Management of Posterior Cruciate Ligament Injuries

Essay
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Master Degree of Orthopedic Surgery

By

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بسم الله الرحمن الرحيم

(قَالُوا سُبْحَانَكَ لا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

(البقرة: ٣٢)

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Introduction

The posterior curciate ligament (PCL) is described as the primary stabilizer of the knee by many authors. Posterior curcaite ligament (PCL) injuries are less common than anterior curciate ligament (ACL) injuries & they often go unrecognized. The PCL is broader & stronger than ACL with a tensile strength of 2000N (1).

The posterior curciate ligament (PCL) originates from the inter-condylar notch of the femur on the roof of the medial femoral condyle. The insertion is central on the posterior aspect of the tibial plateau, on a depression between the medial and lateral tibial plateau, extending 1 cm below the articular surface (2).

The primary function of the posterior cruciate ligament (PCL) is to prevent the posterior translation of the tibia on the femur. Posterior cruciate ligament (PCL) also plays a role as central axis controlling rotational stability of the knee (3).

The PCL injuries may be misdiagnosed in acute knee injuries which are common among athletes. The commonest mechanism of injury of PCL is direct trauma to the front of upper flexed tibia (4).

The injury may be isolated or associated with another injury, complete, partial or avulsion from bony attachment, it all depend on the mechanism &severity of the injury. Diagnosis can be achieved by clinical &radiological techniques (5).

Treatment of PCL injuries is controversial, non-operative treatment have been recommended for isolated tears, but reconstruction is better for PCL injuries associated with another injuries. The choice of specific option best suited for a particular patient is based on the injury pattern, the structures that are deficient, the patient's age, level of expectation& the experiences of the surgeon. Avulsions may be sutured or fixed by screw, if the bone fragment was large enough, by open or arthroscopic surgery. Numerous techniques have been advocated to reconstruct the PCL. The semitendinosus tendon, combined gracilis semitendinosus substitutes &bone-patellar tendon-bone auto graft were used (5,6).

Arthroscopic reconstruction of PCL is advancing, single &double tunnel reconstruction was described. Interest is increasing in techniques that allow direct fixation of a tibial bone plug, the tibial inlay technique allows that (5).

PCL injuries surgery, in addition to postoperative complications, may be complicated with loss of motion ,instability ,failure of reconstruction ,neurovascular injuries or osteonecrosis of medial femoral condyle (7).

AIM OF THE WORK

The aim of this study is to give an attention to PCL injuries which was misdiagnosed and underestimated in the past and to provide an up to date methods of treatment of this kind of injuries.

Anatomy of the Posterior Curciate Ligament

Gross anatomy

The cruciate ligaments appear to be in fact crossed in space. They are crossed in sagittal plane and in the frontal plane. In the horizontal plane by contrast they run in parallel to each other and are in contact at their axial borders. The cruciate ligaments don't have the same angle of inclination thus in full extension the anterior cruciate ligament is more horizontal, their femoral insertion show similar difference thus; the insertion of posterior cruciate is horizontal, while that of anterior cruciate ligament is vertical (8).

The posterior cruciate ligament (PCL) is named for its insertion on the tibia. It originates from the lateral surface of the medial femoral condyle and passes posteriorly and laterally behind the ACL. The PCL has an area of origin shaped as a segment of a circle. The attachment is generally oriented near the horizontal plane with the lower boundary being convex and congruent with the articular margin of the condyle. The dimensions of the PCL origin from the medial femoral condyle average 32 mm in the anteroposterior direction (Fig.1). The most distal fibers, on average, extend to within 3mm of the articular cartilage of the condyle (9).

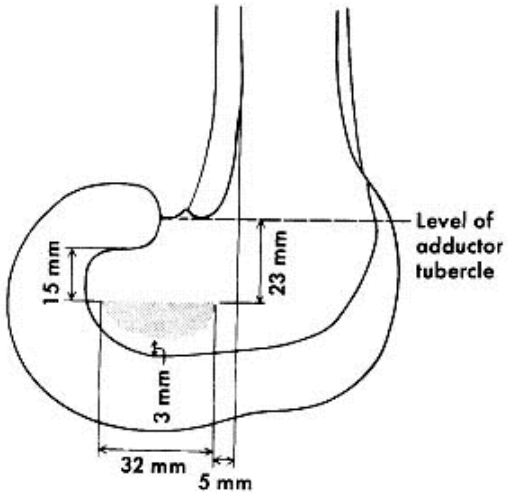

Fig. 1. Lateral surface of medial condyle of femur showing average measurements and relationships of femoral attachment of posterior cruciate ligament (shaded area) (5).

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The femoral insertion site characteristics of the PCL were recently mapped and found to have a broad attachment with an angle of 88° ± 5.5° to the roof. The anterior portion inserts in a more vertical orientation compared with the posterior portion, which inserts on the flat intercondylar surface (10).

The tibial attachment of PCL is to the depression behind the intra-articular upper surface of the tibia and extends for 3 mm on the adjoining superior surface of the tibia (fig.2). Near its tibial attachment, a separate slip arises to blend with the posterior horn of lateral meniscus. It's narrowest at midportion and fans out superiorly. The width of the tibial attachment averages 13mm and varies with the width of the intercondylar notch (9).

