Posterolateral Corner Injuries of the Knee: Anatomy, Diagnosis, and Treatment

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Abstract: Injuries to the posterolateral corner of the knee continue to be a complex problem for orthopedic surgeons. Early recognition and treatment are important factors in the patient's long-term outcome. To properly treat these patients, the surgeon must have a clear understanding of the anatomic relationships amongst the structures in the posterolateral knee. This knowledge combined with a thorough physical examination and imaging studies, allows the surgeon to make the correct diagnosis and devise an appropriate treatment plan. This article will discuss the anatomy, diagnosis, and treatment options to improve the surgeon's understanding of posterolateral knee injuries. The senior author's technique for anatomic reconstruction of the posterolateral corner of the knee and the rehabilitation protocol are described.

Key Words: posterolateral corner, repair, reconstruction, lateral knee injuries, fibular collateral ligament, popliteofibular ligament

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Posterolateral corner injuries of the knee can be very debilitating for patients when unrecognized or treatment is delayed. In recent decades, a concerted effort has been made to more precisely define the anatomy, biomechanics, diagnosis, and treatment of posterolateral knee injuries.[1–12] Despite significant gains in our understanding of the posterolateral knee, these injuries remain elusive and treatment continues to be controversial with publications centered around expert opinions and case series creating a limited hierarchy of evidence. The complex anatomy with multiple layers and fibrous attachments between local tendons, ligaments, and bones contribute to the diagnostic difficulties.[1,6]

Failure to recognize a posterolateral knee injury can cause instability during normal gait resulting in a varus-thrust pattern. Posterolateral instability with a concurrent anterior or posterior cruciate ligament tear places the cruciate ligament grafts at significant risk for failure during subsequent reconstruction if the posterolateral injury is not repaired or reconstructed.[4,13,14] In turn, graft failure and possible revision surgery can result in further patient morbidity.

A complete understanding of the anatomy and thorough physical examination combined with proper imaging studies and arthroscopic evaluation will allow the surgeon to make a correct diagnosis and formulate a treatment plan. The timing of surgery is critical as it can dictate whether an anatomic repair is possible or a reconstruction may be required.

APPLIED ANATOMY

Most authors now agree that the popliteus tendon, popliteofibular ligament, and fibular collateral ligament are the most important structures for posterolateral knee stability. These static stabilizers are of significance due to the convex opposing surfaces of the lateral femoral condyle and lateral tibial plateau. Comprehension of the anatomy of the main static stabilizers is fundamental to understanding their biomechanical function, appearance on magnetic resonance imaging (MRI) scans, and repair/reconstruction at the time of surgery.

The fibular collateral ligament is the primary static stabilizer to varus opening of the knee. It is thought to be most important in preventing varus instability of the knee during the initial 0 to 30 degrees of knee flexion.[7] The proximal attachment site of the fibular collateral ligament on the femur is in a depression slightly proximal and posterior to the lateral epicondyle.[10] At its distal attachment to the fibular head, the fibular collateral ligament is easily identified by making a horizontal incision through the anterior arm of the long head of the biceps femoris and entering the bursa between the fibular collateral ligament and the biceps femoris.[12]

The popliteus muscle and tendon complex has many components providing static and dynamic stabilization to posterolateral rotation of the knee.[10,15] The proximal attachment of the popliteus tendon is in the proximal half of the anterior fifth of the popliteus sulcus. This is on average 18.5 mm from the attachment of the fibular collateral ligament.[10] As the popliteus tendon courses distally, three popliteomeniscal fascicles extend to the lateral meniscus (anteroinferior, posterosuperior, and posteroinferior).[10] Further distal, at the musculotendinous junction, the popliteofibular ligament courses laterally and distally to insert on the posteromedial aspect of the fibular styloid.[10,15] The popliteofibular ligament is an important stabilizer of external rotation

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of the knee and is composed of 2 divisions (anterior and posterior).[16]

