Endoscopic Anatomy of the Knee

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Abstract

Knee arthroscopy is one of the most common arthroscopic procedures performed in the orthopedic surgery.

Professor Kenji Takagi in Tokyo has been considered as the first surgeon who performed an arthroscopic examination of a knee joint in 1919 (Takagi, J Jpn Orthop Assoc 8:132, 1933). In 1920 the Swiss Eugen Bircher published several papers describing his experiences regarding knee arthroscopy with diagnostic purposes. He was the first surgeon to introduce the term arthroscopy (Bircher, Beitr Klin Chir 127:239–50, 1922).

The first interventional arthroscopy was conducted by the Japanese surgeon Masaki Watanabe and his student and consisted of the removal of an intraarticular pigmented villonodular synovitis (Watanabe et al. Atlas of arthroscopy, Springer, 1969).

Arthroscopy techniques developed significantly during the 1970 and 80 decades due to the improvement of the optical and imaging technologies.

Keywords

Knee · Arthroscopy · Endoscopy · Anatomy
Extra-articular

2.1 Knee Anatomy

The knee joint consists of several structures including the distal epiphyses of the femur, the proximal epiphysis of tibia and fibula, the patellar bone, the surrounding and the internal soft tissues.

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It is helpful to divide the knee joint into a medial compartment, a lateral compartment, a central pivot, and the patellofemoral joint (Fig. 2.1).

2.1.1 The Medial Compartment

The medial compartment of the knee consists of the medial femoral condyle, the medial tibial plateau, the medial meniscus, and the medial part of the joint capsule and its ligaments (Fig. 2.2).

2.1.1.1 The Anterior Third

The anterior third of the medial compartment is mainly capsular. Superficial to the capsule, the part of the vastus medialis muscle attached to the patella, the vastus medialis obliquus (VMO), is found. The VMO is the most distal segment of the vastus medialis muscle and it is not clearly delineated. The

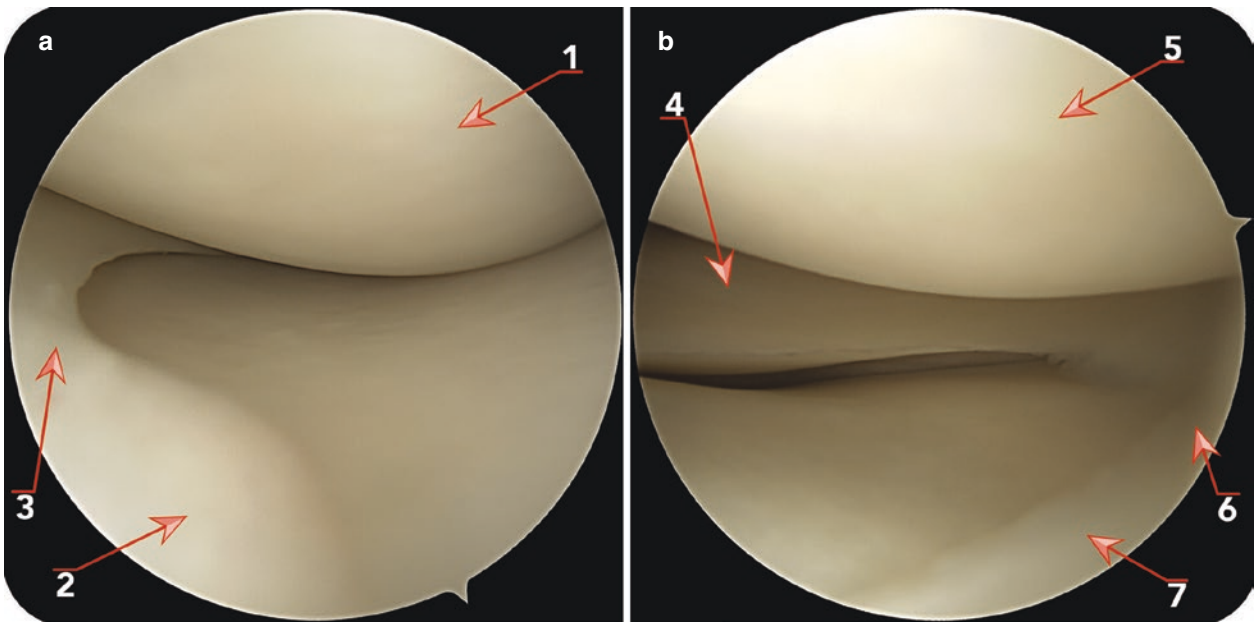

Fig. 2.1 Arthroscopic view of the medial (**a**) and lateral (**b**) compartments of the knee. (1) Medial femoral condyle. (2) Anterior horn of the medial meniscus. (3) Medial meniscus. (4) Posterior horn of the lateral meniscus. (5) Lateral femoral condyle. (6) Lateral meniscus. (7) Anterior horn of the lateral meniscus