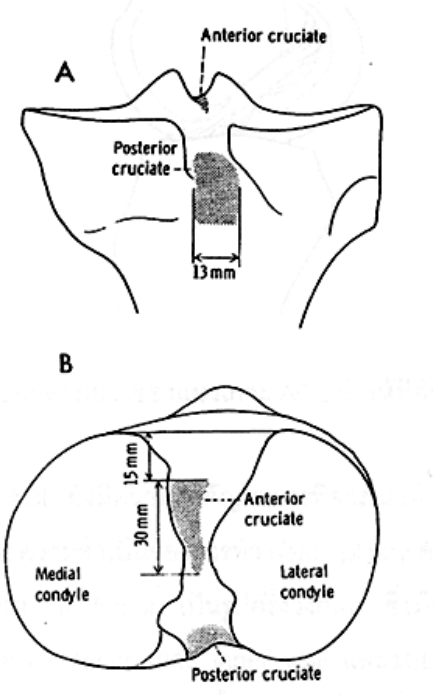

Fig. 2. Posterior upper portion of the tibia (A) and superior surface of the tibia (B), showing the average measurements and relationships of the tibial attachments of the anterior and posterior cruciate ligaments.(5)

The average length of the PCL is 38mm and average width is 13mm compared to 11mm for the ACL.PCL is approximately 1.5 as large as the ACL at femoral and midsubstance level, it also increase in size from tibial to femoral insertion where the ACL demonstrate the exact oppsite trend (11).

Investigators have divided the PCL into various components or bundles on the basis of their tensioning patterns.The ligament consist of three main components: the anterolateral bundle, the posteromedial bundle, and the meniscofemoral ligaments (ligaments of Humphry and Wrisberg). The components have been shown to possess unique anatomic and biomechanical properties as well as specific sites of bone insertion. The anterolateral component runs from the anterior aspect of the intercondylar surface of the medial femoral condyle posterolaterally to insert on the lateral aspect of the posterior tibial fossa. The posteromedial bundle arises from the posterior portion of the femoral insertion site and extends obliquely to insert on the medial aspect of the posterior tibial fossa (fig.3). The anterolateral bundle tightens with a knee flexion, whereas the posteromedial component tightens with knee extension. (12)

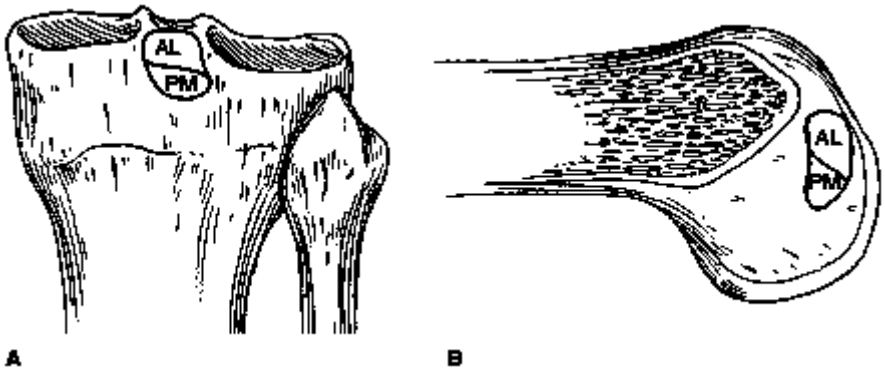

Fig. 3. Anatomy of the PCL insertion. A, Outline of the anterolateral bundle (AL) and posteromedial bundle (PM) of the PCL tibial insertion. B, Femoral origin (5).

The meniscofemoral ligaments (MFLs) represent accessory knee ligament that attach to the medial femoral condyle in the region of PCL, present in 71% to 100% of the dissected knees consist of the anterior ligament of Humphrey and the posterior ligament of Wrisberg. The posterior MFL of Wrisberg originates from the posterior horn of the

lateral meniscus, posterior tibia or posterior capsule and crosses obliquely posterior to the PCL to a separated insertion site on the medial femoral condyle, may be as large as 50% of diameter of the PCL. The anterior MFL of Humphrey arises from the posterior horn of the lateral meniscus, passes along the anterior aspect of the PCL to insert on the medial femoral condyle. MFLs serve as a minor restraint to posterior translation of the tibia when the PCL is cut, but they are believed to play an important role in meniscal kinematics (11).

Synovial covering

Although it's within the knee, the PCL is completely surrounded by synovial sleeve.It's therefore entirely extra-articular in an anatomic sense.The PCL is covered with synovial tissue that is reflected from the posterior capsule and covers the ligament on its anterior, medial, and lateral aspects.Distaly the PCL blends with the posterior capsule and periosteum.The synovial covering is evidently thicker and more compelete than that of the ACL (13).

Functional anatomy

The major control of the knee stability has been ascribed to the PCL. This strong ligament, which according to tensile testing is approximately two times stronger than any other ligaments around the knee (14).

The PCL plays many major roles as:

- It prevents posterior translation of the tibia on the femur (3).
- It plays a role as central axis controlling rotational stability of the knee as it resists varus-valgus angulation of the tibia especially in