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The Posterolateral Aspect of the Knee

Anatomy and Surgical Approach*

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ABSTRACT

Thirty cadaveric knees were dissected to obtain a detailed understanding of the anatomic structures of the posterolateral aspect of the knee, and a dependable surgical approach to evaluate injuries to these structures was developed and used on 71 consecutive patients who were operated on for posterolateral knee injuries. Three fascial incisions and one lateral midcapsular incision were used to provide surgical access. The following individual anatomic structures were identified: the layers of the iliotibial tract, long and short heads of the biceps femoris muscle, fibular collateral ligament, midthird lateral capsular ligament, fabellofibular ligament, posterior arcuate ligament, popliteus muscle complex, lateral coronary ligament, and posterior capsule. This study increased our understanding of the individual anatomic structures and the relationships between these components. The surgical approach provided for the evaluation of these anatomic structures should aid the surgeon in properly assessing the injuries before surgical repair. This information should also stimulate more anatomic, biomechanical, and clinical studies of the posterolateral aspect of the knee.

The anatomy of the posterolateral aspect of the knee is a complex arrangement of static and dynamic stabilizing structures. In an attempt to simplify this complexity, Seebacher et al.[23] defined three anatomic layers of this portion of the knee. With this three-layer approach, however, it is difficult to discern the interrelatedness of the individual anatomic components. It is also difficult to discern the best surgical access to these structures. In a review of the literature, we found no report of a detailed surgical approach that was helpful for identifying injured posterolateral structures. Our purpose, therefore, was to describe the anatomy and the relationships of the anatomic components of the posterolateral aspect of the knee and to describe a surgical approach that allows access for evaluating injuries to these structures.

MATERIALS AND METHODS

Anatomic Study

Thirty fresh-frozen cadaveric knees were dissected to obtain a detailed understanding of the posterolateral anatomy of the knee. The approach for the dissections was similar to a surgical approach. The specimens were photographed, and the anatomic components were identified and recorded on specially designed knee forms. Radiographs were obtained for 25 of the 30 knees to determine the presence or absence of a fabella.

Surgical Approach

Our clinical population comprised 71 consecutive patients who were operated on for posterolateral knee injuries. With the patient supine and the knee flexed 60° to 70°, a lateral curved incision was centered distally between Gerdy's tubercle on the tibia and the anterior aspect of the fibular head. The incision crossed the lateral epicondyle at its proximal boundary and was extended parallel to the femur to provide surgical access. The skin and subcutaneous tissues were reflected from the fascia as a posteriorly based flap. After the skin flap was reflected, it was possible to view the entire superficial fascia from the iliotibial tract to the biceps femoris muscle. Three fascial incisions and one capsular incision were then used to evaluate the deeper structures.

The first fascial incision was oriented parallel to the fibers of the iliotibial tract (Fig. 1). It originated at the midpoint of Gerdy's tubercle and extended proximally, splitting the proximal portion of the iliotibial tract. The second fascial incision was made in the interval between the posterior aspect of the iliotibial tract and the short

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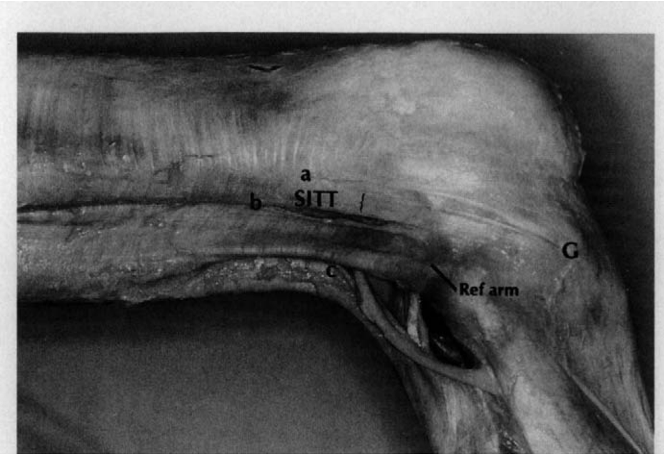

Figure 1. Three fascial incisions (and one lateral capsular incision) were used to evaluate the deeper structures of the knee: a, fascial incision splitting the iliotibial tract; b, fascial incision in the interval between the iliotibial tract and short head of biceps femoris tendon; c, fascial incision posterior to long head of biceps femoris tendon and parallel to peroneal nerve. G, Gerdy's tubercle; SITT, superficial layer of the iliotibial tract; Ref arm, reflected arm.

head of the biceps femoris muscle. This incision was started approximately 6 to 7 cm proximal to the lateral epicondyle. It extended distally, parallel to the femur but posterior to the lateral intermuscular septum. The third fascial incision was made posterior to the long head of the biceps femoris muscle and parallel to the peroneal nerve. Because the peroneal nerve blocked access to the structures posterior and medial to the fibular head, an external neurolysis was required to allow retraction of and to prevent iatrogenic injury to the nerve. After the nerve was retracted, this incision then provided access to the interval between the lateral gastrocnemius tendon and the soleus muscle. Through this interval, the popliteus muscle, the medial and lateral limbs of the arcuate arch, the fabellofibular ligment, and the posterior popliteofibular ligament were evaluated.