The mid-third lateral capsular ligament is a thickening of the lateral capsule of the knee and is thought to be similar to the deep medial collateral complex on the medial aspect of the knee.[17] Two components make up the mid-third lateral capsular ligament. The meniscofemoral component extends from the femur to the meniscus, and the meniscotibial component from the meniscus to the tibia. The meniscotibial component is injured more frequently and often with a bony avulsion (Segond fracture).[18,19]

The long head of the biceps femoris branches into 5 arms as it courses distally[10,11] (Fig. 1). The 3 most important branches are the direct arm which attaches to the posterolateral aspect of the fibular styloid, anterior arm that courses lateral to the fibular collateral ligament, and lateral aponeurotic arm attaching to the posterolateral portion of the fibular collateral ligament. The short head of the biceps femoris also consists of 5 branches.[10,11] The capsular arm extends from the main tendon of the short head to the posterolateral capsule just lateral to the tip of the fibular styloid. The capsular arm provides a stout attachment to the posterolateral capsule, lateral gastrocnemius tendon, and the capsuloosseous layer of the iliotibial band. The distal edge of the capsular arm is the fabellofibular ligament.[8,10,18,19] The fabellofibular ligament is tight in extension and becomes lax with increasing flexion. The anterior arm of the short head passes medial to the fibular collateral ligament and blends with the meniscotibial component of the mid-third lateral capsular ligament as it attaches to the tibia. Injury to the anterior arm of the short head of the biceps femoris is often recognized on coronal MRI scans avulsed with a Segond fracture or a soft tissue Segond-type injury.[18]

The iliotibial band is an important structure in preventing varus opening of the knee. Because the superficial layer of the iliotibial band is seldom injured with posterolateral knee injuries, it serves as an important reference for many other structures.[17] It attaches to Gerdy tubercle distally. The capsuloosseous layer extends from the region of the lateral intermuscular septum and blends with the capsular arm of the short head of the biceps femoris on its way to attach just posterior to Gerdy tubercle. This creates an anterolateral sling for the knee.[10,20]

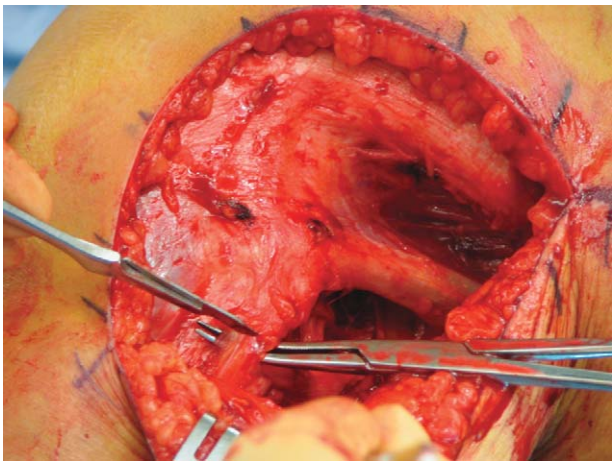

FIGURE 1. The iliotibial band and long head of the biceps femoris are landmarks as the common peroneal nerve neurolysis is performed.

DIAGNOSIS OF POSTEROLATERAL KNEE INJURIES

History and Physical Examination

A properly performed history and physical examination with certain tests for the posterolateral knee will guide proper diagnosis in the majority of cases. Many posterolateral knee injuries occur in combination with cruciate ligament injuries. When the diagnosis is more difficult, such as in cruciate or other ligament injuries, radiographs and MRI scans are useful adjuncts for the physician to aid in accurate diagnosis.[17]

The history often concentrates on the mechanism of injury and the subsequent symptoms. The main mechanisms for injury to the posterolateral knee are a blow to the anteromedial knee, contact or noncontact hyperextension, or a varus noncontact force.[8] During the history, it is important to inquire about numbness or tingling in the extremity or possible muscle weakness especially in ankle dorsiflexion and great toe extension, as 15% of posterolateral knee injuries have associated common peroneal nerve injury.[8]

A complete physical examination of the extremity including a neurovascular examination and gait must be performed in coordination with the posterolateral knee examination. For each test, it is always important to evaluate the unaffected knee to have a physiologic baseline for comparison.