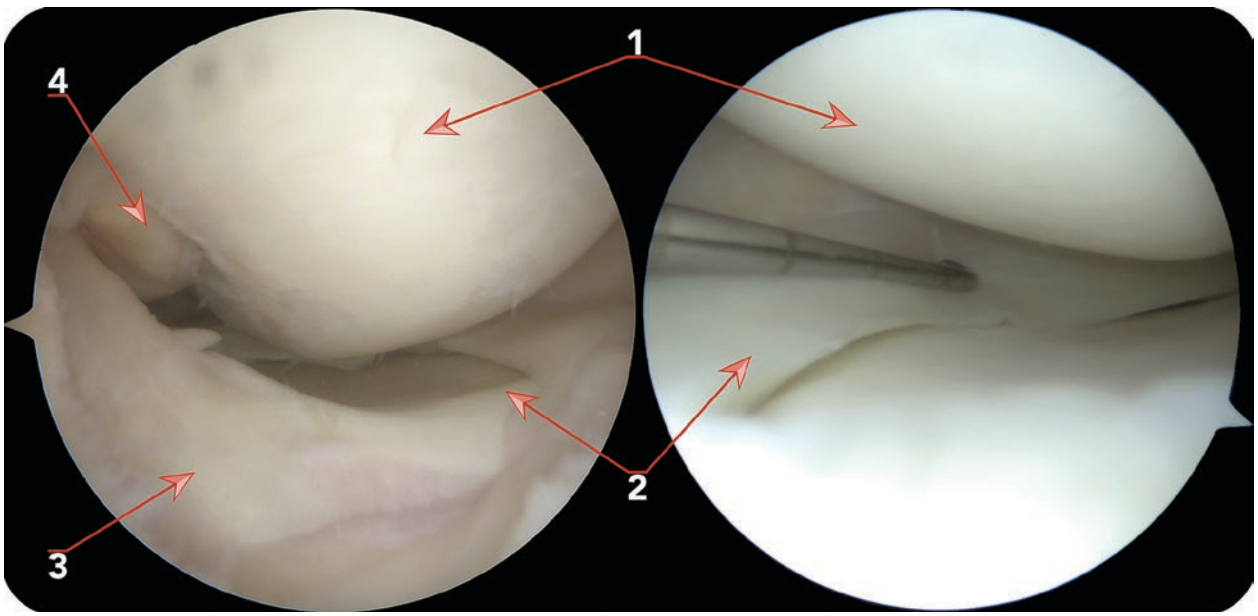

Fig. 2.2 Arthroscopic view of the medial compartment of the knee. (1) Medial femoral condyle. (2) Medial meniscus. (3) Tibial insertion of ACL. (4) Femoral insertion of ACL

distal border of the VMO is attached along the proximal edge of the medial patellofemoral ligament. It has an important role in maintaining patellar stability.

The medial patellofemoral ligament (MPFL) is found superficially to the anterior joint capsule. The distal border of the vastus medialis obliquus is attached to this ligament. It is inserted on the superomedial aspect of the medial border of the patella. The ligament coursed medially, and it is attached just distal and anterior to the adductor tubercle and 10 mm proximal and 8 mm posterior to the medial epicondyle [1]. The MPFL is the main static medial restraint of the patella and the VMO the main dynamic stabilizer, with obliquely oriented fibers [2]. The MPFL is frequently damaged in patients with patellar instability with recurrent lateral patellar dislocation. Many techniques are described for MPFL reconstruction with minimally invasive-arthroscopically assisted surgery.

At the anterior medial distal knee, the pes anserinus tendon attachment is found. It consists of the sartorius, gracilis, and the semitendinosus muscle attachments at the anteromedial aspect of the proximal tibia. The sartorius tendon is attached to the superficial fascial layer and the gracilis and semitendinosus are located deep to the fascial layer. The sartorius tendon is located superiorly to the gracilis and semitendinosus tendons, which follow inferiorly. The pes anserinus attachment is located anteriorly and superficial to the distal insertion of the superficial medial collateral ligament [3]. The pes anserinus helps knee stability to valgus stress. The semitendinosus and/or the gracilis tendons are frequently harvested for ACL reconstruction and other ligament reconstruction surgeries.

2.1.1.2 The Middle Third

The middle third of the medial aspect of the knee includes the medial collateral ligament of the knee as the main structure (Fig. 2.3). It consists of a superficial and a deep part.