In the first incision, posterior retraction of the superficial layer of the iliotibial tract allowed visualization of its deep and capsuloosseous layers[31,32] (Fig. 2), which could then be dissected from the lateral intermuscular septum, thus allowing posterior retraction of the posterior half of the iliotibial tract to expose the more posterior structures of the lateral side. A lateral capsular incision was also made through the midthird lateral capsular ligament when arthroscopy was not performed or to supplement arthroscopic evaluation. This more vertical incision was made with the knee in approximately 60° of flexion. It was oriented anterior and parallel to the fibular collateral ligament and began at the anterior edge of the fibular head (Fig. 3). This allowed evaluation of the midthird capsular ligment, the popliteal attachments, and the lateral meniscus.

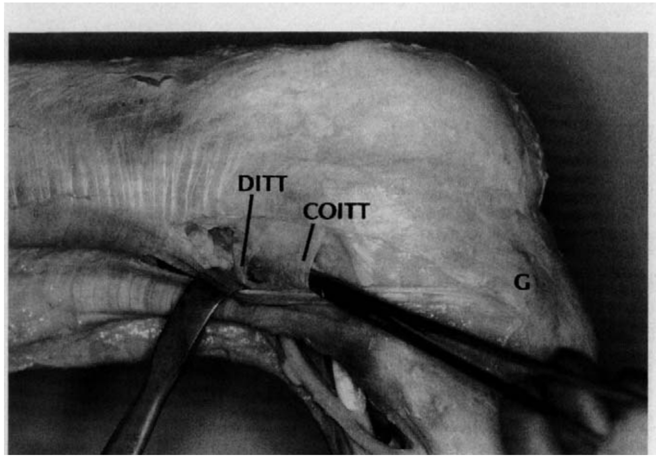

Figure 2. Retraction of the superficial layer of the iliotibial tract reveals the deep (DITT) and capsuloosseous (COITT) layers. G, Gerdy's tubercle.

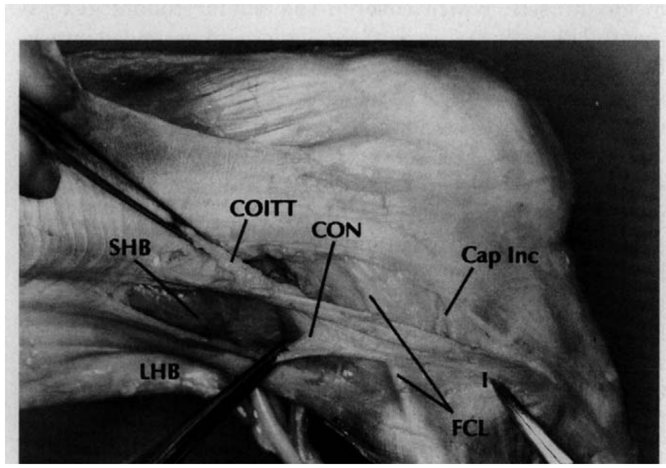

Figure 3. Retraction of the superficial layers of the iliotibial tract reveals the capsuloosseous layer (COITT), short head of biceps tendon (SHB), short head of biceps-capsuloosseous layer confluens (CON), long head of biceps tendon (LHB), fibular collateral ligament (FCL), lateral capsular incision (Cap Inc), and iliotibial tract insertion (I).

RESULTS

Anatomy of Individual Structures

Iliotibial Tract. The superficial layer of the iliotibial tract (SITT in Fig. 1) could be seen when the posteriorly based skin flap was reflected from the fascial layer surrounding the lateral aspect of the knee. Distally, the anterior portion of the superficial layer attached to Gerdy's tubercle (G in Fig. 1). After splitting the iliotibial tract, a deep layer, separate from the superficial layer, could be seen continuing in the coronal plane and attaching to the lateral intermuscular septum of the distal femur (Fig. 2). It began 5 cm proximal to the lateral epicondyle. Deep to these two layers, the capsuloosseous layer of the iliotibial tract began proximally as the lateral investing fascia of the lateral gastrocnemius tendon and the medial investing fascia of the short head of the biceps femoris muscle (COITT in Fig. 2). Distally, the capsuloosseous, deep, and posterior parts of the superficial layers of the tract merged to insert on the lateral tibial tuberosity just posterior and proximal to Gerdy's tubercle[32,33] (I in Fig. 3).