Gait is an important component of the physical examination as a patient with chronic posterolateral corner injury may display a varus thrust gait pattern. In this pattern, the lateral compartment of the knee opens at foot strike and the joint subluxes into varus. The patient may have learned to compensate for this thrust by ambulating with a flexed knee. It is important to remember that not all patients with a varus thrust gait pattern have a posterolateral knee injury. A varus thrust simply implies that medial condyle weight bearing is occurring along with separation of the lateral tibio-femoral compartment, which can also be seen in medial compartment arthrosis.

The external rotation recurvatum test is performed by lifting the patient's great toe while stabilizing the thigh and looking for any increase in recurvatum of the affected knee. Measurement of the external rotation recurvatum test is expressed in negative degrees of knee motion or increased heel height off the table compared with the contralateral knee.[3,4] This test is most commonly positive with an anterior cruciate ligament injury or a bicruciate injury.

The varus stress test at 0 and 30 degrees of knee flexion is performed by stabilizing the thigh against the examination table while applying a varus force on the knee by grasping the foot or ankle.[8] A positive varus stress test at 0 degrees is often indicative of severe posterolateral knee injury to the fibular collateral ligament, meniscotibial portion of the mid-third lateral capsular ligament, the popliteus tendon, and possibly the superficial layer of the iliotibial band.[8]

Varus stress testing at 30 degrees of flexion is performed off the side of the examination table while stabilizing the thigh. It is beneficial to have the stabilizing hand over the joint line to better evaluate gapping of the joint line.[17] Greater varus opening at 30 degrees of flexion often correlates with a complete tear of the fibular collateral ligament and injury to the other varus stabilizing structures on the posterolateral knee.[8] The authors prefer to grade the varus stress test in relation to joint line opening with grade I having 0 to 5 mm, grade II having 5 to 10 mm, and grade III having >1 cm of joint line opening compared with the normal contralateral knee.

The dial test, also called the posterolateral rotation test, is performed at 30 and 90 degrees of knee flexion. In the cadaver, this test has been found to provide a good assessment of the injury to the posterolateral corner of the knee.[7,21,22] The test can be performed either supine or prone. When only one examiner is present, our preference in the clinic is to perform the test supine with the knee flexed off the edge of the table. The thigh is stabilized against the table and the foot externally rotated while the examiner records the amount of external rotation of the tibial tubercle and again, compares it to the unaffected knee. An increase of 10 to 15 degrees of external rotation at 30 degrees of flexion, compared with the unaffected side, indicates a concurrent posterolateral knee injury[7,21,23] (Fig. 2). The test is repeated with the knee in 90 degrees of flexion. In an isolated posterolateral knee injury, external rotation will decrease at 90 degrees compared with 30 degrees due to the intact posterior cruciate ligament.[21] If external rotation of the knee increases at 90 degrees, a combined posterior cruciate ligament and posterolateral corner injury is suspected.[21]

The posterolateral drawer test assesses posterolateral rotation of the knee at 80 to 90 degrees of flexion with the foot externally rotated 15 degrees, where posterolateral instability would be greatest.[3,17] In this test, increased posterolateral rotation usually indicates injury to the popliteus complex. This test must be differentiated from the posterior drawer test in neutral rotation, which tests the posterior cruciate ligament. The importance of making this distinction is demonstrated in a knee with an intact posterior cruciate ligament and concomitant posterolateral instability. When this injury pattern is tested in maximum internal rotation, it can appear stable. The authors prefer to sit on the patient's foot to stabilize it while applying a posterolateral rotation force. Close comparison with the contralateral knee is important as patients with physiologic genu recurvatum have some normal laxity.[24]

FIGURE 2. The dial test performed with one examiner holding the knees at 30 degrees of flexion and a second examiner applying external rotation. Note the increased external rotation of the left lower extremity.

