RECENT TRENDS IN MANAGEMENT OF POST TRAUMATIC KNEE STIFFNESS

AN ESSAY

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BY

Ahmed Awad Ahmed Ahmed
M.B.B,ch

Under Supervision Of

Prof. Dr. ASHRAF ABD EL KADER EL NAHAL
Professor of Orthopedic Surgery
Faculty of Medicine
Cairo University

Prof. Dr. AHMED MAHMOUD ATIA
Professor of Orthopedic Surgery
Faculty of Medicine
Cairo University

Dr. AHMED RIZK MOHAMED EL-SAID
Lecturer of Orthopedic Surgery
Faculty of Medicine
Cairo University

Cairo University
Faculty of Medicine
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Ahmed Awad Ahmed Ahmed

Abstract

Stiff knee following trauma defined as a difficulty moving the knee or a range of movement less than 90° of flexion that persists longer than 6 weeks. Better understanding of surgical timing, improved surgical technique, and advanced rehabilitation protocols has led to decreased incidence of motion. Causes contributing to a stiff knee after trauma can be separated in to intra-articular and extra-articular. A detailed history, physical examination, radiographs, and laboratory tests are important for evaluation. Prevention, consisting of control of inflammation and early motion, remains the key element in avoiding motion loss. However, certain techniques, such as manipulation under anesthesia in conjunction with arthroscopic lysis of adhesions, custum knee device, joint active system and or botulinum toxin injections are reliable treatment options. Arthroscopic lysis of adhesions, open arthrotomy or modified open lysis of adhesions, Quadricepsplasty (arthroscopic and open), percutaneous knee lysis, capsulotomy and free tissue transefer were applied.

Keywords: *knee; Stiffness; cyclope lesion; motion loss; arthrofibrosis; Manipulation; Adhesion around knee, Quadricepsplasty.*

Contents

Introduction

Maintaining a full range of knee motion requires congruent articular surfaces; adequate muscle function; an articular capsule with suitable capacity and flexibility; effective space in the medial and lateral articular recesses, intercondylar notch, and suprapatellar pouch; and sufficient meniscal motion.

Stiff knee following trauma can be defined as a difficulty moving the knee or a range of movement less than 90° of flexion that persists longer than 6 weeks. Better understanding of surgical timing, improved surgical technique, and advanced rehabilitation protocols has led to decreased incidence of motion loss after anterior cruciate ligament injury and reconstruction. However, motion loss from high-energy, multiligament injuries continues to compromise functional outcome. Causes contributing to a stiff knee after trauma can be separated in to intra-articular and extra-articular. Other factors are classified as preoperative, intraoperative, and postoperative categories. Evaluation of the patient with a stiff knee must follow a thorough and logical progression. A detailed history, complete physical examination, radiographs, and laboratory tests. Prevention, consisting of control of inflammation and early motion, remains the key element in avoiding motion loss. If there is evidence of infection or complex regional pain syndrome, we have to treat the underlying etiology. If clinical examination, radiographs and laboratory tests are normal, treatment depends on the duration after the index procedure. However, certain techniques, such as manipulation under anesthesia in conjunction with arthroscopic lysis of adhesions, custum knee device, joint active system and or botulinum toxin injections are reliable treatment options. Open surgical débridement is rarely necessary and should be considered only as a salvage procedure. , Arthroscopic lysis of adhesions, open arthrotomy or modified open lysis of adhesions, Quadricepsplasty (arthroscopic and open), percutaneous knee lysis, open capsulotomy and free tissue transefer were applied. A greater understanding of the pathogenesis of arthrofibrosis and related inflammatory mediators may result in novel therapies for treating the patient with motion loss.

Keywords: *knee; Stiffness; cyclope lesion; motion loss; arthrofibrosis; Manipulation; Adhesion around knee, Quadricepsplasty.*

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AIMS OF THE WORK

The main aim of this research is to explain the most recent trend in the treatments of post traumatic stiffness of the knee.

ANATOMY OF THE KNEE

The knee joint is a synovial joint, the largest in the body. It is a modified hinge joint. A compound joint includes two condylar joints between the femur and the tibia and a sellar (saddle) joint between the patella and the femur. ***(Sinnatamby C.S, 1999).***

Larson and James classified the structures about the knee into three broad categories**:**

a. **Osseous structures:**
The distal femoral condyles, the proximal tibial plateaus or condyles, and patella.

b. **Intra-articular structures:**
The medial and lateral menisci and the anterior , posterior cruciate ligaments and the synovium . ***(Miller2003)***.

c. **Extra-articular structures:**
The capsule, collateral ligaments, musculotendinous units.