Biceps Femoris Muscle. At the knee, the long head of the biceps femoris muscle divided into two tendinous components—a direct arm and an anterior arm—and three fascial components—a reflected arm, and anterior and lateral aponeurotic expansions (Fig. 4).[31] The direct arm inserted on the posterolateral edge of the fibular head, while the anterior arm attached to the lateral edge of the fibular head, crossing lateral to the fibular collateral ligament. The anterior arm, separated from the anterolateral distal fourth of the fibular collateral ligament by a bursa, terminated as an anterior aponeurosis covering the anterior compartment of the leg. A lateral aponeurosis was formed off the anterior arm of the long head of the biceps muscle, which covered the fibular collateral ligament. The reflected arm of the long head ascended superficially across the distal termination of the short head of the biceps muscle and attached to the posterior edge of the iliotibial tract just proximal to the fibular head.

The short head of the biceps femoris muscle comprised six components (Figs. 4 and 5). Beginning medially, there was a muscular attachment to the tendon of the long head of the biceps muscle proximal to the fibular head. Next, there was a muscular attachment to the posterolateral aspect of the joint capsule, and, just lateral to the "capsular arm," a third muscular attachment formed a confluens with the capsuloosseous layer of the iliotibial tract. Once the short head reached the fibular head, two tendinous components were demonstrated: an anterior arm along the medial aspect of the fibula that passed medial to the fibular collateral ligament and inserted on the posterior aspect of the tibial tuberosity, and a direct arm that inserted onto the superior surface of the fibular head lateral to the tip of the styloid process and medial and posterior to the fibular collateral ligament (Fig. 5). Finally, a lateral aponeurotic expansion off the short head of the biceps muscle attached to the posteromedial aspect of the fibular collateral ligament.

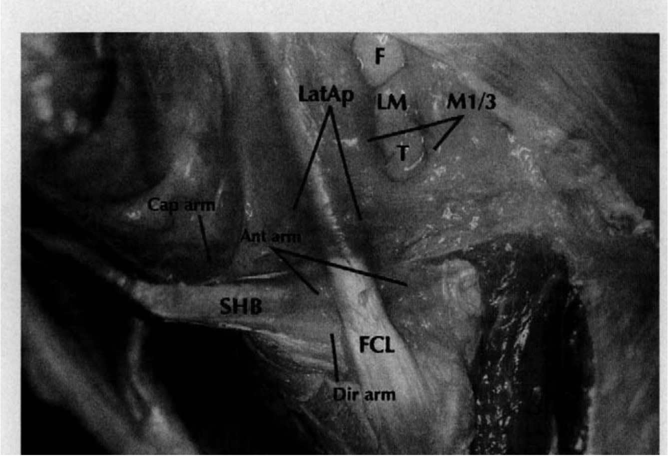

Figure 5. Removal of the long head of the biceps femoris tendon reveals components of the short head of the biceps (SHB): capsular arm (Cap arm), direct arm (Dir arm), anterior arm (Ant arm), and lateral aponeurosis (LatAp). M 1/3, the midthird lateral capsular ligament; F, femur; LM, lateral meniscus; T, tibia; FCL, fibular collateral ligament.

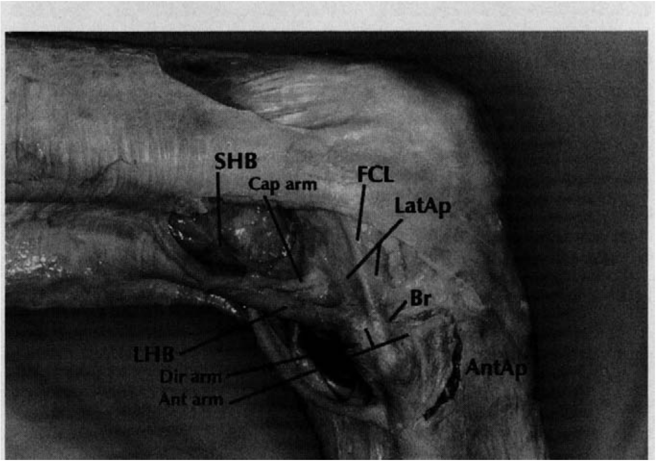

Figure 4. Components of the long head of the biceps femoris tendon (LHB): direct arm (Dir arm), anterior arm (Ant arm), lateral aponeurosis (LatAp), and anterior aponeurosis (AntAp). Components of the short head of the biceps femoris tendon (SHB) visible here include the short head's attachment to the long head's tendon and capsular arm (Cap arm) of the short head. (See Fig. 1 for reflected arm of biceps.) FCL, fibular collateral ligament; Br, bicipital bursa.