The reverse pivot shift test is basically a dynamic posterolateral drawer test.[25] The knee is flexed to 45 to 60 degrees, the foot externally rotated, and a valgus stress applied. While the knee is slowly extended, it will be reduced if it is subluxed in flexion by the iliotibial band as it changes from a flexor to an extensor at 25 to 30 degrees of knee flexion. This test has been found to have a large number of false positives as 35% of healthy knees can have a positive test when examined under anesthesia.[24]

Imaging Examination

Plain radiographs in the AP and lateral projections can help identify medial compartment arthrosis, a Segond fracture of the lateral capsule, or an arcuate avulsion fracture of the fibular head.[8,18] The standing long leg AP (from hip to ankle) is important, especially in chronic injuries, to determine whether the extremity is in varus alignment. Bilateral varus stress radiographs can also be useful in determining if a significant amount of lateral joint space opening is present (Fig. 3).

High quality MRI scans are very useful in the assessment of the individual structures of the posterolateral knee.[18] In addition to the standard coronal, sagittal, and axial images, thin-slice (2 mm) proton density coronal oblique images, which include the complete fibular head and styloid, are extremely useful in evaluating the fibular collateral ligament and popliteus tendon.[18] Low signal magnets make it difficult to evaluate injuries to the posterolateral structures of the knee. It is therefore recommended that these MRI scans be obtained on a 1.5 T magnet or higher.[17]

Arthroscopic Evaluation

In a prospective case series, arthroscopic evaluation of the lateral compartment of the knee has been found to be a valuable tool in the assessment of posterolateral knee injuries for patients in whom it is difficult to determine

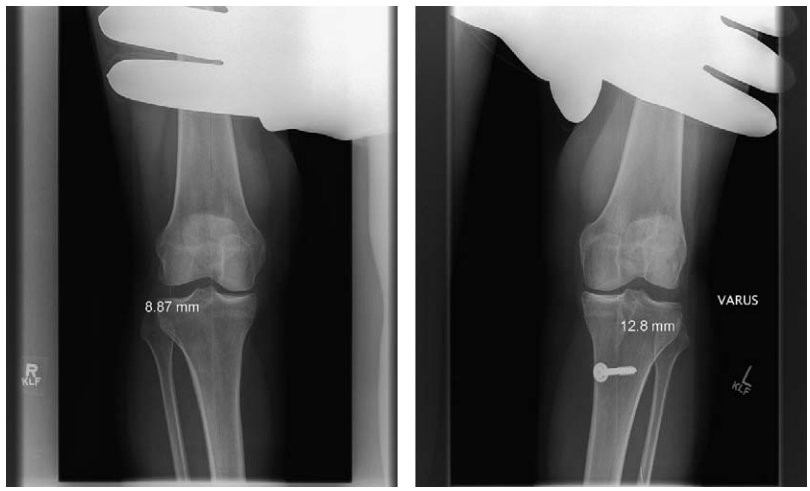

FIGURE 3. Bilateral varus stress radiographs looking for asymmetric lateral joint space opening.

whether there is an underlying injury.[20] With the patient under anesthesia for the arthroscopy, a physical examination of the knee can provide more information in difficult cases. In a prospective series of 30 patients with grade III posterolateral knee injuries, a positive drive-through sign, whereby there was > 1 cm of lateral joint line opening with a varus stress, was present in all 30 patients during arthroscopy[20] (Fig. 4). The individual posterolateral knee structures whose injury can be readily identified on arthroscopy are the popliteus tendon attachment on the femur, the popliteomensical fascicles, the meniscofemoral, and meniscotibial portions of the mid-third lateral capsular ligament, and the coronary ligament to the posterior aspect of the lateral meniscus. Arthroscopic identification of the structures involved can help assess whether the major component of the injury is meniscofemoral or meniscotibial and with surgical planning of incisions for a repair/reconstruction of the injured posterolateral knee structures.