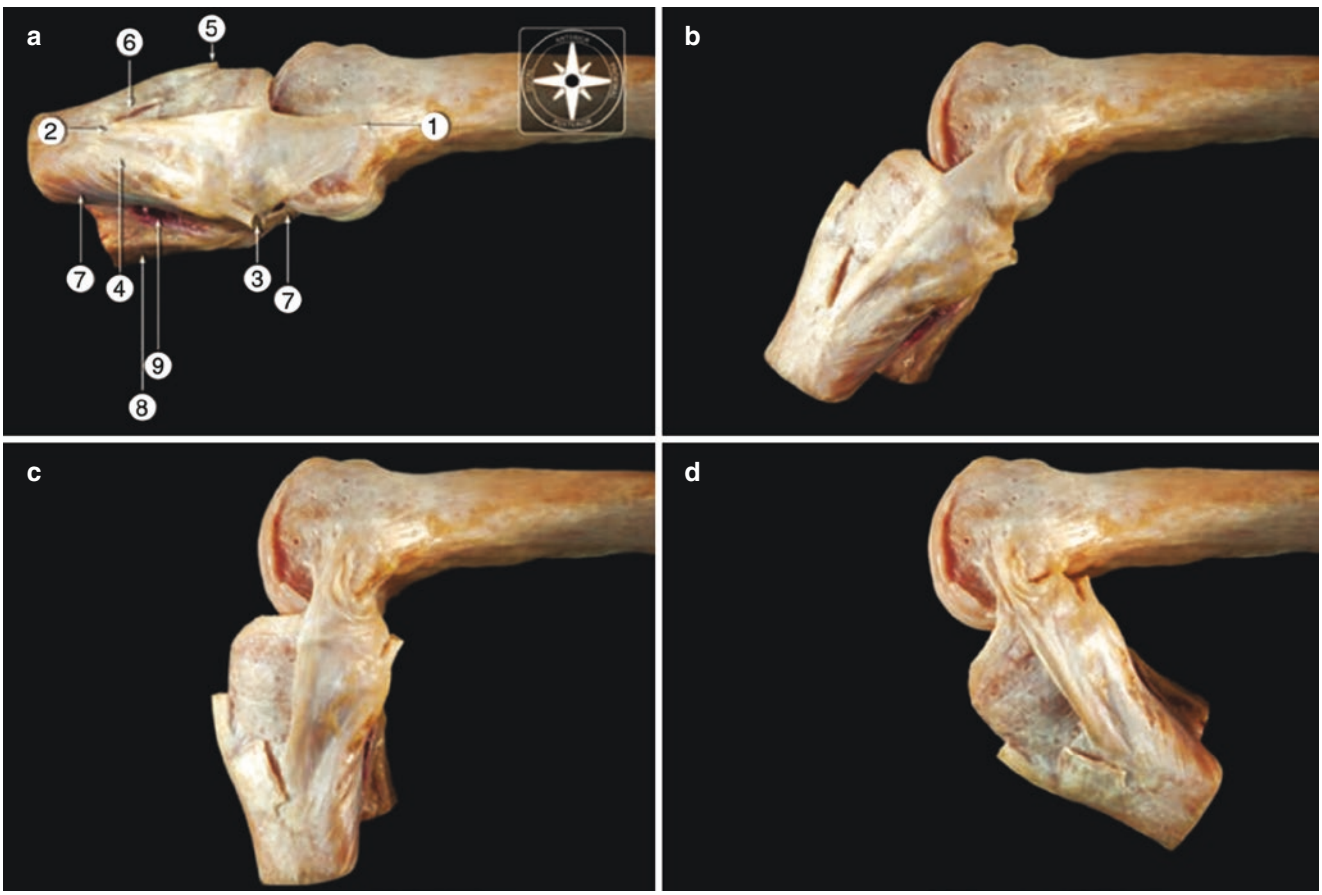

Fig. 2.3 Osteoarticular anatomic dissection of the medial collateral ligament during the range of motion of the knee joint (**a**, extension to **d**, maximal flexion). (1) Medial epicondyle. (2) Tibial insertion of medial collateral ligament. (3) Semimembranosus tendon (cut). (4). Inferior or popliteal expansion of the semimembranosus tendon. (5) Patellar tendon (cut). (6) Pes anserinus (cut). (7) Popliteus muscle. (8) Soleus muscle (cut). (9) Neurovascular bundle (popliteal artery, veins, and tibial nerve). Figure reproduced with permission from: Malagelada F, Vega J, Golanó P. Chapter 91: Knee Anatomy and Biomechanics of the Knee. In Miller MD, Thompson SR (Eds.). De Lee & Drez's Orthopaedic Sports Medicine: Principles and Practice. 4th ed. Elsevier, 2015

The superficial part of the Medial Collateral Ligament (sMCL) is the largest structure over the medial knee. Its proximal insertion is on the femur, in a depression found proximal and posterior to the medial epicondyle and distal to the adductor and gastrocnemius tubercles. As the superficial part of the medial collateral ligament travels distally it presents two different attachments at the tibia. A superior attachment is found on the bone insertion of the anterior part of the semimembranosus tendon, just distal to the joint line. Its inferior attachment is anterior to the posteromedial crest of the tibia and runs deeply to the pes anserinus tendons attachments. Between these two tibial attachments of the superficial medial collateral ligament the inferior medial genicular artery and vein along with their nerve branch from the tibial nerve can be found. The proximal division of the sMCL serves as the primary static stabilizer to valgus stress and rotational forces. The distal division of the sMCL stabilizes the knee against rotational forces specially with the knee in flexion [3, 4].

The deep part of the medial collateral ligament (dMCL) is considered as a thickening of the medial joint capsule. The anterior rim runs parallel to the superficial medial collateral ligament. The posterior rim is inseparable from the posterior oblique ligament. The dMCL consists of meniscofemoral and meniscotibial ligament at the middle third of the medial compartment. The dMCL acts as a stabilizer against valgus and internal rotation forces [3, 4].

2.1.1.3 The Posterior Third

The medial posterior knee includes the following structures: the posterior oblique ligament, the semimembranosus tendon, the adductor magnus tendon, and the medial gastrocnemius tendon.

The posterior oblique ligament (POL): the POL was considered part of the superficial medial collateral ligament, but it is considered to be an independent structure. The POL is a primary restraint to internal rotation and is a secondary restraint to valgus translation and external rotation of the knee specially with the knee in extension. It is attached at the femur proximal and posterior to the insertion of the superficial medial collateral ligament and just anterior to the gastrocnemius tubercle. As it runs distally it has three arms: the superficial, central, and capsular arms. The superficial arm coursed parallel to the anterior arm of the semimembranosus muscle. The central arm is the thickest arm of the POL and it is distally inserted direct to the medial meniscus, the meniscotibial ligament and the deep medial collateral ligament, and the posteromedial side of the tibia. The capsular arm is attached to soft tissue, the medial gastrocnemius tendon and the adductor magnus tendon femoral attachment.

