POSTEROLATERAL CORNER INSTABILITY OF THE KNEE

Essay

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By

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بسم الله الرحمن الرحيم

" وَضَرَبَ لَنَا مَثَلًا وَنَسِيَ خَلْقَهُ قَالَ مَن يُحْيِي
الْعِظَامَ وَهِيَ رَمِيمٌ (78) قُلْ يُحْيِيهَا الَّذِي
أَنشَأَهَا أَوَّلَ مَرَّةٍ وَهُوَ بِكُلِّ خَلْقٍ عَلِيمٌ (79) "

صدق الله العظيم

الآية (78،79) سورة يس

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without his remarkable thoughts and notable orientation.

Essam A. Ghanem
2005

DEDICATION

To my beloved mother, for her everlasting love and support,

To my father for his guidance throughout my life

To my wife for here patience and support.

To my great teacher, Prof, Ezzat M. Kamel to whom I am indebted for whatever I am and whatever I will be.

INTRODUCTION

Isolated posterolateral corner instability (PLCI) of the knee is an uncommon injury pattern that may result in significant degrees of functional disability. this injury complex can be a challenging diagnostic and therapeutic problem for the orthopaedic surgeon. The presence of associated ligamentous and soft-tissue injuries, resulting in combined instability patterns, further complicates management. The results of recent research have enhanced our understanding of complex anatomy and biomechanics of the posterolateral aspect of the knee. Numerous surgical techniques have been described for both repair and reconstruction of the injured posterolateral structures; however, long term functional results have been only moderately successful ***(Frank and Chen et al., 2002)***

Acute or chronic Posterolateral instability of the knee is a complex problem in terms of diagnosis and treatment and is often neglected. Appropriate recognition and treatment of Posterolateral instability of the knee are important clinically and may affect the treatment of associated ligamentous instabilities, which may involve the cruciate ligaments. Unrecognized and untreated Posterolateral knee injuries may cause failure of concomitant cruciate ligament reconstruction, because the Posterolateral corner (PLC), especially the popliteus, shares the function of the posterior cruciate ligament (PCL) ***(MacGillivray and Warren, 1999; Harner et al., 2000; M.C. Lee, et al., 2003).***

Aim of the work

The aim of this work is to provide update approacfhes to clear out what’s the posterolateral corner of the knee, the mechanism of injury and different ways of management of isolated and combined injuires of posterolateral corner instability of the knee and its impact on the knee functions and prognosis

ANATOMY

The anatomy of the PLC of the knee has not been well understood because of inconsistencies terminology and variations in the anatomy. The principle structures of the Posterolateral corner **(PLC)** were first described **by *Seebacher et al. (1982)*** they introduced the concept of the lateral 3 layers; among these, layer 3 consists of the lateral collateral ligament (LCL), the fabellofibular ligament, the the popliteus tendon (PL T). and the arcuate complex. In addition to these, the popliteofibular ligament (PFL) is another important structure in layer 3, which has aroused the interest of surgeon in terms of its reconstruction ***(Maynard et al., 1996; Veltri, 1996; and M.C. Lee et al., 2003)***. Terminology describing these structures has been confusing: differentiation between the arcuate ligament and the arcuate ligament complex described by ***(Baker et al., 1984)*** which includes arcuate ligament, LCL, popliteus muscle and tendon, and lateral head of gastrocnemius, these constituents form a sling that functions statically and dynamically to control rotation of the lateral tibiofemoral articulation, must be recognized. beside the variations in terminology, there are reported variations in the anatomy ***(Kaplan, 1961; Seebacher 1982; Watanabe, 1993 and Frank et al., 2002).***

Seebacher et al. (1982) developed a three layer concept of the **PLC** from superficial to deep (fig. 1):