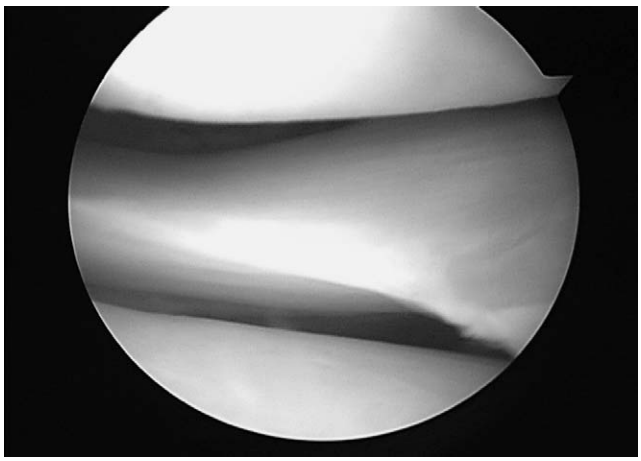

FIGURE 4. A positive drive-through sign with >1 cm of lateral joint space opening.

TREATMENT OF POSTEROLATERAL INJURIES OF THE KNEE

Nonoperative Treatment

For patients with partial injuries of the posterolateral knee, nonoperative treatment has been shown to bring acceptable results.[26,27] These grade I and II injuries can initially be treated with a knee immobilizer in full extension for 3 to 4 weeks.[17] The patient may perform straight leg raises and quadriceps sets while in the immobilizer. After the period of immobilization, progressive range of motion exercises are begun, and weight bearing to tolerance is allowed. Closed chain exercises may begin around 6 to 8 weeks, with avoidance of hamstring exercises until around 10 weeks. Patients progress their activity and strength training as tolerated, with anticipation of full release to activities 12 to 14 weeks after injury.[17]

In general, retrospective evaluation of complete tears of the structures of the posterolateral corner, grade III injuries, do poorly with nonoperative management.[26,28] For this reason, operative treatment of grade III injuries is recommended by the authors.

Operative Treatment

Operative treatment of injuries to the posterolateral corner of the knee can be divided into 4 broad categories: isolated acute posterolateral injuries, combined acute posterolateral injuries, isolated chronic posterolateral injuries, and combined chronic posterolateral injuries. Operative treatment and planning is dependent on the timing of the injury and other associated injuries. The goal of operative treatment is to restore the normal anatomic relationships in a stable enough fashion to allow early motion.

Isolated Acute Posterolateral Corner Injuries

Many authors agree that an anatomic repair of the acute posterolateral corner structures results in a more successful outcome than reconstruction for chronic

injuries.[29–32] With adequate tissue, repair has been most successful when surgery can be performed within 3 weeks of the injury.[19,27,33–37] After 3 weeks, formation of scar tissue obscures the planes along the posterolateral knee. This scar can make it difficult to identify the common peroneal nerve. For this reason, the current authors recommend that attempted anatomic repair of the posterolateral structures be done within the first 1 to 2 weeks after injury.[17]

Multiple incisions to expose the posterolateral corner of the knee have been described in the literature. Surgeons may chose to use either a straight, curvilinear, or lateral hockey-stick incision depending on their preference.[9,32,38,39] No matter which incision is used a thorough understanding of the anatomy is crucial for the safe dissection and repair. All the major structures of the posterolateral corner should be evaluated including the iliotibial band, biceps tendon, popliteus, fibular collateral ligament, popliteofibular ligament, and the peroneal nerve. The senior author believes that the peroneal nerve should be identified first before proceeding with the repair.

Anatomic repair of the injured posterolateral structures can usually be performed with direct suture repair back to bone using suture anchors or a recess procedure. The author's preference for an avulsion of the popliteus tendon or fibular collateral ligament at the femoral attachment is repair with a recess procedure. The recess procedure is performed by making a small tunnel, usually 5 mm in diameter and 10 mm in depth, at the attachment sites of the popliteus tendon and/or fibular collateral ligament. A large beath pin is passed from lateral to medial. The avulsed tissue is then sutured in a whip-stitch fashion and pulled into the bony tunnel. The sutures are then tied against the medial femur either over a button or bone bridge. This allows for secure fixation and the ability for early range of motion.[19,40]

Avulsions of the fibular collateral ligament, popliteofibular ligament, or the biceps femoris from the fibular head can be reattached directly to bone with either assistance of bony tunnels or suture anchors. If there is an avulsion of the fibular head with the related posterolateral structures still attached to the avulsed piece of bone, repair by either open reduction and internal fixation or by wiring of the bony fragment back to its original position. Rigid anatomic fixation is important so that the fragment heals and early range of motion can be started.