Semimembranosus tendon: The main tendon of the semimembranosus muscle is divided in two arms in its tibial course, the anterior and the direct arms. The anterior arm attaches to the tibia deeply and distally to the proximal attachment of the proximal sMCL. The direct arm attaches posterior to the medial tibial crest at an osseous prominence, the *tuberculum tendinis*, and distally to the joint line. Before its final attachment the direct arm attached to the posterior aspect of the coronary ligament and the posterior horn of the medial meniscus (Fig. 2.4).

Adductor magnus tendon: it is inserted on the femur just proximal and posterior to the adductor tubercle. The distal aspect of the adductor magnus tendon is attached to the gastrocnemius tendon and the capsular arm of the posterior oblique ligament and the posterior capsule.

The medial gastrocnemius tendon: it is attached onto the femur, just proximal and posterior to the gastrocnemius tubercle. The tendon has fascial attachments to the adductor magnus tendon and the capsular arm of the posterior oblique ligament and capsule [3, 4].

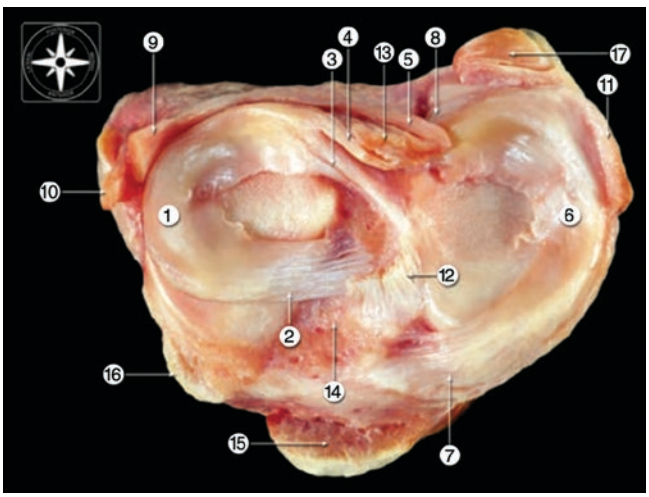

Fig. 2.4 Osteoarticular dissection showing the morphology and relationship of the proximal epiphysis of the tibia in a superior view. (1) Lateral meniscus. (2) Anterior horn of the lateral meniscus. (3) Posterior horn of the lateral meniscus. (4) Anterior meniscofemoral ligament. (5) Posterior meniscofemoral ligament. (6) Medial meniscus. (7) Anterior horn of the medial meniscus. (8) Posterior horn of the medial meniscus. (9) Popliteus tendon (cut). (10) Lateral collateral ligament (cut). (11) Medial collateral ligament (cut). (12) Tibial footprint of the anterior cruciate ligament. (13) Posterior cruciate ligament (cut). (14) Anterior intercondylar area. (15) Patellar tendon (cut). (16) Iliotibial tract insertion in the anterior tubercle or Gerdy's tubercle (cut). (17) Semimembranosus tendon (cut). Figure reproduced with permission from: Malagelada F, Vega J, Golanó P. Chapter 91: Knee Anatomy and Biomechanics of the Knee. In Miller MD, Thompson SR (Eds.). De Lee & Drez's Orthopaedic Sports Medicine: Principles and Practice. 4th ed. Elsevier, 2015

2.1.2 The Lateral Compartment

The lateral compartment of the knee consists of the lateral femoral condyle, the lateral tibial plateau, the lateral meniscus, and the lateral part of the capsule and its ligaments (Fig. 2.5).

2.1.2.1 The Anterior Third

At the anterior third of the lateral compartment of the knee the following structures are present: the lateral patellofemoral retinaculum, the iliotibial tract, and the anterolateral ligament.

The lateral patellofemoral retinaculum consists of a condensation of tissue that braces the patella from its lateral side. This tissue comes from the deep fascia, the vastus lateralis aponeurosis, and the iliotibial tract.

The Iliotibial tract is a broad fascial structure that originates at the anterolateral external crest and inserts at the Gerdy's tubercle. It has an anterior extension to the patella that is called the iliopatellar band or the superficial oblique retinaculum of the patella. The deep layer of the iliotibial tract that attaches to the distal femur is known as Kaplan fibers. It also has attachment to the lateral head of the gastrocnemius and the biceps femoris tendon. Due to its attachments, the iliotibial tract acts as a lateral femorotibial collateral ligament.

The anterolateral ligament (ALL) has been previously known as the mid-third lateral capsular ligament or the capsule-osseus latter of the iliotibial tract. The ligament originates from the prominence of the lateral femoral epicondyle and runs distally to the proximal tibia between Gerdy's tubercle and the fibular head. During it course it also attaches to the lateral meniscus. The anterolateral ligament provides rotary stability and the distal avulsion, have been its fracture correlated with the Segond Fracture characteristic of the anterior cruciate ligament injuries [5, 6]. The ALL reconstruction associated with ACL reconstruction surgery could be performed in patients with complete ACL tears with major rotational instability.