Fibular Collateral Ligament. The fibular collateral ligament originated from the femur in a fan-like fashion in the "saddle" formed between the lateral epicondyle and the supracondylar process. As the ligament coursed distally, its more medial fibers inserted into the lateral edge of the fibular head (Fig. 5). The lateral fibers of the ligament then continued distally, medial to the anterior arm of the long head of the biceps muscle, and blended with the superficial fascia of the lateral compartment of the leg. Along its proximal course, the posterior aspect of the fibular collateral ligament was directly connected to the lateral aponeurotic expansions of the short head and covered laterally by the lateral aponeurosis of the long head of the biceps femoris muscle.

Midthird Lateral Capsular Ligament. The midthird lateral capsular ligament originated anterior and proximal to the lateral femoral epicondyle (Fig. 5). It inserted on the tibia just distal to the articular cartilage margin. Its anterior boundary terminated just posterior to Gerdy's tubercle, and its posterior boundary was defined by the anterior edge of the popliteal hiatus.

Fabellofibular Ligament. Among the 30 specimens dissected, we palpated a fabella or a fabella analog of varying sizes in all specimens. Radiographs were taken in 25 of the 30 specimens to determine whether the structure was an osseous, a cartilaginous, or a tendinous thickening. An ossified fabella was seen in five (20%) of the specimens.

From its origin along the lateral edge of the fabella, the fabellofibular ligament descended distally and laterally to attach on the fibular styloid (Fig. 6). If no osseus fabella was present, the ligament's origin was on the posterior aspect of the supracondylar process of the femur, where it blended with the anterior fibers of the lateral gastrocnemius tendon. With the knee in extension, this ligament, near its distal insertion, paralleled the tendon of the long head of the biceps muscle and at the posterolateral joint line was a site of insertion for the capsular arm of the short head of the biceps femoris muscle. It then inserted on the fibular styloid process just posterior to the lateral arm of the arcuate.

Posterior Arcuate Ligament. The arcuate ligament is not a single ligament but actually several structures that combine to form an arched, or arcuate, appearance (Fig. 7). The medial and lateral limbs of this "posterior arcuate ligament" crossed over the popliteus muscle at its junction with the popliteal tendon.

The lateral limb of the arch inserted just anterior to the fabellofibular ligament on the fibular styloid. It diverged from the fabellofibular ligament in its proximal course, arching medially to attach to the posterior capsule of the knee. In the transverse plane, this attachment was just proximal to the popliteal-musculotendinous junction at the level of the superior edge of the posterior horn of the lateral meniscus and in line with the posterosuperior popliteomeniscal fascicle, which was directly anterior to it.

The medial limb of the arcuate arch was formed by the oblique popliteal ligament (ligament of Winslow) (Fig. 7C), which was formed by a coalescence of the oblique popliteal expansion of the semimembranosus and the capsular arm of the posterior oblique ligament originating from the medial side of the knee. These two structures, which merged anterior to the medial head of the gastrocnemius muscle, crossed proximally and laterally from the medial side of the knee to form the ligament of Winslow. It crossed the midpoint of the posterior aspect of the joint at the level of the tibial insertion of the posterior cruciate ligament and then continued at a proximal angle to insert on the inferomedial edge of the fabella. If no fabella was present, it inserted on the posterior capsule overlying the lateral femoral condyle.

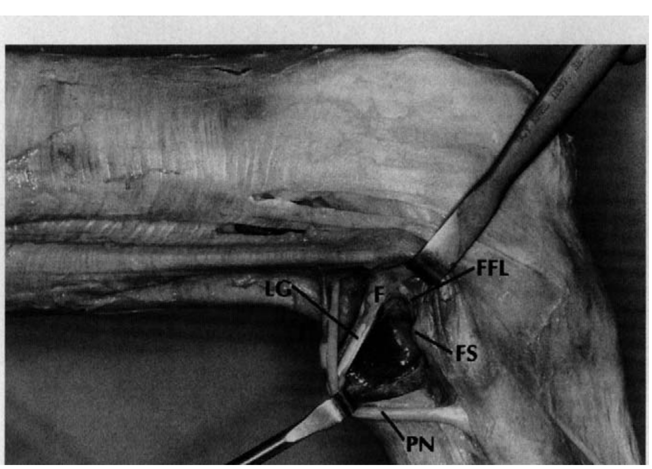

Figure 6. The origin and insertion of the fabellofibular ligament (FFL). F, fabella; FS, fibular styloid; PN, peroneal nerve; LG, lateral gastrocnemius tendon.