Other injured structures of the posterolateral corner of the knee can usually be addressed by side-to-side suture repair. These include tears of the coronary ligament of the posterior horn of the lateral meniscus, the popliteomeniscal fascicles, portions of the iliotibial band, and the other components of the long and short heads of the biceps femoris.[17]

The main goal of repairing the posterolateral structures of the knee is to make sure that secure fixation is achieved so that early range of motion can begin. Patients without secure fixation or that need to have augmentation of their repair due to tenuous tissues, may need to be immobilized in extension for approximately 2 weeks to allow healing of the tissues.[19] During this time of immobilization, it is imperative to keep the patient from actively externally rotating their repaired extremity.

After a primary repair of the posterolateral corner of the knee, patients remain nonweight bearing for approximately 6 weeks. Range of motion begins after 1 to 2 weeks as to not affect the repair. It has also been recommended that no active hamstring exercises begin before 4 months after the repair. However, closed chain quadriceps exercises may begin around 6 to 8 weeks after the operation depending on how secure the fixation at the time of repair. Patients then progress their strengthening activities during the 4 to 6 month postoperative period.

Combined Acute Posterolateral Corner Injuries

Posterolateral corner injuries are commonly seen with other knee ligament injuries. The entire picture of the knee injury must be identified before entering the operating suite with the examination under anesthesia and arthroscopic evaluation being used as adjuncts to assist in decision making.

Operative planning becomes more involved with multiple ligament knee injuries and with combined posterolateral knee injuries. Recommended treatment for acute combined posterolateral corner injuries remains the same as isolated posterolateral corner injuries. The senior author recommends that the posterolateral corner be repaired (if possible) and the other ligamentous injuries be reconstructed at the same time. Usually this is performed between 2 and 3 weeks after the injury. Again, the main goal is to provide secure fixation to begin early range of motion after the repair and reconstruction. Depending on the severity of the injury, a brief period of immobilization may be needed. Usually 1 to 2 weeks is sufficient to allow the tissues to settle down before the surgery is performed. If surgery is performed too early, there is an increased risk of arthrofibrosis.

Once the extent of the injury is known, the authors recommend performing all the ligament repairs and reconstructions at the same sitting. There are authors who would stage the operation by repairing the posterolateral corner within 2 to 3 weeks after the injury. The anterior cruciate and or posterior cruciate ligament reconstruction could then be performed at a later date after the tissue has had a chance to heal. The same principles would apply to repair the posterolateral corner as if an isolated injury. The anterior or posterior cruciate ligament injury (or both) would be reconstructed, using the standard techniques preferred by the surgeon. One of the issues that can be a challenge to the operating surgeon could be finding the appropriate landmarks within the knee itself. With multiple ligaments injured and an unstable knee, it can be a challenge to identify the exact origin and insertion of the cruciate ligaments.

Treatment of Chronic Posterolateral Corner Injuries

Chronic posterolateral corner injuries present specific problems not usually encountered in the acute

setting. Scar tissue and possible limb malalignment can make treating chronic injuries a challenge, however, the goals of reconstruction remain the same. Ultimately, the physician would like the patient to have a stable well-aligned knee that restores the preinjury kinematics of the knee joint. A general consensus exists supporting a better functional outcome for patients who undergo a reconstructive procedure for a chronic grade III injury to the posterolateral corner of the knee.[13,19,33,34,41–44] Although a consensus exists on reconstructing the chronic posterolateral corner injury of the knee, there is no "gold standard" procedure.

To assess limb malalignment, long leg standing radiographs should be obtained in all cases. If the knee is in varus alignment, a staged treatment plan is preferred with an opening wedge osteotomy performed first, otherwise, the soft tissue graft may stretch out. The reconstruction of the posterolateral corner is planned for 6 months after the osteotomy if the patient has symptoms of posterolateral knee instability.

