

Posterior Cruciate Ligament (PCL) Knee Injuries

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Introduction

The Posterior Cruciate Ligament (PCL) is one of the four major ligaments of the knee joint that functions to stabilize the tibia on the femur. It originates from the anterolateral aspect of the medial femoral condyle in the area of the intercondylar notch and inserts onto the posterior aspect of the tibial plateau. It functions to prevent posterior translation of the tibia on the femur. To a lesser extent, the PCL functions to resist varus, valgus, and external rotation forces. It is approximately 1.3 to 2 times as thick and about twice as strong as the anterior cruciate ligament (ACL) and, consequently, less commonly subject to injury.

Etiology

Injuries to the PCL are caused by an extreme anterior force applied to the proximal tibia of the flexed knee. Common causes include dashboard injuries where the knee is forced into the dashboard during a motor vehicular collision. The PCL also can be injured secondary to falling forward onto a flexed knee. The most common sports where PCL injuries occur are football, skiing, soccer, and baseball. Less commonly, damage can occur due to a rotational hyperextension injury to the knee joint.

Epidemiology

According to a 2003 study by Schulz et al., the mean age of PCL injuries was 27 years. The two most common causes of PCL injury were car accidents (45%) and athletic injuries (40%). Specifically, the two most common causes of injury are motorcycle accidents (28%) and soccer-related injuries (25%). The most common injury mechanism was dashboard injuries (35%) and falls on a flexed knee with the foot in plantar flexion (24%). The male to female ratio is 2:1.

Pathophysiology

The PCL originates from the anterolateral aspect of the medial femoral condyle in the area of the intercondylar notch and inserts extra-articularly onto the posterior aspect of the tibial plateau. It is 1.3 to 2 times as thick and about two times the strength of the ACL. It can be further separated into anterolateral and posteromedial bundles. The anterolateral and posteromedial bands are respectively 65% and 35% of the body of the PCL. The anterolateral bundle is taut in knee flexion and lax in knee extension where the posteromedial bundle is tight in knee extension and lax in knee flexion. The function of the PCL is to prevent posterior translation of the tibia on the femur. Because a majority of the injuries occur in knee flexion, the anterolateral portion is more commonly injured. The PCL is the primary restraint to posterior tibial translation between 30 degrees and 90 degrees. At 90 degrees, the PCL accepts 95% of posterior translational forces. It resists posterior translation with the assistance of the posterolateral joint

capsule, popliteus, medial collateral ligament, and posterior oblique ligament.

The Posterior cruciate ligament receives blood supply from the middle geniculate artery and is innervated by the tibial nerve.

History and Physical

Patients often will present with complaints of acute onset of posterior knee pain, swelling, and instability. A thorough history includes the mechanism of injury, such as trauma from falling onto a flexed knee or recent motor vehicle accident. There may or may not be a complaint of a “pop” with PCL tears like those frequently reported with ACL tears.

A thorough knee exam should be performed, including gait assessment. The neurovascular integrity of the lower extremity distal to the injury should also be assessed.

- **Inspection:** Affected knee will often present with mild to moderate joint effusion. Swelling is usually less than an ACL tear. Patients may present with antalgic gait on examination with obvious favoring of affected knee. They may have difficulty walking up or down stairs or at an incline. There may be a positive sag test; The sag test is performed with the patient supine, hip flexed to 45 degrees, and knee flexed to 90 degrees. The tibia will be noted to sag distally relative to the femur as compared to the opposite knee.
- **Palpation:** There may be an effusion on physical exam.
- **Muscle strength testing:** Strength should be normal, but there may be weakness with knee extension and flexion secondary to guarding.
- **ROM:** The passive range of motion may be limited 10 to 20 degrees with flexion. It may be further decreased with other concomitant injuries such as meniscal, muscular, or ligamentous etiology.
- **Special Testing:** The posterior drawer test is the most accurate test for assessing PCL integrity. It is performed with the patient in the supine position with the hip flexed to 45 degrees and knee flexed to 90 degrees. A posterior force is applied to the proximal tibia with one hand with stabilization of the femur with the other. Ligamentous and meniscal testing should be performed to assess the integrity of other structure of the knee. The Dial test can be performed to distinguish isolated PCL injuries with an associated posterolateral joint capsule, popliteus, medial collateral ligament, and posterior oblique ligament injuries.

Evaluation

Initial imaging should be limited to plain X-rays. Include ipsilateral standing AP, 45 degree flexion, weight bearing, and merchant patellar views with contralateral views to assess for associated fractures, arthritis, joint effusion, and the 45-degree flexion view may show a positive sag compared to the contralateral knee.

MRI is the gold standard for evaluation of a PCL injury. It has been reported to have accuracy in the range of 96% to 100%. It can also assess for concomitant injuries such as meniscal, Ligamentous, posterolateral joint capsule, popliteus, medial collateral ligament, and posterior oblique ligament injuries.

PCL injuries are graded on a scale of I-III.

- **Grade I (partial tear)** - 1-5mm posterior translation. Tibia remains anterior to femoral condyles.
- **Grade II (complete isolated)** – 6-10mm posterior tibial translation. A complete tear of PCL without another

injury. Anterior tibia flush with femoral condyles.

- Grade III (complete PCL with combined capsular and/or Ligamentous injury) - > 10mm posterior tibial translation. Tibia posterior to femoral condyles which may indicate concomitant capsuloligamentous injury.

Treatment / Management

Non-operative treatments are indicated for acutely isolated grade I and II injuries. Acute treatment involves RICE (rest, ice, compression, and elevation). Rehabilitation is important with a focus on knee extensor strengthening. Estimated return to play is 2 to 4 weeks. Grade III injuries can be treated with knee immobilization x 4 weeks with a transition to rehabilitation focusing initially on passive range of motion to knee extensor strengthening.

Operative treatment is reserved for combined capsuloligamentous injuries, grade II or grade III injuries with bony avulsion, or chronic PCL injuries with instability.

Questions

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