2.1.2.2 The Posterolateral Corner of the Knee

The following structures are located in this area: the fibular collateral ligament, the popliteal tendon, the popliteofibular ligament, the biceps femoris tendon, the lateral gastrocne-

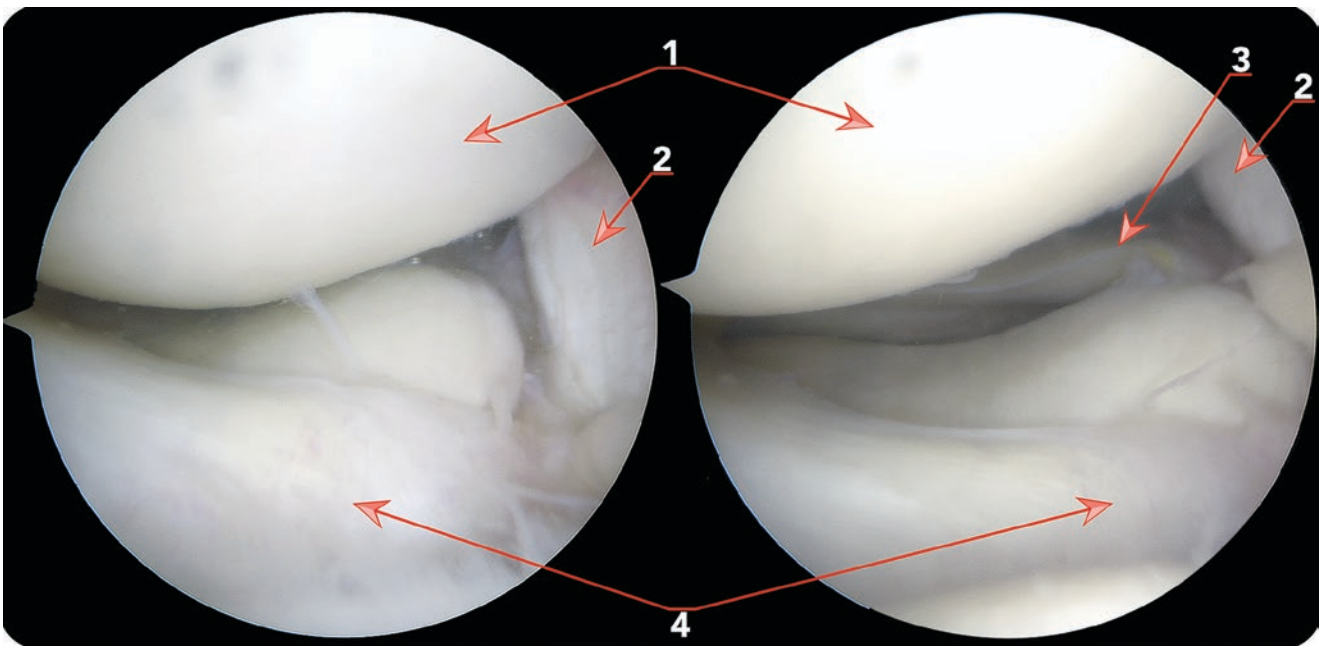

Fig. 2.5 Arthroscopic view of the lateral compartment of the knee. (1) Lateral femoral condyle. (2) ACL. (3) Posterior horn of the lateral meniscus. (4) Anterior horn of the lateral meniscus

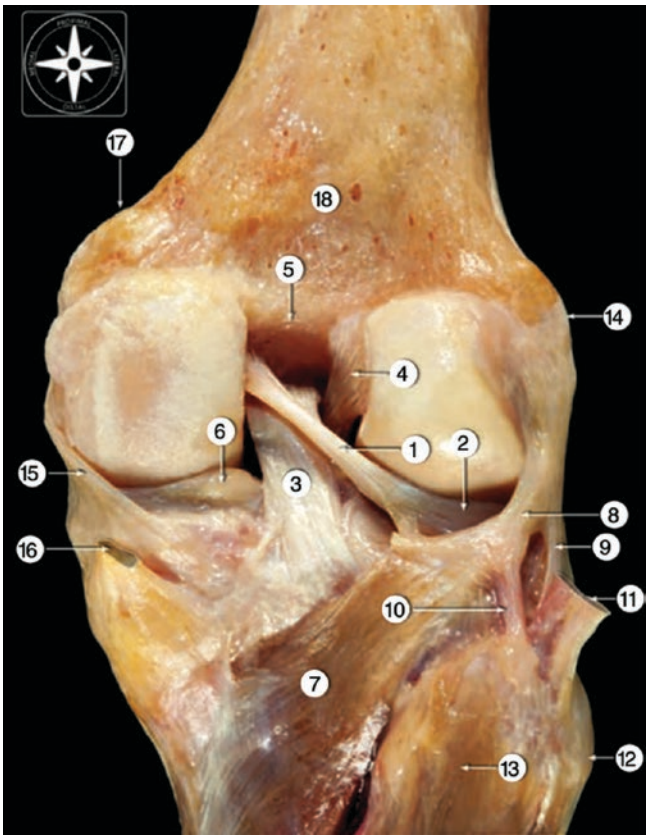

Fig. 2.6 Osteoarticular dissection showing the posterior structures of the knee joint after removing the joint capsule. (1) Posterior meniscofemoral ligament or the ligament of Wrisberg. (2) Lateral meniscus. (3) Posterior cruciate ligament. (4) Femoral insertion of the anterior cruciate ligament. (5) Intercondylar notch. (6) Medial meniscus. (7) Popliteus muscle. (8) Popliteus tendon. (9) Lateral collateral ligament. (10) Popliteus capsular extension. (11) Biceps femoris tendon (cut). (12) Head of the fibula. (13) Soleus fibular insertion muscle. (14) Lateral epicondyle. (15) Medial collateral ligament. (16) Semimembranosus (cut). (17) Adductor tubercle. (18) Popliteal surface. Figure reproduced with permission from: Malagelada F, Vega J, Golanó P. Chapter 91: Knee Anatomy and Biomechanics of the Knee. In Miller MD, Thompson SR (Eds.). De Lee & Drez's Orthopaedic Sports Medicine: Principles and Practice. fourth ed. Elsevier, 2015