Reconstructive procedures can be divided into 2 broad categories, nonanatomic reconstructions and anatomic reconstructions. Nonanatomic reconstructions attempt to stabilize the posterolateral corner of the knee but do not try to recreate the normal anatomic relationships of the injured structures. These nonanatomic reconstructions make an effort to address the varus laxity of the knee, but patholaxity can remain. It is this author's preference to perform an anatomic reconstruction to address both the static and dynamic stabilizers to the posterolateral corner of the knee.

In combined chronic posterolateral corner injuries, the posterolateral injury is treated the same as if it were an isolated injury. The anterior cruciate ligament and/or posterior cruciate ligament injuries are then reconstructed using standard techniques.

Senior Author's Preferred Method for Posterolateral Corner Reconstruction of the Knee

As stated previously, an anatomic approach to reconstructing the posterolateral corner of the knee is preferred. The patient is placed in a supine position with the leg prepped and draped free with a sandbag at the end of the table. The initial skin incision is centered over Gerdy tubercle, starting 7 to 8 cm proximal to the joint at the lateral intermuscular septum and extending distally 3 to 4 cm over the anterior compartment of the leg.[10] Two or 3 fascial incisions are then made. The first fascial incision splits the superficial layer of the iliotibial band in line with its fibers. It extends proximally from the supracondylar process of the femur to Gerdy tubercle distally. The fascial incision is retracted to expose the normal femoral attachments of the fibular collateral ligament and the popliteus tendon and the mid-third lateral capsular ligament. Next, a vertical arthrotomy is made through the meniscofemoral portion of the mid-third lateral capsular ligament, approximately 1 cm anterior and parallel with the fibular shaft with the patient's knee flexed to 70 degrees. This incision allows for access to the popliteus origin on the femur, the popliteomeniscal fascicles, and the lateral meniscus.

The second fascial splitting incision is made just posterior and parallel to the long head of the biceps femoris (Fig. 1). The common peroneal nerve must be identified in its location posterior and medial to the long head of the biceps femoris tendon via a common peroneal nerve neurolysis. It is important to know where the nerve is during the entire case and that it is free of any tension. The interval between the lateral head of the gastrocnemius and soleus is then developed with blunt dissection to provide access to the posteromedial aspect of the fibular styloid and the posterolateral aspect of the tibia. The posterior popliteal sulcus, which is at the musculotendinous junction of the popliteus, can be identified through this interval by palpation of the posterolateral aspect of the tibial plateau.[45] A third fascial incision can be made if necessary between the posterior border of the iliotibial tract and the anterior aspect of the short head of the biceps femoris. The popliteofibular ligament's attachment site on the posteromedial down slope of the fibular styloid can be identified through this interval, if it cannot be identified through the second fascial incision.

The tendon grafts are prepared by splitting a calcaneus and Achilles tendon allograft into 2 equal portions parallel with the fibers of the tendon. The tendons must be at least 23 cm in length to complete the reconstruction in most patients. The bone blocks of the grafts are fashioned to fit 9×20 mm tunnels for the femoral attachments with 2 sutures through drill holes in the bone blocks. The tendinous ends of the grafts are tubularized using a whip-stitch.

A fibular, tibial, and 2 femoral bone tunnels are used in the reconstruction. The 7 mm fibular tunnel is made through the fibular head from the attachment site of the fibular collateral ligament, on the lateral aspect of the fibular head, to the attachment site of the popliteofibular ligament on the posteromedial down slope of the fibular styloid. The attachment site of the fibular collateral ligament is found by entering the bursa between the long head of the biceps femoris and the fibular collateral ligament. For the tibial tunnel, a cannulated-aiming guide is placed on the posterior popliteal sulcus at the level of the popliteus musculotendinous junction. A guide-wire is then drilled in an AP direction from the distal and medial aspect of Gerdy tubercle to the posterior popliteal tibial sulcus (Fig. 5). It is important to leave a bony roof under the articular cartilage in the tibial tunnel. A 9 mm reamer is then passed over the guide-wire to prepare the tunnel from anterior to posterior.

