Posterior Cruciate Ligament Injuries of the Knee Joint

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Abstract

Posterior cruciate ligament (PCL) injuries have a reported incidence of between 3 and 37%, depending on the clinical setting. The most common mechanism of injury in motor vehicle accidents is a dashboard injury or direct force to the proximal anterior tibia. Sports related injuries result from hyperflexion of the knee with the foot typically plantarflexed. The latter mechanism is the most common cause of isolated PCL injuries, while in the trauma population as many as 95% of patients with knee injuries have combined ligamentous damage. Improved knowledge at an anatomical, biomechanical and clinical level has provided the orthopaedist with a more defined treatment algorithm. Isolated, partial PCL injuries (grades I and II) can best be treated nonoperatively while complete injuries (grade III) may require operative treatment based on clinical symptoms. All combined ligamentous injuries usually respond best with surgical management.
Over the past 2 decades the treatment of knee ligament injuries has focused on injuries to the anterior cruciate ligament (ACL). The reason for this disparity is probably multifactorial. Certainly techniques for treating ACL injuries are more refined than our current methods for treating posterior cruciate ligament (PCL) injuries. There is a considerable level of disagreement amongst experts concerning all aspects of PCL treatment. As a result, the most appropriate method of managing these patients remains controversial.

1. Anatomy and Biomechanics

Anatomical studies have demonstrated that the PCL averages between 32 and 38 mm in length from origin to insertion, and the cross-sectional area narrows distally. The anterolateral and posteromedial bundles comprise the majority of the PCL, but consideration must also be given to the variably present meniscofemoral ligaments. Each component is named by its femoral insertion first, followed by the tibial insertion. The PCL femoral insertion is half-moon shaped and the PCL tibial insertion is nonplanar and rectangular in shape. The anterolateral bundle has twice the cross-sectional area and 150% of the structural properties (ultimate strength, stiffness) of the posteromedial bundle. The former bundle becomes taut in flexion, while the latter bundle is taut in extension but loosens in flexion. Recent biomechanical testing revealed that the meniscofemoral ligaments possessed an elastic modulus twice as large as the posteromedial bundle. The exact implication of this finding is unclear, but signifies that these ligaments may play a more important secondary role than has been previously recognised.

The PCL is the primary restraint to posterior tibial translation and the secondary restraint to external rotation. These functional roles are most pronounced at 90° flexion as sectioning studies have demonstrated minimal posterior translation with an isolated PCL lesion with the knee in full extension. Additional studies have demonstrated significant interactions between the posterolateral corner and the PCL. Kinematic differences increased significantly with combined PCL/posterolateral corner (PLC) lesions compared with isolated lesions. The following grades are based on standard knee scoring systems. Posterior translation at 90° flexion increased from ±0 (isolated PLC) or 2+ (isolated PCL) to 3+ with a combined lesion. Similarly, external rotation and varus increased from 1+ with either isolated lesion to 2+ with combined injuries. These findings verify the significance of recognising the associated involvement of the posterolateral structures in PCL injuries.

Another significant sectioning study revealed that the absence of the PCL and the posterolateral complex produced noticeable increases in the articular contact pressures in the patellofemoral and medial compartments with increasing flexion angles. These findings are consistent with the late degenerative changes in these 2 compartments observed with late follow-up in this patient population.

2. Natural History

The natural history of an isolated posterior cruciate deficient knee has yet to be clearly defined. Insight can be gained from the literature. However, most papers are retrospective and combine isolated PCL injuries with combined ligamentous injuries and do not stratify their findings by the degree of instability.

The largest series is from Shelbourne et al. He evaluated 133 patients prospectively with isolated, acute PCL deficient knees. The majority of patients had sporting injuries with grade I to II laxity. No patient had grade III laxity. The mean follow-up was 5.4 years (2.3 to 11.4 years). He reported that patients with grade II knees had the same results as those with less laxity, and there was a low incidence...