mius tendon, the fabello-fibular ligament, the arcuate popliteal ligament, and the proximal tibiofibular joint ligaments (Fig. 2.6).

The fibular collateral ligament is the primary restraint to varus instability in the knee. It is attached to the femur 1.4 mm proximal and 3.1 mm posterior to the lateral epicondyle in a small bony depression and 18.5 mm proximal and posterior to the popliteal tendon attachment. It runs distally to the anterior and lateral aspect of the fibular head and attaches in a small depression 8 mm posterior to the anterior margin of the fibular head and 28.4 mm distal to the apex of the fibular styloid.

Popliteus muscle tendon: it is attached just posterior to the limit of the cartilage of the femoral condyle at the anterior end of the popliteal sulcus. The tendon runs obliquely in posterior and inferior direction, passes the popliteal hiatus, and attaches at the posterior aspect of the tibia. The tendon is attached to the lateral meniscus at the popliteal hiatus with three popliteomeniscal fascicles. It can be explored arthroscopically as it is an intraarticular structure. The popliteus tendon is loose in extension and tight in flexion, it is a stabilizer against varus and rotational stresses during flexion. With its attachment to the lateral meniscus helps to keep it in place as the knee flexes.

Popliteofibular ligament: it is attached to the popliteus musculotendinous junction and runs distally to the tip of the fibular head. It is a primary stabilizer during external rotation specially around 60° of flexion [6, 7].

Biceps femoris muscle has two heads. The long head originates from the ischial tuberosity and runs through the posterior and lateral aspect of the thigh. It is attached lateral to the fibular apex at the fibular head. The short head of the biceps femoris muscle originates medial to the linea aspera on the distal femur and it is attached distally to the long head of the biceps femoris, the joint capsule, and the iliotibial tract. There is an anterior arm that attaches posterior to Gerdy's tubercle.

Lateral gastrocnemius tendon: the tendon is attached 13.8 mm posterior to the insertion of the fibular collateral ligament. It has also fibers attached to the fabella and the supracondylar process. It is connected to the meniscofemoral joint capsule. The muscle belly runs superficial to the popliteus muscle.

Fabello-fibular ligament: the fabella is a sesamoid bone or cartilage located at the head of the lateral gastrocnemius muscle. This structure is presented in most but not all people. The fabello-fibular ligament is attached at the fabella and runs distally to the tip of the fibula.

The arcuate popliteal ligament is a classic dissection that involves an Y-shape extraarticular structure that connects the fibular head to the popliteus tendon and the posterolateral joint capsule and fabella. It corresponds to the popliteofibular ligament, fabello-fibular ligament, popliteo meniscal fascicles, and the capsular arm of the short head of the biceps femoris.

Proximal tibiofibular joint ligaments: the anterior and posterior ligaments connect the medial side of the head of the fibula to the lateral sides of the lateral condyle of the tibia [6, 7].

2.1.3 The Posterior Knee

The posterior knee includes two major structures: the posterior semimembranosus complex and the posterior popliteus complex. These major complexes have been already described in this chapter. These complexes are connected by the oblique popliteal ligament (OPL). The OPL is a structure that originates together with the tendon of the semimembranosus muscle. It arises in the semimembranosus tendon proximal to the tibial plateau, runs superolaterally, and then is attached to the fabella or to the tendon of the lateral head of the gastrocnemius and blended with the posterolateral joint capsule. However, it has a broad anatomical variability. It is the primary ligamentous restrain to knee hyperextension [8–11].

2.1.4 The Menisci

Menisci play an important role in the distribution of loads, shock absorption, joint stability, and lubrication of joint surfaces (Fig. 2.4). Arthroscopic surgery for the treatment of meniscal injuries is one of the most common orthopedic procedures worldwide. The operative treatment for meniscal injuries is continuously evolving as a result of the better understanding of its anatomy, histology, and function. Nowadays the meniscal preservation surgery is emerging in front of the classic meniscectomy procedures. Specific arthroscopic techniques for different locations and patterns of meniscal tears are developed. The meniscal allograft transplantation is also an option for those young patients with, apart from the meniscus, a healthy knee who have lost meniscal tissue.