The anatomic femoral attachments for the popliteus and fibular collateral ligament are identified as described previously. Two large beath pins are then drilled parallel across the femur from the attachment sites, exiting proximal and medial to the medial epicondyle and adductor tubercle. The 2 tunnels are then reamed and the bone plugs pulled into their respective holes on the femur by passing the sutures through the tunnel using the

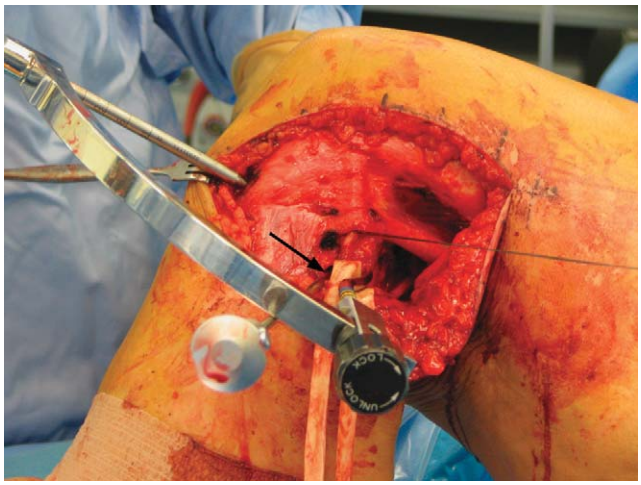

FIGURE 5. The cannulated-aiming guide from Gerdy tubercle to the posterior popliteal sulcus is in place. The arthroscopic trochar is placed in the fibular tunnel (black arrow) at the attachment site of the fibular collateral ligament (suture) to show the path of the popliteofibular ligament.

beath pin. The bone plugs can then be secured with titanium interference screws.

The graft fixed into the popliteus attachment on the femur is used to reconstruct the popliteus tendon. The free end of this graft is passed distomedially through the popliteal hiatus to reach the posterolateral aspect of the lateral tibial plateau. The graft is pulled through the tibial tunnel from posterior to anterior.

The second graft, from the fibular collateral ligament attachment on the femur, is used to reconstruct both the fibular collateral ligament and the popliteofibular ligament. It is initially passed deep to the superficial layer of the iliotibial tract and anterior arm of the long head of the biceps femoris, along the normal course of the fibular collateral ligament. The graft is then passed through the fibular head from lateral to posterior medial. While the knee is flexed to 30 degrees and a slight valgus stress applied, the graft is pulled tight and fixed to the fibular head with a bioabsorbable interference screw. This will reconstruct the fibular collateral ligament. The remaining portion of the fibular collateral ligament graft is then passed from posterior to anterior through the tibial tunnel, reconstructing the popliteofibular ligament. With the knee flexed 60 degrees and in neutral rotation, the popliteofibular ligament and popliteus tendon are secured using a bioabsorbable interference screw placed in the anterior tibial tunnel. This fixation is reinforced using a staple over the free tendon ends onto the anterior tibia.

Our rehabilitation protocol for a reconstruction is like that of a repair. It consists of the patient being nonweight bearing for 6 weeks. They are kept in full extension for 1 to 2 weeks and then allowed full range of motion. At 6 weeks, the patient begins using the exercise bike and light leg presses at no more than 70 degrees of knee flexion. Hamstring exercises are avoided until after 4 months. The patient is progressed with their rehabilitation at a pace to return to full activities at 6 to 9 months based on any associated injuries.

CONCLUSIONS

The biomechanics of each anatomic structure in the posterolateral knee is important for proper functioning of the knee. Most grade I and II injuries can be treated nonoperatively. Grade III injuries are best treated by direct repair, augmentation, or reconstruction depending on the acuity of the injury and the remaining tissue quality. Many techniques for reconstruction of the posterolateral corner of the knee have been described, but it appears anatomic reconstructions restoring normal knee stability and kinematics have the potential for the best patient outcomes. However, the results of long-term outcome studies are still around the corner.

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