A. Osseous structures:

Distal Femoral Condyles: The femoral condyles are two rounded prominences that are eccentrically curved. Anteriorly the condyles are flattened, creating a larger surface for contact and weight transmission. The groove found anteriorly between the condyles is the patellofemoral groove, or trochlea. Posteriorly the condyles are separated by the intercondylar notch. The articular surface of the medial condyle is longer than that of the lateral condyle, but the lateral condyle is wider. ***(Clarke H. D et al, 2004)***.

Proximal Tibial Plateaus Or Condyles: They are separated in the midline by the intercondylar eminence with its medial and lateral intercondylar tubercles. Anterior and posterior to the intercondylar eminence are the areas that serve as attachment sites for the cruciate ligaments and menisci (Figure 1-1). The larger medial tibial plateau is nearly flat and has a squared off posterior aspect.

Both have a posterior inclination with respect to the shaft of the tibia of approximately 10º. ***(Clarke H. D et al, 2004).***

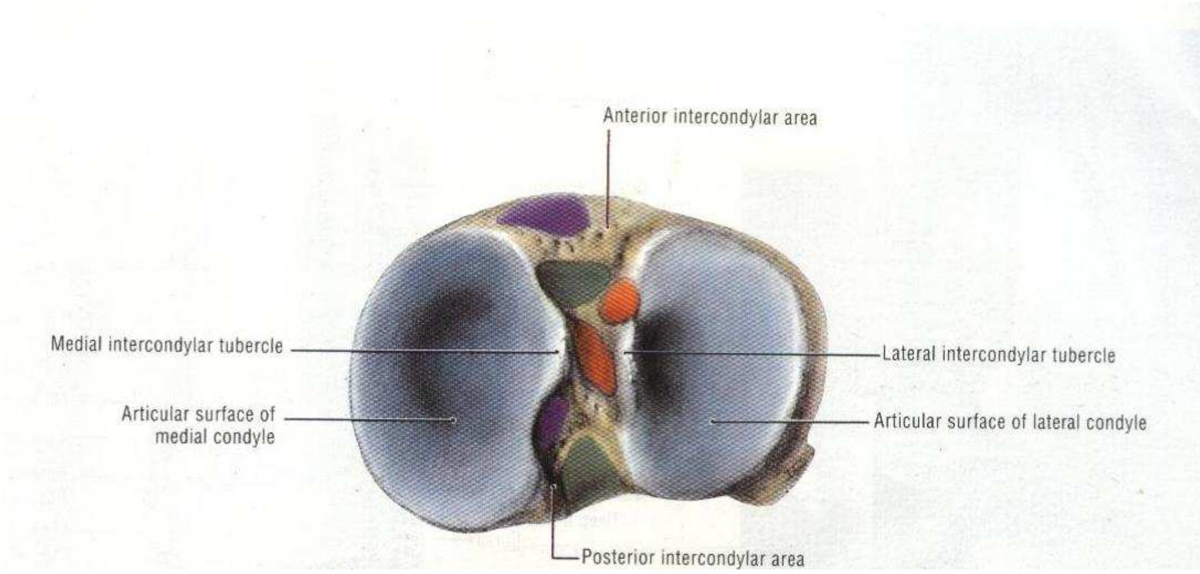

Fig.(1-1) superior aspect of the tibial plateau,Bony landmarks.***(Agur and Ming 2001)***

Patella: The largest sesamoid bone in the body. The articulation between the patella and the femoral trochlea forms the patellofemoral compartment. (Figure 1-2)

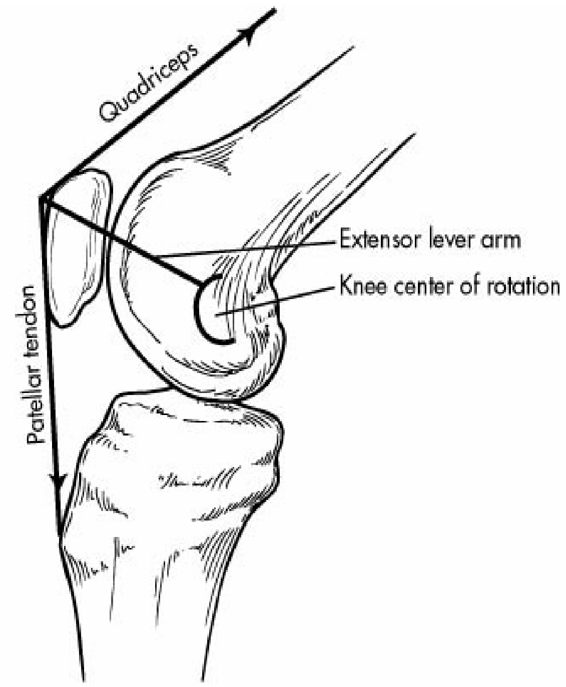

Fig. (1-2) Patella acts to lengthen extensor lever arm by displacing force vectors of quadriceps and patellar tendons away from center of rotation (COR) of knee. Length of extensor lever arm changes with varying amounts of knee flexion.