Popliteus Muscle Complex (Fig. 7D). With the knee flexed to 45°, the popliteus muscle ascended at a 45° angle from its origin on the posteromedial surface of the proximal tibia posterior to the coronal plane of the tibia. In addition, it angled laterally approximately 45° from the sagittal plane. A transition from the 45° posterior angulation of the muscle to an anterior angulation of 45° toward the coronal plane of the tibia was observed in the tendon of the popliteus muscle. Medial to the popliteal tendon was the muscle's aponeurotic attachment to the posterior capsule. The attachment provided an inferior tie to both the medial limb of the arcuate arch (POPAP in Fig. 7C) and the posterior capsule, as well as a direct connection to the inferior surface of the posterior horn of the lateral meniscus (PIPMF in Fig. 7D). This meniscal attachment is the meniscal aponeurosis described by Last[17] and termed the posteroinferior popliteomeniscal fascicle by Stäubli and Birrer.[26] The direct attachment of the anterior surface of the popliteus muscle to the tibia provided a tibial attachment to substitute for the lack of a coronary ligament attachment to the posterior horn of the lateral meniscus medial to the popliteal tendon. This attachment to the tibia began just lateral to the fovea of the posterior cruciate ligament and extended laterally to the popliteal-musculotendinous junction (Fig. 7D). The most medial part of this attachment also provided a secure fixation of the tibia to both the inferior meniscal surface and the posterior capsule medial to the popliteal tendon.

As the popliteal tendon turned anteriorly to continue to its insertion in the anterior aspect of the popliteal groove of the femur, it produced an attachment to the fibula—the posterior division of the popliteofibular ligament (PFL in Fig. 7D). This attachment was just anterior to the fibular styloid and thus anterior to the two structures originating from the styloid process, the lateral limb of the arcuate and the fabellofibular ligament. The lateral limb of the arcuate and the fabellofibular ligament are separated from the posterior division of the popliteofibular ligament by the inferior lateral geniculate artery. The inferior lateral geniculate artery crossed the popliteus muscle to pass anterior to the two structures originating from the styloid process—the fabellofibular ligament and the lateral limb of the arcuate arch—and posterior to the posterior division of the popliteofibular ligament (Fig. 7, A and B), which inserts on the medial edge of the fibular head just anterior to the styloid process. The point of entry of the artery was just medial to the tip of the styloid process. The artery then continued anteriorly beside the lateral meniscus.

The popliteofibular ligament provided a fibular fixation point for the lateral and inferior quadrant of the popliteal tendon. From the medial superior surface of the tendon, as it penetrated the posterior capsule, a meniscal attachment was formed—the posterosuperior popliteomeniscal fascicle (Fig. 8). This point was marked externally (posteriorly) by the insertion of the lateral limb of the arcuate's attachment to the posterior capsule. Thus, the posterosuperior

