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ICL
ACL REVISION SURGERY

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Introduction

Interest in the injuries of the posterolateral corner (PLC) of the knee is increasing in the last 20 years.

Isolated lesions are rare, most often they occurs in association with other ligaments of the knee, particularly the anterior cruciate ligament (ACL) and/or posterior cruciate ligament (PCL). Isolated lesions of the posterolateral structures account for 5.7%of knee sprains. The frequency of posterolateral lesions associated with ACL tear is about 10% and those associated with PCL tear about 27%. It is to note that the fibular nerve is involved in 15% of case.

Normally, ruptures of the lateral collateral ligament (LCL) are easily recognized, and an anatomical graft reconstruction is straightforward to restore varus stability. However fewer physicians are familiar with the structures of the posterolateral corner and the methods by which injuries to the area can be detected. For this reason The PLC is referred to as the 'dark side of the knee', which denotes the fact that little is known about it.

Non-recognition of a posterolateral lesions is responsible for serious sequelae. Persistent posterolateral instability leads to a varus thrust gait, which increases forces on the medial compartment of the knee. This may result in meniscal injuries and accelerated medial compartment osteoarthritis. Chronic posterolateral instability has also been shown to increase forces on the ACL and PCL, which can potentially lead to graft failure in the setting of multiligament injury such as progressive degenerative joint changes and ACL or PCL reconstruction failures.

PLC laxity is characterized by posterior subluxationand external rotation of the lateral tibial plateau due to the failure of one or more structures of the PLC. A great number of surgical techniques have been described, demonstrating the difficulties involved in PLC structure reconstruction. Nowadays literature reports that anatomic reconstructions show superior results compared to repair, augmentation, or isometric reconstructions. Anatomic reconstructions attempt to recreate the disrupted LCL, PFL, and popliteal tendon in each of their respective anatomic relations, insertions, and origins. These techniques vary between surgeons but essentially use a tunnel through the fibular head (fibular based) as well as a transtibial tunnel (tibial based) to facilitate graft passage and reconstruction of all 3 main stabilizers.

Anatomy & Biomechanics

PLC is a collection of tissues located at the back, outer corner of the knee rather than one individual structure. Ten are the components that comprise the posterolateral corner of the knee: FCL, lateral head of gastrocnemius, fabella bone in the lateral head of the gastrocnemius tendon (if present), fabellofibular ligament (if fabella is present), popliteofibular ligament (PFL), popliteus tendon, biceps femoris tendon, iliotibial tract, arcuate ligament, and posterolateral capsule.However the lateral/fibular collateral ligament (LCL/FCL), popliteus tendon (PLT) and the popliteofibular ligament (PFL) are considered the most important of these. All of these components help prevent posterior translation of the tibia relative to the femur and also help prevent excessive external rotation and medial deviation (varus angulation) of the tibia.

The LCL is the primary restraint of the varus angulation of the leg relative to the femur, particularly between 5° and 25° of flexion. The FCL also helps prevent internal rotation of the knee. The PFL, extends from the musculotendinous junction of the popliteus muscle to insert onto the head of the fibula. This ligament is tense during extension of the knee; in this position, it is the main structure that prevents excessive external rotation. The popliteus tendonIt is the primary dynamic lateral stabilizer of the knee, and its primary function is to internally rotate the leg by pulling the posteromedial aspect of the tibia toward the lateral side of the distal femur.3,5,6 Because contraction of this muscle internally rotates the leg, it also prevents excessive external rotation of the leg, particularly when the knee is in flexion. Contraction of the popliteus muscle helps unlock the knee from full extension. It also assists in preventing varus angulation and posterior translation of the tibia relative to the femur.

All the PLC structures restrain the knee hypextension and are secondary stabilizer against posterior tibial translation.

Combined damage to these structures results in postero-lateral rotatory instability where the postero-lateral aspect of the tibial plateau translates posteriorly and rotates laterally. Therefore failing to address a PLC injury may compromise concurrent cruciate ligament reconstructions. A great increase in tensile forces on ACL or PCL graft with a fixed posterolateral subluxation has been reported. The altered knee biomechanics leads to early degenerative joint changes.

Incidence

Isolated lesions of the posterolateral structures account for 2-5% of knee sprains. The frequency of posterolateral lesions associated with ACL tear is as high as 10% and those associated with PCL tear 27%.

Diagnosis

Common mechanisms of injury include a posterolaterally directed blow to the anteromedial proximal tibia, with resultant hyperextension; a noncontact hyperextension and external rotation twisting injury; direct blow to a flexed knee; or high energy trauma. Injuries to the PLC are often combined with other ligamentous injuries, especially those of the PCL.

The clinical features of PLC injury include history of significant injury to the knee. The patient reports pain, swelling and bruising around the PLC. He is unable to weight bear. Tenderness, swelling, effusion, ecchymosis can be detected over the fibular head or the PLC. A local tenderness over joint line can be recorded if a Segond fracture is present. During walking a varus thrust or a hyperextension varus thrust in midstance phase of gait is easily detectable.