(Crockarell and Guyton, 2003)

The stability of the patella in the trochlear groove is a combination of bony, ligamentous, and muscular restrains. In addition, several soft tissue constraints contribute to the tracking of the patella within the trochlear groove. The constraints include the medial patellofemoral ligament, the medial patellomeniscal ligament, medial patellotibial ligament, the horizontal fibers of the vastus medialis obliqus, and medial and lateral patellar retinaculua. ***(Goldblatt and Richmond, 2003).***

B.Intra-articular structures:

Cruciate Ligaments: (Figure 1-3)

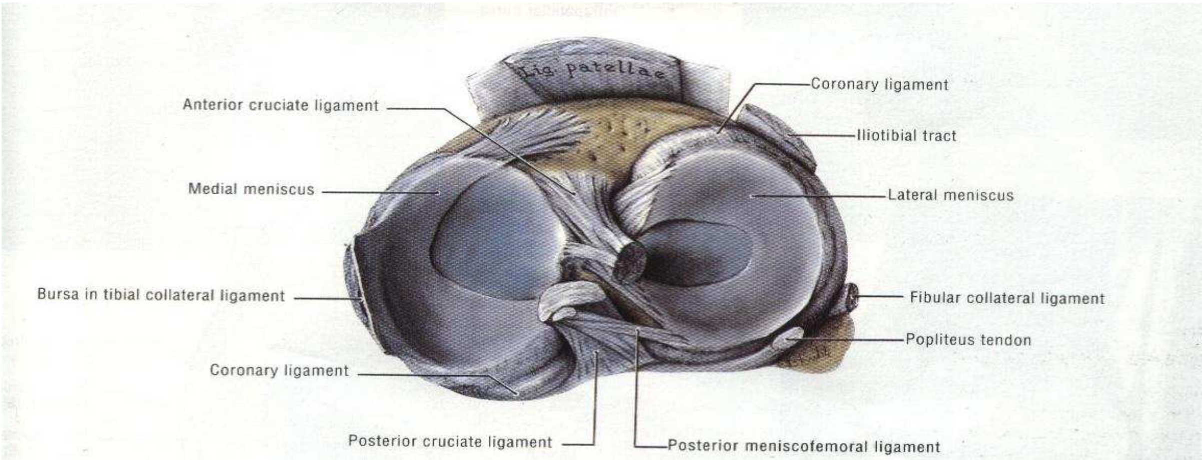

Fig. (1-3) superior aspect of the tibial plateau, ligament and tendon attachment sites. ***(Agur and Ming 2001)***

The Anterior Cruciate Ligament (ACL):

The ACL extends from a broad area anterior to and between the intercondylar eminences of the tibia to a semicircular area on the posteromedial lateral femoral condyle. It is composed of two bundles: an anteromedial bundle, which is tight in flexion, and a posterolateral bundle, which is more convex and tight in extension. Anatomic studies have shown that the ACL ranges from 30 to 38 mm in length and 10 to 12 mm in width. ACL is intra-articular, but it is encased in its own synovial membrane. The vascular supply of the ACL is derived from the middle geniculate artery.

The innervation of the ACL consists of mechanoreceptors derived from the tibial nerve and contributes to its proprioceptive role. Pain fibers in the ACL are virtually nonexistent, which explains why there is minimal pain after an acute ACL rupture before developing a painful heamarthrosis**. *(Anikar Chhabra, M.D. et al, 2001).***

The posterior cruciate ligament (PCL):

The PCL like the ACL is intraarticular and extrasynovial, with a broad semicircular area on the lateral aspect of the medial femoral condyle and projects to a sulcus that is posterior and inferior to the articular plateau of the tibia.

The PCL consists of two bundles: a larger anterolateral bundle, which is tight in flexion, and a smaller posteromedial unit, which is tight in extension. Its average length and width are 38 and 13 mm, respectively. **(*Giris F.G. et al, 1975)*.**

PCL cross sectional area is 50% greater than the ACL at the femur and 20% greater at the tibia. In contrast to the ACL, the PCL is larger at its femoral insertion than at its tibial insertion. The vascular supply of the PCL is similar to the ACL, derived from the middle geniculate artery, and mainly soft tissue-based, not osseous-based. The innervation of the PCL is from the tibial and obturator nerves. Similar to the ACL, this serves primarily as a proprioceptive function.

(Anikar Chhabra, M.D. et al, 2001).