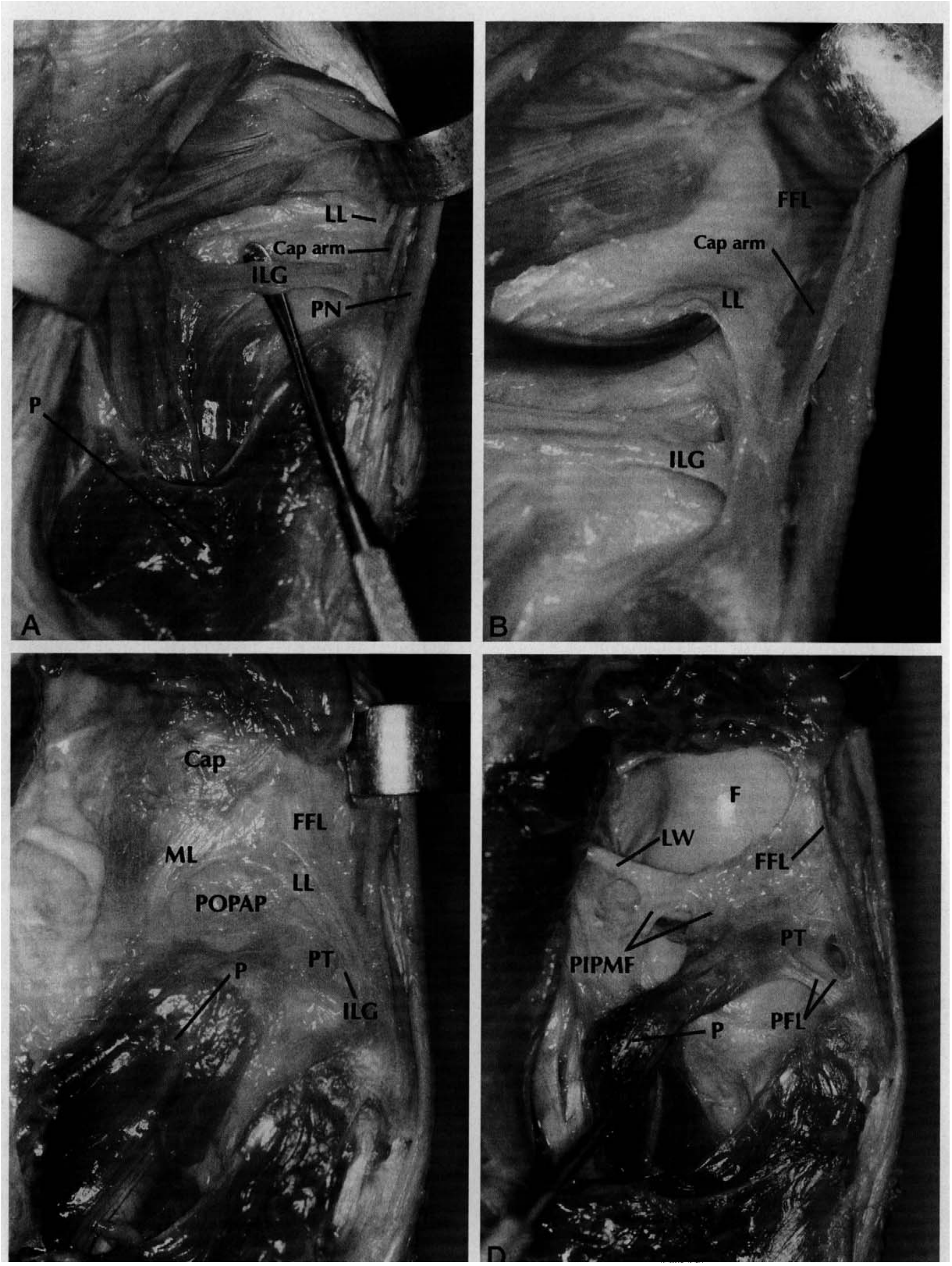

Figure 7. Posterior view of lateral structures. A: inferior lateral geniculate artery (ILG), lateral limb of the arcuate (LL), capsular arm of biceps (Cap arm), peroneal nerve (PN), popliteus muscle (P). B: capsular arm of short head (Cap arm), fabellofibular ligament (FFL), lateral limb of arcuate (LL), inferior lateral geniculate artery (ILG). C: posterior capsule (Cap), fabellofibular ligament (FFL), medial limb of arcuate (ML), lateral limb of arcuate (LL), popliteus muscle (P), popliteal tendon (PT), popliteal aponeurosis (POPAP). D: femur (F), ligament of Wrisberg (LW), fabellofibular ligament (FFL), posterior inferior popliteomeniscal fascicle (PIPMF), popliteus muscle (P), popliteal tendon (PT), popliteofibular ligament (PFL).

Figure 8. Attachments of the popliteus muscle to the femur (F) and lateral meniscus (LM). PT, popliteal tendon; posterosuperior popliteomeniscal fascicle (PSPMF); anteroinferior popliteomeniscal fascicle (AIPMF); PH, popliteal hiatus; CL, coronary ligament.

popliteomeniscal fascicle was formed off the popliteal tendon, and the posteroinferior popliteomeniscal fascicle was formed from the popliteus muscle aponeurosis medial to the tendon. The ligament of Wrisberg, identified in all but one specimen, inserted between these two posterior popliteomeniscal attachments and provided a firm attachment to the medial femoral condyle for the posterior horn of the lateral meniscus (LW in Fig. 7D).

The anterior division of the popliteofibular ligament inserted just anterior to the posterior division and medial to the fibular collateral ligament. These two divisions formed an inverted "Y," providing a firm connection between the fibula and the popliteal tendon, which continued to its femoral insertion site in the popliteal fossa. These complex relationships of the popliteofibular ligament, the popliteus muscle and its popliteomeniscal fascicles, and the ligament of Wrisberg provide the lateral meniscus with attachments that extend from the medial femoral condyle to the fibula (Fig. 7).

The final division of the popliteal tendon, the anteroinferior popliteomeniscal fascicle (AIPMF in Fig. 8), arose along the anterior edge of the popliteal tendon, forming the anterior boundary of the popliteal hiatus.

Lateral Coronary Ligament. The medial boundary of the popliteal hiatus (PH in Fig. 8) was formed by the coronary ligament connecting the lateral meniscus to the tibia. The lateral coronary ligament (Fig. 8) provided a tibial attachment to the inferolateral surface of the lateral meniscus, from the anterior margin of the popliteal hiatus to the lateral aspect of the posteroinferior popliteomeniscal fascicle. Medial to the popliteal tendon, the posteroinferior popliteomeniscal fascicle provided a posterior tibial attachment for the lateral meniscus. Anterior to the popliteal hiatus, the lateral tibial attachment for the lateral meniscus was provided by the meniscotibial portion of the midthird capsular ligament.