Several clinical test are available to detect a lesion of PLC structures. Specialty testing should include tests for both varus and rotational deformities. Varus testing or collateral stress testing is performed at 0° and 30° of flexion. An increased lateral joint opening compared to the contralateral knee is indicative of a LCL deficiency. The most commonly used test to assess external rotation is the dial or posterolateral rotation test. With the patient in prone position the examiner externally rotates both feet at 30° and 90° of knee flexion. 10° difference in external rotation at 30° to be evidence of pathology to the PLC. When examination at 90° of flexion reveals a decrease in the amount of external rotation compared to 30°, then injury to the PLC is isolated. When there is further increased external rotation at 90°, then a combined PCL/PLC injury is present. Another external rotational test is the reverse pivot shift test. A positive test result occurs when the posteriorly subluxated lateral tibial plateau abruptly reduces at 20° to 30° of flexion as the IT band changes from a flexor to an extensor of the knee. A positive reverse pivot-shift test is indicative of a PLC + PCL injury.

Useful investigation to detect a PLC lesion are standard and stress Xray views which may show an increased widening of the lateral joint, a Segond fracture, or a fracture of the fibular styloid. The MR imaging will determine the extent of injury, including structures that are involved. Associated injuries can be quantified and this can help in determining a plan of management; however, all the PLC structures may not be visualised.

Treatment

The natural history of PLC injuries depends on the severity or the grade of injury.

Grade I and II sprains can be treated non-operatively which involves extension-bracing-protected weight-bearing for two weeks, followed by functional rehabilitation and range of motion exercises. Studies suggest that nonsurgical treatment results in acceptable outcomes for grade I and some grade II tears, but it leads to residual laxity and poor functional outcomes with all grade III and some grade II injuries. All grade II and III patients treated surgically in these studies were found to have improved varus stability and good functional results; therefore, grade III injuries should be treated surgically.

PLC injuries are best treated in the acute stage, before significant capsular scarring and soft-tissue stretching occur. This can be done by direct repair, with or without augmentation, or by primary reconstruction. Acute (as early as possible) repair generally gives more favorable results than does chronic reconstruction because of the restoration of native anatomy and normal biomechanics. Anatomic structures of the PLC should be identified and repaired sequentially, from deep to superficial. All concomitant injuries must be identified and addressed. Avulsion injuries are best treated with either rigid internal fixation or sutures, depending on the nature of the avulsion.

Some authors support reconstruction over repair in the acute setting. The reason for this discrepancy may have to do with the fact that most of the cruciate injuries of these knees were not treated primarily but were staged in treatment.

Many surgical techniques for PLC reconstruction have been described. All can be adopted either in acute or chronic injuries. To simplify they can be grouped in 2 types of procedures: non anatomic and anatomic reconstructions. The last can be further divided in : tibial based, fibular based, and tibial-fibular based.

Nonanatomic reconstructions do not directly address injured functional anatomic structures but provide primary varus support by advancement procedures in a nonisometric fashion. Thoroughly described by Hughston and Jacobson, and Trillat, the objective of ligament tightening was to tighten the distended posterolateral structures (poplitealtendon, LCL, and lateral condyle).This procedure was performed transposing a boneblock, detached from femoral insertion of the LCL and PLT, above and in front of its insertion using a staple or a screw. These reconstructions are primarily historical procedures and include also biceps tenodesis, arcuate complex or proximal bone block advancements, extracapsular IT band sling, or miscellaneous augmentations. The major problem in these tightening procedures is that the isometry differs from that of the original anatomic structures. In extension, laxity is controlled, but as flexion begins and through-out flexion, these structures are more or less relaxed and cannot control the rotational subluxation of the tibia. For this reason, these tightening procedures were abandoned.

Anatomic reconstructions can be useful for the LCL, the PLT, and/or the PFL. Anatomic reconstruction can be broadly separated into fibular-based and combined tibial-fibular–based reconstructions. Larson was one of the first proponents of a fibular-based technique, which reconstructs both the LCL and PFL ligament. A similar reconstruction has also been described by Arciero with a two-tailed technique. These fibular-based technique are still often used because they are less technically demanding and have good clinical outcomes compared with more anatomically accurate reconstructions. Combined tibial-fibular–based techniques are a recent trend in PLC surgery. These techniques reconstruct all three primary functional components of the PLC, the LCL, PLT, and the PFL, in accordance with the proper insertion site anatomy of each. LaPrade et al reconstructed all three components with two separate femoral tunnels and two grafts. Other anatomic combined techniques that pay particular attention to the PFL have been described by other authors.

Results

Despite the numerous reconstructive techniques reported in the literature, data on long-term results of PLC reconstruction are limited. Moreover, effective comparison of clinical outcomes is difficult because of the high frequency of associated injuries, a mixed number of acute and chronic cases, and lack of consistent outcome measurements in the treatment of these injuries. What is clearly demonstrated it is that repair techniques show inferior outcome results with and increased number of failures compared to anatomic reconstruction. A prompt surgical management as early as possible shows significantly better results than delayed treatment. All studies show favorable short-term results for anatomic PLC reconstructions; however, it remains unclear, from both a clinical and a biomechanical perspective, which type of anatomic PLC reconstruction is superior. Nevertheless a recent systematic review of the literature report favorable outcome result in 90% of the cases regardless the anatomic surgical technique employed at an average follow-up between 2 and 16 years.

Conclusions

Isolated PLC injuries are uncommon. In most of the cases are associated to other knee ligament injuries. Recognition is critical because, if untreated, PLC injury can lead to disability – and if missed in conjunction with reconstruction of ACL or PCL, reconstruction can lead to graft failure. Early repair is favored because of the superior outcome compared with delayed reconstruction. Many reconstruction techniques are described but anatomical ones show better outcome results.

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