The ligaments of Humphrey and Wrisberg:

Two intraarticular accessory ligaments, the menisco femoral ligaments, extend from the posterior horn of the lateral meniscus and insert anterior and posterior to the PCL onto the medial femoral condyle. They are not present in all knees. They average approximately 22% of the entire cross-sectional area of the PCL. They serve as secondary stabilizers to posterior tibial translation. ***(Anikar Chhabra, M.D. et al, 2001).***

Menisci: (Figure.1-4)

The menisci are two crescent-shape fibrocartilaginous structures that are triangular when viewed in cross section. The menisci are attached to the peripheral border of the joint capsule, lie flat on the tibia, and deepen the articular surface of the tibial plateau for articulation with the femoral condyles. Only the peripheral 20% to 30% of the menisci are vascularized, supplied by the medial and lateral geniculate arteries. Historically, repaired meniscal tears in this red-red zone have a better healing potential than tears in the red-white or white-white zone, which are the middle and inner thirds**. *(Anikar Chhabra, M.D. et al, 2001).***

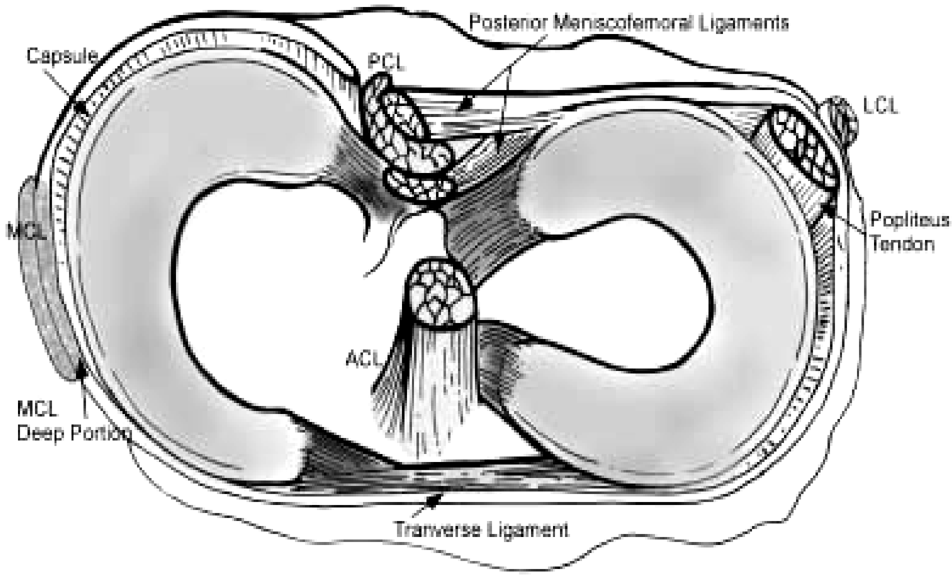

Fig. (1-4**)** Meniscal horn attachments**. (*Douglas and et al, 2003)***

The Medial meniscus:

The medial meniscus is C-shaped (Figure 1-4). Its stability can be attributed to its multiple attachments. Posteriorly, it is attached to the posterior intercondylar fossa of the tibia. The anterior aspect of the medial meniscus is attached to the anterior horn of the lateral meniscus through the transverse intermeniscal ligament and to the tibia at the anterior intercondylar fossa. It sometimes inserts below the tibial plateau anteriorly. Medially, the coronary ligament attaches the medial meniscus to the tibial margin distal to the articular surface. In addition, the capsule of the knee thickend at the midportion of the meniscus, giving rise to the deep medial ligament, which augments the tibial attachment and also attaches to the femur. ***(Anikar Chhabra, M.D. et al, 2001).***

The Lateral meniscus:

The lateral meniscus is more circular and accommodates the narrower lateral tibial plateau. It is smaller than the medial meniscus, but it covers a larger percentage of the lateral tibial plateau. Thus, the lateral meniscus is an important weight-bearing structure, and its preservation is paramount in preventing degenerative changes in the lateral knee compartment (Figure 1-4). The anterior and posterior horns of the lateral meniscus attach to the intercondylar fossa in front of and behind the ACL footprint. ***(Anikar Chhabra, M.D. et al, 2001).***

The Transverse Ligament:

Connects the anterior convex margin of the lateral meniscus to the anterior end of the medial meniscus; its thickness varies considerably in different subjects, and is sometimes absent.

(Warick and Williams, 1973).

The Synovium:

The knee is the largest synovial joint in the body, but the amount of synovial fluid in a normal knee is about 5 ml. ***(McMinn, 1994).*** At the proximal patellar border, it forms a large suprapatellar bursa between the quadriceps femoris and the lower femoral shaft. This is in practice,and extention of a joint cavity.

Alongside the patella, the synovial membrane extends beneath the aponeurosis of the vasti, more extensively under the medialis. Distal to the patella the synovial membrane is separated from ligamentum patellae by infrapatellar pad of fat, which covered by the membrane and then