

Knee: Anterior Cruciate Ligament (ACL) Tear, Posterior Cruciate Ligament (PCL) Tear

Diagnosis/Condition: Sprain/strain of the cruciate ligament of the knee; Internal derangement of the knee; old disruption of anterior cruciate ligament; Internal derangement of the knee; Old disruption of posterior cruciate ligament

Discipline: DC

ICD-10 Codes: S83.509A; M23.50

Origination Date: 1996

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Next Review Date: 07/2025

Anterior cruciate ligament (ACL) tears are among the most common knee injuries. An estimated 150,000 to 200,000 ACL tears occur each year in the United States.¹ Anterior cruciate ligament sprains may be due to contact or non-contact injuries, but noncontact injuries are more common, accounting for approximately 70 percent of ACL tears. The most common mechanism involves a low-energy, noncontact injury sustained during an athletic activity. The typical mechanism for a noncontact ACL injury involves a running or jumping athlete who suddenly decelerates and changes direction (e.g., cutting) or pivots or lands in a way that involves rotation and lateral bending (i.e., valgus stress) of the knee and anterior translation of the tibia on the femur. This type of injury occurs commonly in sports such as soccer, football, basketball, gymnastics, and skiing.^{2,3} The classic presentation of non-contact injury is twisting with an audible pop and the rapid onset of swelling.⁴ Contact-related ACL injuries usually occur from a direct blow causing hyperextension or valgus deformation of the knee. Female athletes sustain higher rates of ACL injury per athletic exposure across sports and countries.⁵ Initial symptoms include hemarthrosis, crepitus, instability, and pain around the knee.⁶

The posterior cruciate ligament (PCL) is the largest and strongest ligament in the human knee, and the primary posterior stabilizer. It is almost twice as strong as the ACL. Most athletic injuries to the PCL occur during a fall on the flexed knee with the foot plantar flexed. Recent anatomy and biomechanical studies have provided an improved understanding of PCL function. PCL injuries are typically combined with other ligamentous, meniscal, and chondral injuries.⁷

Age-specific patterns differed in male and female patients, with a peak in incidence between 19 and 25 years in males and a peak in incidence between 14 and 18 years in females.⁸

Injury to either the anterior or posterior cruciate ligament can be graded from Grade 1, a stretching of the ligament, to Grade 2 which involves a partial tear and loosening of the ligament, to Grade 3 which is a complete tear of the ligament.

Some people can live and function normally with a torn ACL. However, most people complain that their knee is unstable and may "give out" with attempted physical activity. Although the issue is controversial, the use of knee braces during aggressive athletic activity, such as football, has not been shown to decrease the incidence of knee injuries. Certain athletic training programs have been shown to alter athlete's lower extremity biomechanics in order to reduce the risk of ACL injury by between 52-85%.^{9,10,11}

In the last decade much has been learned about ACL injuries of the knee. However, much less research has been done on the PCL injuries because it is injured far less often than the ACL.

A recent retrospective analysis of complete ACL tears suggests that the combination of the history of injury, rapid onset of swelling, family history, and positive provocative tests provide better accuracy of both positive and negative diagnosis of complete ACL tear.¹² Long-term sequelae of ACL injury include knee osteoarthritis in up to 90 percent of patients.¹³

Subjective Findings and History

- Trauma to knee.
- Pain.
- May have noted a "pop", giving away.
- Swelling within 6 hours of trauma.
- Family history of ACL tear.¹⁴

Objective Findings

The reliability and validity of orthopedic tests for detecting knee injury is fair at best. Other tests in the context of a "complete physical examination" (i.e., a history and physical exam) has been shown to be diagnostically valid for ACL/PCL injury.¹⁵

- Effusion (edema/hemarthrosis).
- Limited motion secondary to swelling.
- Instability as evidenced by: "positive" Lachman's, pivot shift, and anterior and posterior drawer tests, etc.
- Evaluate kinetic chain and spine for joint dysfunction.
- Radiographs to rule out fracture.
- MRI for further evaluation.

Assessment/Differential Diagnoses

Other problems to be considered include:

- Patellar dislocation/fracture.
- Osteoarthritis.
- Knee dislocation.
- Femoral, tibial, or fibular fracture.
- Meniscal knee injury/tear.
- Collateral or medial ligament tear.
- Articular or subchondral bone injury.