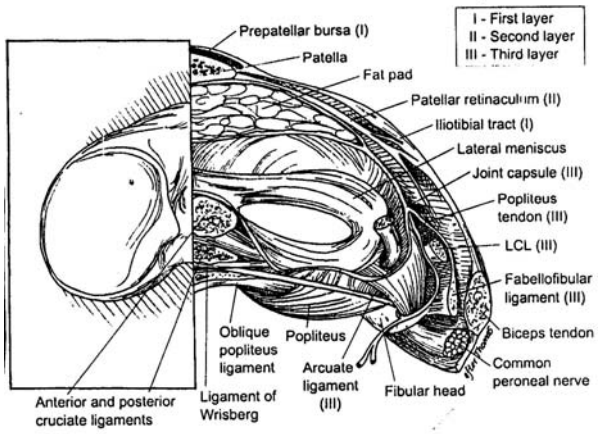

Fig. (1): Coronal section of the knee illustrates the three-layer concept of the anatomy of the posterolateral structures, as described by Seebacher et al. (Adapted with permission from Seebacher JR, Inglish AE, Marshall JL, Warren RF: The structure of the posterolateral aspect of the knee ***(Bone Joint 1982)***

Layer I:

- Iliotibial tract - anteriorly.
- Biceps femoris tendon-posteriorly.

Layer II:

- Quadriceps retinaculum - anteriorly.
- LCL in superficial lamina of the capsule.
- Patello-femoral and patello-meniscal ligaments.

Layer III:

- Oblique popliteal ligament of Winslow.
- The deep lamina of posterolateral part of the capsule and coronary ligament.
- Popliteus muscle and tendon.

- Fibers related to the musculo tendinous part of the popliteus muscle:
  - Popliteo-capsular.
  - Popliteo-meniscal.
  - Popliteo-fibular.
- The menisco-femoral ligaments of Wrisberg and Humphery.
- The Arcuate complex and fabello-fibular ligament of Vollois (termed short lateral collateral ligament by (***Kaplan, 1961)***.

Layer I: (fig. 2)

It is The most superficial layer and consists of:

- The iliotibial band (ITB) and its expansions anteriorly.
- The superficial portion of biceps femoris and its expansion posteriorly.

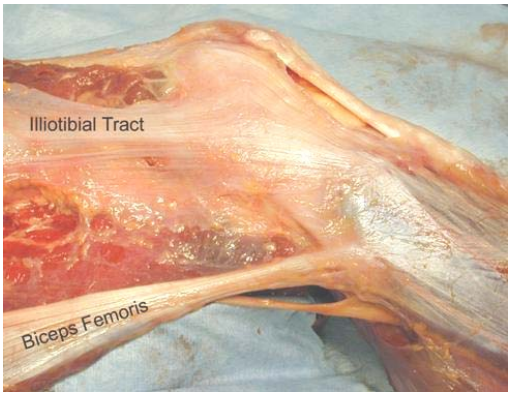

Fig. (2): The first layer of PLC 1)iliotibial tract ;2) biceps femoris ***(Laprade, 2002, anatomy and biomechanics of the posterolateral knee; ISAKOS, 2003)***.

1. ITB, which runs between the supracondylar tubercle on the femur and Gerdy`s tubercle on the proximal tibia, extends to the patella, including the patellar bursa ***(Kaplan 1958; Frank, et al., 2002).***

Kinematics: 1) The most important portion of this structure acts as an accessory anterolateral ligament ***(Kaplan, 1958; Frank, et al., 2002).*** 2) during normal walking gait, most of the knee joint force passes through the medial tibio-femoral compartment. There is transient tension in the ITB to prevent varus opening. Because of this, any varus alignment of the leg leads to transfer tension on the posterolateral structures (PLS) (the "varus thrust") ***(Laprade, 2002)***. 3) during knee flexion, the ITB becomes tight and moves posteriorely, exerting an external rotational and backward force on the lateral tibia. During knee extension ,it moves anteriorly and is thus spared in most cases of varus stress and Posterolateral injury ***(Koval, 2002).***

2.The Biceps femoris muscle (fig. 3): consisting of a long and a short head with numerous arms-courses posterior to the ITB and inserts primarily on the fibular head .It also sends strong attachments to the ITB, Gerdy`s tubercle, LCL, and the Posterolateral capsule. the peroneal nerve lies deep and posterior to biceps tendon at the level of the distal femur ***(Jakob, 1974; Delee, 1983; Frank, et al., 2002).***

If the posterolateral tendinous expansions of the Biceps are severed along with the iliotibial tract anteriorly only the fibular collateral ligament is left laterally and the PL T is left

posterolaterally ***(Marshall, 1977; Terry and Laprade, 1997)***.