Posterior Capsule. Proximally, the posterior capsule was attached to the femur, proximal to the articular margin of the lateral femoral condyle (Cap in Fig. 7C). It was covered from medial to lateral by the muscular origins of the plantaris and the lateral gastrocnemius and by the lateral gastrocnemius tendon. Distally, its attachment was more complex. It had a firm tibial attachment just lateral to the fovea of the posterior cruciate ligament. Lateral to that attachment, the popliteus muscle and its posterior aponeurosis provided a tibial attachment. Finally, its lateral distal corner was stabilized to the fibular styloid by the lateral limb of the arcuate and the fabellofibular ligament. Because the musculotendinous junction of the popliteus muscle blends with the posterior capsule, the posterior division of the popliteofibular ligament tethers the lateral distal posterior capsule to the fibula. If an osseous fabella was present, the posterior capsule was reinforced laterally and proximally by the tendon of the lateral gastrocnemius muscle, and the proximal extent of the fabellofibular ligament was less substantial. Medial to the popliteal tendon, the proximal posterior capsule was covered by the lateral gastrocnemius tendon and the muscular portions of the lateral gastrocnemius muscle and the plantaris muscle from lateral to medial. If an osseous fabella was not present, the tendon of the lateral gastrocnemius muscle provided the proximal posterolateral capsular attachment and the proximal extent of the fabellofibular ligament was less substantial.

Surgical Correlation to Posterolateral Anatomy

In the acutely injured knee, surgical access through the injured structures is best; however, an understanding of the anatomic relationships is necessary before this can be done safely. It is rarely necessary to use all of the incisions in the same knee. However, the shorter, deeper structures are under the greatest strain with marked joint displacement. Thus, deeper access for injury assessment and repair requires an understanding of these complex anatomic relationships. Also, combined injuries of the lateral, fibular attaching, and posterior structures are common in the same injury.

The initial fascial incision, which split the iliotibial tract, allowed evaluation of the deep and capsuloosseous layers of the iliotibial tract, the anterior arms and lateral aponeuroses of the long and short heads of the biceps femoris muscle, the midthird lateral capsular ligament, and the fibular collateral ligament. The deep and capsuloosseus layers of the iliotibial tract could then be dissected from the posterior aspect of the lateral intermuscular septum and lateral gastrocnemius tendon, respectively, to allow evaluation of the meniscofemoral portion of the posterior capsule and the capsular arm of the short head of the biceps femoris muscle, which was seen medial to the biceps-capsuloosseous-iliotibial confluens. Because a branch of the inferior lateral geniculate artery is transected in this dissection, the surgeon must coagulate this potential source of postoperative hematoma. A midlateral capsular incision can also be used to evaluate the deeper lateral structures further.

The lateral capsular incision permitted assessment of the meniscofemoral and meniscotibial portions of the midthird lateral capsular ligament, the popliteal tendon insertion on the femur, the lateral meniscus, and the intracapsular components of the popliteal hiatus—the lateral coronary ligament, the anterior popliteofibular ligament division, and the anteroinferior and posterosuperior popliteomeniscal fascicles. This capsular incision transects the inferior lateral geniculate artery, which must be ligated to prevent a marked postoperative hematoma.

The second fascial incision, between the iliotibial tract and the long head of the biceps femoris muscle, permitted assessment of the attachment of the short head onto the tendon of the long head, the biceps-capsuloosseous-iliotibial confluens, and the direct and anterior arms and lateral aponeurotic expansion of the long head of the biceps femoris muscle. If injury is observed in the biceps-capsuloosseus confluens, access through the injury allows evaluation of the direct head of the short biceps, the capsular arm of the short head of the biceps femoris muscle, and the fabellofibular ligament.

The third fascial incision, which was in the superficial fascia posterior to the tendon of the long head of the biceps, required an external neurolysis of the peroneal nerve. Next, anterior retraction of the long head of the biceps femoris muscle and posterior retraction of the peroneal nerve and lateral gastrocnemius muscle allowed evaluation of the direct arm of the long head of the biceps femoris muscle, the distal tendon of the lateral gastrocnemius muscle, the lateral limb of the posterior arcuate ligament, the fabellofibular ligament, the posterior division of the popliteofibular ligament, the popliteus muscle, the popliteal aponeurosis, and the medial limb of the posterior arcuate ligament. The inferior lateral geniculate artery can be identified and protected just medial to the fibular styloid process.

DISCUSSION

The complexity of the anatomy of the posterolateral aspect of the knee is due in large part to the evolutionary changes in the anatomic relationships of the fibular head, the popliteal tendon, and the biceps femoris muscle. Distal migration of the fibular head from a more proximal articulation with the femur to its current position below the articular surface of the tibia has occurred.[6,8,9] In addition, at an earlier evolutionary time, the popliteal tendon inserted on the fibula when it articulated with the femur. However, with subsequent migration of the fibula distally, the popliteal tendon has acquired a femoral attachment while still maintaining its fibular attachment.[37] A third factor is the change in the insertion of the biceps femoris tendon from the lateral aspect of the capsule and proximal tibia in some primates[21,34] to the fibula in man. Another unanswered evolutionary question is the fate of the meniscus that existed between the fibula and the femur in earlier species.[37]

Additional confusion results from the use of inconsistent terminology to describe the anatomic structures within the posterolateral portion of the knee. The most notable example is that of the "short lateral ligament," a term that has also been used to describe the fabellofibular ligament, the popliteofibular ligament, and the lateral limb of the posterior arcuate.[12,16,23,38] The popular description, attributed to Last,[16] is that the fabellofibular ligament and the short lateral ligament are the same structure.