2.1.5 The Medial Menisci

The medial meniscus is C-shaped. It has a wedge section with the free edge facing to the joint and the rim attached to the capsule. Its radius of curvature varies so it is larger anteroposterior than mediolateral. The meniscus is narrower anteriorly than posteriorly. The anterior horn is attached to the tibial plateau at the intercondylar fossae anteriorly to the ACL insertion. Berlet et al. have described four different insertion patterns for the anterior horn of the medial meniscus [12]. The anterior horns of the lateral and medial meniscus are connected by the transverse ligament of the knee. The medial meniscus is attached to the joint capsule along the entire periphery. The inferior or tibial portion of this peripheric capsular attachment is the coronary ligament. At the region of the tibial collateral ligament, a superior (femoral) attachment is present, the medial meniscus is firmly attached to the femur and tibia through a robust thickening in the capsule, the deep tibial collateral ligament. The POL and the semimembranosus complex have insertions at the posterior horn of the medial meniscus. These attachments explain the generation of some special meniscal tears at the posterior horn of the medial meniscus in knees affected by rotational instability. The posterior root is attached to the tibia at the intercondylar fossae between the posterior cruciate ligament and the posterior horn of the lateral meniscus insertion [13].

2.1.6 The Lateral Menisci

The lateral meniscus covers a wider area of the plateau of the lateral tibial condyle. Its radius of curvature is constant resulting in an O-shaped structure. The anterior horn is attached anterior to the intercondylar eminence, just posterior and lateral to the ACL insertion. The anterior and posterior horns of the lateral meniscus are inserted close to each other, both are visible during the ACL reconstruction surgery and can be used as a reference for ACL tibial positioning [14].

The lateral meniscus has fewer attachment to the periphery than the medial meniscus. It is only attached to the capsule through the coronary ligament, which is absent at the area of the hiatus popliteus, so the lateral meniscus is more mobile than the medial one.

The posterior root of the lateral meniscus is attached posterior to the lateral tibial eminence at the intercondylar notch and just posterior to the insertion of the anterior horn. The anterior fibers of the posterior root of the lateral meniscus extend to the lateral aspect of the medial femoral condyle, forming the anterior meniscofemoral ligament (ligament of Humphrey) which can be found in 50% of the population. The posterior fibers of the posterior root of the lateral menis-

cus can cross the PCL posteriorly and attach to the intercondylar fossa of the medial femoral condyle, forming the posterior meniscofemoral ligament (ligament of Wrisberg) which can be found in 75% of the population.

2.1.7 The Central Pivot

The central pivot includes the cruciate ligaments, which are the central stabilizers of the knee joint. They are the anterior cruciate ligament of the knee (ACL) and the posterior cruciate ligament of the knee (PCL).

The anterior cruciate ligament of the knee (ACL) is the most surgically reconstructed ligament of the body [15]. The ACL is inserted anteromedially onto the anterior intercondylar area of the tibia in front of the medial tibial spine, between the anterior roots of the lateral and medial meniscus. It ascends through the intercondylar fossa to insert at the posteromedial aspect of the lateral femoral condyle.

The ACL is divided into two different bundles, the anteromedial bundle (AM) and the posterolateral bundle (PL) according to their insertion on the tibia. In full extension, both bundles run parallel being the AM bundle relaxed while the PL bundle is tightened. During the knee flexion the bundles wrapped together, the AM becomes tight while the PL bundle is relaxed [16].

The ACL stabilizes the tibia when it is anteriorly displaced relative to the femur. The posteromedial angle, the semimembranosus complex, and the anterolateral ligament also act as anterior translation stabilizers. Due to its orientation, it is also a powerful restraint against internal rotation forces.

The ACL has poor healing capacity, so the techniques for ACL repair are limited. Therefore, most of the ACL procedures consist of autograft ligament reconstruction using hamstring tendons, bone-patellar tendon bone, or quadricipital tendon.

The posterior cruciate ligament (PCL) is inserted on the lateral side of the medial femoral condyle and runs to the posterior intercondylar area of the tibia. It also has two bundles, the anterolateral and posteromedial. Posteromedial fibers are tighten during extension and thus limit hyperextension. The anterolateral bundle is also tight during semi and full flexion. Due to its fiber orientation, the PCL mostly prevents posterior displacement of the tibia when the knee is flexed.

2.1.8 The Patellofemoral Compartment

The patella is the largest sesamoid bone of the body. The articular surface of the patella is divided into two surfaces by a median ridge. The lateral surface is longer and more sloped than the medial articular surface. The Wiberg classification of patella size includes four different types based on the location of the median ridge.

The quadriceps tendon is inserted at the base of the patella. This tendon is formed by the confluence of four muscle bellies, the rectus femoris, the vastus medialis, the vastus lateralis, and the vastus intermedius. An intraarticular space extends from the tip of the patella to the quadriceps tendon, along the front side of the femur, the suprapatellar recess.

The medial patellofemoral ligament, which runs from the femoral medial epicondyle, is inserted on the proximal two thirds of the medial edge of the patella. The distal part of the vastus medialis obliquus is overlaid the proximal side of the MPFL. From the inferior border of the medial patellar edge, the medial patellomeniscal ligament connects the patella to the anterior horn of the medial meniscus.

On the lateral side of the patella, the lateral patellofemoral retinaculum is identified. It is frequently divided into a superficial and deep layer. The superficial layer is composed of the oblique lateral retinaculum. The deep layer is composed of oblique fibers running distally (the patellotibial band) and transverse fibers to the lateral epicondyle and Iliotibial tract (the epicondylopatellar band).

The patellar tendon is inserted onto the vertex of the patella. It courses distally to the tibial tubercle. The infrapatellar fat separates the posterior side of the patellar tendon from the synovial membrane of the joint, and distally a bursa separates the tendon from the tibia [17–19].