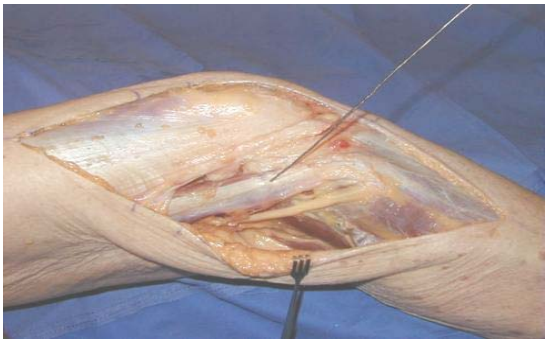

Fig. (3): The biceps femoris tendon ***(Christopher, functional anatomy of the PLC; ISAKOS, 2003).***

Kinematics:

1. The Biceps femoris muscle is an important stabilizer against varus angulation in the extended knee and against internal rotation in the flexed knee. In particular its short head is a direct antagonist to the PLM (and thus to anterior rotation) ***(Marshall, 1977; Terry and Laprade, 1997)***.

2. When the Biceps rotates the tibia externally with the knee flexed and the foot planted, the weakest point in the system, is at the proximal tibio-fibular attachment.

3. In the presence of a sufficient trauma, a rotators dislocation will occur in the proximal tibio-fibular articulation, accompanied by tearing of the biceps tendon fibres that extend across the fibular head to the tubercle of Gerdy ***(Marshall, 1977; Delee, 1983***).

4. Preserve varus as well as rotatory stability Due to its contributions to the arcuate ligament. Injury to the biceps femoris complex frequently occurs in PLCI ***(Frank, et al., 2002)*.**

Layer II:

Consists of:

1. The quadriceps retinaculum.
2. The LCL.
3. Patello-femoral and patello-Meniscal ligaments.

1.**The Quadriceps Retinaculum:**

Which is a fibrous expansion from the lower margin of the vastus lateralis muscle; coursing anterolaterally adjacent to the patella in front of the LCL; the retinaculum blend with capsule, and attached anteriorly to the margins of the patellar ligament; below the patellar attachment of the capsule.

2. Lateral Collateral Ligament:

a) Firbular collateral ligament which is around cord like about 5 cm long descends obliquely backward from the lateral epicondyle of the femur to the fibular head, reinforcing the posterior third of the capsule (fig. 4).

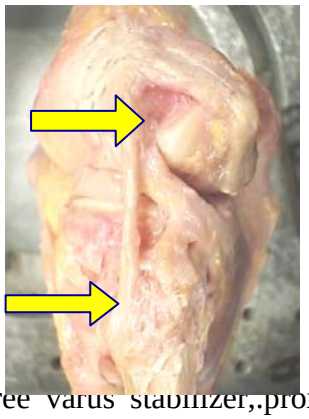

Fig. (4): LCL,.1 degree varus stabilizer,.proximal / posterior to lateral epicondyle,.midway along fibular head ***(Laprade, et al; 2002; anatomy and biomechanics of the posterolateral knee; ISAKOS, 2003)***.

b) It lies free from the capsule and lateral meniscus, being separated from the meniscus by the tendon of popliteus muscle (PL M), inside the joint and the inferior lateral genicular vessels outside the joint.

Kinematics:

1. The LCL is the primary stabilizer against varus stress and is also an important contributor in maintaining Posterolateral knee stability ***(Delee, 1983; Maynard, 1996; CHih-Hwa, 2001; M.C. Lee, et al.,2003) .***

2. Biomechanical studies have shown that more than 750 N of force is required to cause failure of the LCL ***(Laprade, 2001 and Frank, et al., 2002)***.

3. It is functioning as a synergist to the posterior cruciate ligament ***(Grood, 1981; Terry and Laprade, 1996; Meister et al., 2000)***.