-up may include planning a safe return to work, exercise, or sport. The plan should reflect the demands of the activity rather than using pain relief alone as proof that the knee is ready.

## Sources

- American Academy of Orthopaedic Surgeons. Management of Anterior Cruciate Ligament Injuries: Evidence-Based Clinical Practice Guideline . Published August 22, 2022.
- American Academy of Orthopaedic Surgeons OrthoInfo. Anterior Cruciate Ligament (ACL) Injuries .
- American College of Radiology. ACR Appropriateness Criteria: Acute Trauma to the Knee .
- Centers for Disease Control and Prevention. Preventing Blood Clots . Updated June 28, 2024.
- Kotsifaki R, Korakakis V, King E, et al. Aspetar clinical practice guideline on rehabilitation after anterior cruciate ligament reconstruction. British Journal of Sports Medicine . 2023;57:500-514.
- Ardern CL, Glasgow P, Schneiders A, et al. 2016 consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern. British Journal of Sports Medicine . 2016;50:853-864.