2.1.9 The Neurovascular Structures of the Knee

Saphenous nerve (SN): it is a sensory nerve, being the longest cutaneous branch of the femoral nerve. It descends along with femoral vessels and crosses the adductor canal anterolateral to the femoral artery. After piercing the anteromedial septum along with the saphenous branch of descendent genicular artery, it passes through the fascia between the sartorius and the gracilis muscles and gives rise to the infrapatellar branch. It runs anteriorly on the medial side of the capsule and carries the sensitivity of the anterior and medial knee. The saphenous nerve continues travelling distally and provides sensitivity to the skin of the medial side of the leg and the dorsomedial ankle and midfoot.

The SN is particularly vulnerable during arthroscopic surgical procedures. It is at risk in meniscal repair procedures, when the posteromedial portal is established, or the meniscal

repair needles are passed for the medial meniscus repair. It can also be damaged during the hamstring harvest as for ACL reconstruction [20]. The saphenous nerve injury is the most frequent neurovascular complication in knee arthroscopy procedures [21].

The sciatic nerve is divided at the superior edge of the popliteal fossae into the tibial nerve and the common peroneal nerve. The tibial nerve passes between the two heads of the gastrocnemius muscle, crosses the tendinous arch of the soleus muscle, and lies in the deep posterior compartment of the lower leg. In the popliteal fossa, it receives sensitive branches: the medial sural cutaneous nerve and the genicular posterior articular branch, and gives motor branches to the popliteus, plantar, and gastrocnemius muscles.

The common peroneal nerve runs distally along with the biceps femoris muscle. Then, it, passes medial to the head of the fibula, and courses laterally then anteriorly around the neck of the fibula. The common peroneal nerve is at risk during lateral meniscus repair surgery. The use of a posterior incision and a deflecting retractor is the most important factor in avoiding neurovascular injury during meniscal repair. The common peroneal nerve is also at risk when posterolateral corner ligament reconstruction procedures are performed.

The femoral artery travels anterodistally through the adductor canal, crosses the adductor hiatus, and enters to the popliteal fossa to become the popliteal artery. The genicular arteries arise from it and supply the structures around the knee. In the adductor canal, the femoral artery gives the descending genicular artery (supreme genicular artery) which divides into an articular branch (and also a saphenous branch) to supply the superior and anterior regions of the knee.

From the popliteal artery the medial and lateral superior genicular arteries branch off, running anteriorly and supplying the patella. There is also a small artery, the medial superior genicular artery, that pierces the capsule and supplies the cruciate ligaments and posterior structures. It may emerge from the popliteal superior or inferior genicular arteries (Int. J. Morphol. vol.35 no.3 Temuco set. 2017 https://doi.org/10.4067/S0717-95022017000300019). At the joint line, the lateral and medial inferior genicular emerge. At the lower end of the popliteal fossa, the popliteal artery passes between the two heads of the gastrocnemius muscle and gives rise to two muscular branches to each head. After crossing the tendinous arch of the soleus muscle, it branches into the anterior and posterior tibial arteries. Major vascular complications involving the popliteal artery are very uncommon during knee arthroscopy. Probably the most common vascular injury during knee arthroscopy is the damage of the lateral inferior genicular artery when an anterolateral portal is performed [22].

2.2 Arthroscopy Portals

The anterolateral and the anteromedial portals are the main portals used for routine knee arthroscopic procedures.

The anterolateral portal is the standard viewing portal. It is placed on a soft spot located on a triangle bounded by the lateral border of the patellar tendon, the lateral femoral condyle, and the anterolateral rim of the tibia plateau. The patellar distal apex is the key landmark to determine the height of the portal. The anterolateral portal is performed slightly distal to the vertex of the patella.

The anteromedial portal is the main working and instrumentation portal. It is performed under direct arthroscopic visualization with the camera placed through the anterolateral portal. The entry point should be close to the patellar tendon on the medial soft spot.

In addition, several accessory portals may be used depending on the specific surgical procedure requirements.

The superomedial and superolateral portals give good access to the suprapatellar recess with the knee in extension and are located, medial and lateral, respectively, at the height of the proximal patellar vertex. Both can be used for irrigation or aspiration and during surgical procedures involving the patellofemoral compartment.

The accessory medial portal is more medial and inferior to the standard medial portal and is used in meniscal repair and ACL repair.

The accessory lateral portal is more lateral and inferior to the standard portal and could be useful as a visualization portal or for certain meniscal repair procedures.

The posterior portals are used for posterior horn repair and posterior cruciate ligament reconstruction. Making the posterior portals could be challenging because of the proximity of the neurovascular structures, not just the popliteal artery but the common peroneal nerve at the lateral side and the saphenous nerve at the medial side. The knee should be flexed over 90° so the posterior structures relax and move backwards. The portals are made under direct visualization with the arthroscope placed on an anterior portal.

The posteromedial portal is located 1 cm above the joint line posterior to the tibial collateral ligament. The posterolateral portal is made 1 cm above the joint line between the peroneal collateral ligament and the biceps femoris tendon.

Finally, the transpatellar tendon portal is located 1 cm distal to the patella splitting the tendon longitudinally. It can be helpful during some complex meniscal surgeries and for reduction of tibial spine fractures but can led to side effects as anterior knee pain due to tendon scarring [23].

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