The terminology used to describe the components of the popliteal complex can also be confusing. It can be difficult to recall each fascicle's association with its origin of derivation from the popliteus muscle. Another potential source of confusion is the multiple angles that the muscle and tendon course with respect to normal planes of reference. Using the lateral meniscus as a primary reference, as Fabbriciani et al.[4] and Stäubli and Birrer[26] did, can help clarify this confusion. Descriptions of the posterior horn attachments to the popliteus muscle include a posteroinferior fascicle (the posteroinferior popliteomeniscal fascicle), a posterosuperior fascicle (the posterosuperior popliteomeniscal fascicle), and an anterior meniscal fascicle (the anteroinferior popliteomeniscal fascicle).[26]

The evolutionary change in attachment of the popliteal tendon with the distal migration of the fibula explains the complexities of the popliteal hiatus and the intraarticular position of the popliteal tendon in humans.[6] As the proximal fibula has moved distally from an articulation with the distal femur to its current articulation at the proximal tibiofibular joint, it has pulled the lateral capsule down, forming a new capsular layer between the distal femur and proximal popliteus muscle.[30] In addition, the popliteus muscle, which initially inserted on the fibula, has maintained a fibular attachment and added a femoral attachment. Some investigators believe the fibular insertion of the popliteus muscle observed in earlier species appears to have persisted as the structure now known as the popliteofibular ligament.[4,13,26,27] Others believe the fibulofemoral meniscus, observed in other primitive species, has become the popliteal tendon in humans.[4,6,9] However, the extension of the popliteus muscle to the femur and the conversion of the fibulofemoral meniscus to the popliteofibular ligament is also a reasonable possibility.

Although our description of the lateral aspect of the fibular collateral ligament as being continuous distally with the fascia overlying the lateral compartment of the leg is not new,[29] it is not commonly reported. A review of the described anatomy of other species[24,36] reveals that the fibular collateral ligament is intimately attached distally to the peroneus longus muscle fascia, which is similar to our observation in humans. Its unique relationship to the anterior arm of the biceps femoris tendon, with the bursa in between, suggests a "bowstring," or compression, effect by the biceps on the fibular collateral ligament. This effect may be especially important in flexion, where the dynamic adjustment provided by the biceps femoris muscle could improve fibulofemoral stability in a position known in vitro to be associated with decreased fibular collateral ligament tension.

Another source of confusion is inadequate descriptions of the ligaments in this part of the knee. Specific anatomic descriptions were either omitted or presented only in drawings. For example, the arcuate ligament is not a true ligament by itself, but appears to be a consolidation of several anatomic structures. Visually, it has the appearance of an arch. The medial limb of the arch is formed by the oblique popliteal ligament of Winslow, which is formed from the oblique popliteal expansion of the semimembranosus muscle and the capsular arm of the posterior oblique ligament. The lateral limb of the arch has been confused with the short lateral ligament, or the fabellofibular ligament.[14] However, the lateral limb of the arcuate is more posterior than the fabellofibular ligament and diverges more medially and attaches more distally to the posterior capsule. The relative size and thickness of the lateral limb of the arcuate varied among the cadaveric knees we examined, and appeared to be less prominent in older specimens.

Previous anatomic and surgical reports provide inadequate information for the surgeon who is attempting to identify posterolateral structures through surgical incisions.[1,2,5,7] In addition, published descriptions of the anatomic components of the posterolateral portion of the knee contain insufficient anatomic details from which to develop a dependable surgical approach.[3,4,11,12,14–20,22,25,27–30,35,38] The most detailed surgical approach was described by Hughston and Jacobson[10] in conjunction with a report of a posterolateral reconstructive procedure; however, they did not provide details of the surgical access needed to evaluate injuries to these components.

CONCLUSIONS

This study has increased our understanding of the anatomy of the individual anatomic structures of the posterolateral aspect of the knee and the relationships among these components. Providing a surgical approach that allows dependable access to these individual anatomic structures should aid the surgeon in properly assessing posterolateral injuries before their surgical repair. The best surgical exposure is one in which access is obtained through the interval of the injury. Finally, the information provided on the individual structures and their relation to each other should stimulate more anatomic, biomechanical, and clinical studies of the posterolateral aspect of the knee.

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