The clinical impression should indicate the specific anatomical structures involved and clinically correlate with mechanism of injury, history, subjective complaints, and objective findings.

Thorough bilateral knee examination should include inspection, palpation, testing of mobility, strength, stability, and performance of special tests of ACL integrity (Lachman's, the pivot shift, and the anterior drawer, are the most sensitive and specific).^{16,17,18} As a caveat, the result of an individual history item or physical test does not meaningfully change the probability of an ACL injury. It is the combination of tests that have higher diagnostic accuracy.¹⁹

Diagnostic Imaging

- MRI.
- Diagnostic ultrasound.²⁰
- Xray (most ACL/PCL tears appear normal on plain XR films).

Plan

Passive Care:

- Rest, ice, compression, elevation: Avoid weight bearing if unstable (crutches).
- NSAIDS (short term).
- Nutritional supplementation (Vitamin C, manganese, magnesium, calcium, glucosamine sulfate, chondroitin, methylsulfonylmethane, bromelain and essential fatty acids).
- Botanical supplementation to reduce inflammation (*Curcuma longa* (turmeric), *Capsicum annuum* (cayenne), *Arnica montana* (arnica), *Ruta graveolens* (rue), *Hypericum perforatum* (St. John's wort), and *Gaultheria procumbens* (wintergreen)).
- Topical treatments (e.g., comfrey poultice, hypericum, arnica, wintergreen).
- Immobilization or kinetic bracing, taping.
- Foot orthotics.
- Bracing (mixed results).^{21,22,23}
- Physical therapy modalities.^{24,25,26}
- Passive exercises to improve range of motion.
- Hydrotherapy.
- Homeopathy.

- Acupuncture.
- Lower extremity and spinal manipulation to correct joint dysfunction.
- Ultrasound.

Active Care:

- Active strengthening and stretching exercises (primarily quadriceps and hamstring).
- Resistive exercises (including walking).²⁷
- Neuromuscular training (NT) program.²⁸
- Training in proper mechanics of joint protection.
- Functional training.²⁹
- Electrical stimulation.^{30,31}
- Rehabilitation (including yoga).³²
- Activities/work restrictions: Limit activity depending upon diagnosis, degree of symptoms, and type of daily activities.
- Mixed evidence on surgical vs conservative interventions.^{33,34}
- The goal of treatment is to provide the knee with the stability needed to meet the demands of the patient and to decrease the risk of associated future knee pathology (such as meniscal tears and osteoarthritis).^{35,36}

Length of Treatment

- 6-12 weeks depending upon severity of injury.
- Continue strengthening exercises and neuromuscular training for several months.³⁷

Outcome Assessment Tools

- Outcome assessment of any treatment is a key piece of evidence-informed treatment planning and decision making. A recent consensus process defined 4 categories of outcomes: adverse events, patient reported outcomes (PROs), failure of surgical intervention (graft failure), and clinical measures of knee function.³⁸
- PROs should include a knee-specific functional outcome tool such as the knee outcomes osteoarthritis score (KOOS), patient specific functional scale, pain scale, etc., and health related quality of life score (HRQoL).³⁹

Referral Criteria

- Referral to an orthopedic surgeon should be considered for severe knee instability and if no improvement after 6 weeks of conservative care. There have been a number of small studies comparing surgical treatment (including early and delayed) and conservative care for outcomes. The evidence is mixed overall, however with respect to the development of osteoarthritis there does not appear to be a measurable difference between groups.
- Until larger randomized controlled trials are conducted, patients should be made aware of the lack of evidence of superiority of one management strategy over the other.^{40,41,42} The American Academy of Orthopedic Surgeons (AAOS) has developed evidence-based treatment guidelines regarding ACL tears – *A Summary of Recommendations for the*

Management of Anterior Cruciate Ligament Injuries AAOS. 2014. Available from <http://www.aaos.org/Research/guidelines/ACLGuideline.asp>. This clinical practice guideline is rates the strength of evidence for each recommendation. Strength of evidence ranges from “Consensus” to “Strong.” The rating of the evidence is a useful tool for IH providers to assist their patients in making an evidence informed clinical decision.

- Referral to physical therapy if not available in your clinic.

Clinical Pathway Feedback

CHP desires to keep our clinical pathways customarily updated. If you wish to provide additional input, please use the e-mail address listed below and identify which clinical pathway you are referencing. Thank you for taking the time to give us your comments.

Clinical Services Department: cs@chpgroup.com

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