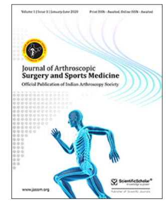
www.jassm.org

ScientificScholar® Knowledge is power
Publisher of Scientific Journals

Journal of Arthroscopic Surgery and Sports Medicine

Article in Press



Narrative Review

Anatomic reconstruction techniques for posterolateral corner injuries: Current concepts in management and rehabilitation

Joseph E. Nassar[1], Bshara Sleem[1], Luke V. Tollefson[2], Robert F. LaPrade[3]

[1]Department of Orthopedic Surgery, Warren Alpert Medical School of Brown University, Providence, Rhode Island, United States, [2]Department of Medicine, American University of Beirut, Beirut, Lebanon, [3]Department of Orthopedic Surgery, Twin Cities Orthopedics, Edina, Minnesota, United States.

ABSTRACT

Background and Aims: Posterolateral corner (PLC) injuries are complex knee injuries that compromise stability due to damage to critical stabilizing structures, requiring accurate diagnosis, effective surgical techniques, and structured rehabilitation for optimal outcomes. This review explores the anatomy, biomechanics, and diagnostic strategies for PLC injuries, emphasizing on LaPrade's anatomical reconstruction technique and its role in restoring stability and function.

Materials and Methods: A comprehensive literature search was conducted across PubMed, Scopus, Embase and Web of Science for studies focusing on PLC anatomy, diagnostics, physical examination techniques, imaging, treatment approaches, and postoperative rehabilitation.

Results: The review highlights the roles of the fibular collateral ligament, popliteus tendon, and popliteofibular ligament in resisting varus forces and controlling knee rotation. Diagnostic approaches, including physical examinations, radiographs, and magnetic resonance imaging, are discussed to identify PLC injuries effectively. Surgical management focuses on anatomical reconstruction techniques, particularly LaPrade's technique, to restore native biomechanical functions. Post-operative rehabilitation protocols are emphasized, with a structured approach to restoring stability, minimizing complications, and improving functional outcomes.

Conclusion: Combining anatomic reconstruction with a rigorous rehabilitation protocol has demonstrated favorable subjective and objective outcomes, providing an effective framework for managing PLC injuries and achieving long-term functional recovery.

Keywords: Anatomic reconstruction, Fibular collateral ligament, Popliteofibular ligament, Popliteus tendon, Posterolateral corner injury

INTRODUCTION

The posterolateral corner (PLC) of the knee, historically termed the "dark side of the knee," poses a challenge to treat due to its complex structures, biomechanics, and treatment approaches.[1] Recent advancements in anatomic knowledge and biomechanically validated reconstruction techniques have improved the management of PLC injuries, which are often associated with anterior cruciate ligament (ACL) or posterior cruciate ligament (PCL) tears, with only around 13-28% occurring in isolation.[1-4] If not adequately addressed, PLC injuries can alter knee biomechanics, compromise cruciate ligament reconstructions, and accelerate joint degeneration.[5-7]

These injuries are increasingly recognized due to improvements in diagnostics and rising sports-related trauma and motor vehicle accidents.[8,9] High-energy traumatic events, such as football, soccer, skiing, and vehicular collisions, are common causes, although non-contact hyperextension or varus injuries can also damage the PLC.[8,10] Complete grade III injuries typically involve disruption of the fibular collateral ligament (FCL), popliteus tendon (PLT), and popliteofibular ligament (PFL).[1,11]

Up to 70% of PLC injuries may be initially missed, necessitating a high index of suspicion and detailed evaluation through physical examination, radiography, and magnetic resonance imaging (MRI).[4,12] Non-operative treatments for grade III injuries have shown poor outcomes, making reconstruction essential for restoring varus and rotational stability, especially in conjunction with cruciate ligament reconstructions.[13-15] Anatomic reconstruction is favored for its ability to restore natural knee biomechanics more accurately than repairs.[16-19]

This narrative review aims to summarize the latest concepts on PLC injuries, including the anatomy, biomechanics, diagnostics, treatment strategies, and outcomes, serving as a practical guide for effective management.

***Corresponding author:** Robert F. LaPrade, Department of Orthopedic Surgery, Twin Cities Orthopedics, Edina, United States. laprademdphd@gmail.com

Received: 14 December 2024 **Accepted:** 04 February 2025 **EPub Ahead of Print:** 27 March 2025 **Published:** XXXXXX **DOI:** 10.25259/JASSM_63_2024

MATERIALS AND METHODS

A comprehensive literature search was conducted across PubMed, Scopus, Embase, and Web of Science from inception through December 10, 2024. The search terms included "posterolateral corner injuries," "PLC injuries," "PLC repair," and "PLC reconstruction." Inclusion criteria encompassed studies that focused on PLC anatomy, diagnostics, physical examination techniques, imaging, treatment approaches, or post-operative rehabilitation. Exclusion criteria included case reports, conference abstracts, non-English studies, and articles without full-text availability. The quality of the included studies was assessed based on methodological rigor, relevance to the topic, and strength of evidence. Studies with significant limitations or lacking sufficient data were excluded from the study.

RESULTS

Anatomy and assessment of PLC injuries

The PLC anatomy is crucial for knee stability, counteracting varus forces, and controlling rotational movements.[1] The lateral knee's complex bony structure, including the convex lateral femoral condyle (LFC) and lateral tibial plateau (LTP), creates inherent instability, complicating the healing of severe grade III injuries.[14,20] The primary stabilizers, including the FCL, PLT, and PFL, each uniquely contribute to knee stability [Figure 1].[21]

The FCL attaches to a shallow depression on the femur, 1.4 mm proximal and 3.1 mm posterior to the lateral epicondyle, extending to the lateral fibular head, 8 mm posterior to its anterior aspect.[4,21] Measuring about 70 mm in length, the FCL is the primary static restraint to varus movement and resists external knee rotation, particularly during extension. It also provides secondary stability for internal rotation and anterior tibial translation.[4,19,22,23] Varus gapping >2.2-2.7 mm compared to the contralateral knee indicates an isolated FCL tear.[4,24]

The PLT originates from the anterior fifth of the popliteal sulcus and inserts broadly on the posteromedial tibial cortex, spanning about 54.9 mm.[1] Positioned deep to the FCL, it primarily restrains external tibial rotation relative to the femur. The PLT also anchors to the lateral meniscus at three popliteomeniscal fascicles, enhancing knee stability.[22,25,26] Its femoral insertion, the most anterior PLC attachment, is located 18.5 ± 1.5 mm anterior to the FCL attachment when the knee is at 70° [Figure 2].[4,22]

The PFL originates at the popliteus musculotendinous junction and attaches distally to the posteromedial aspect of the fibular

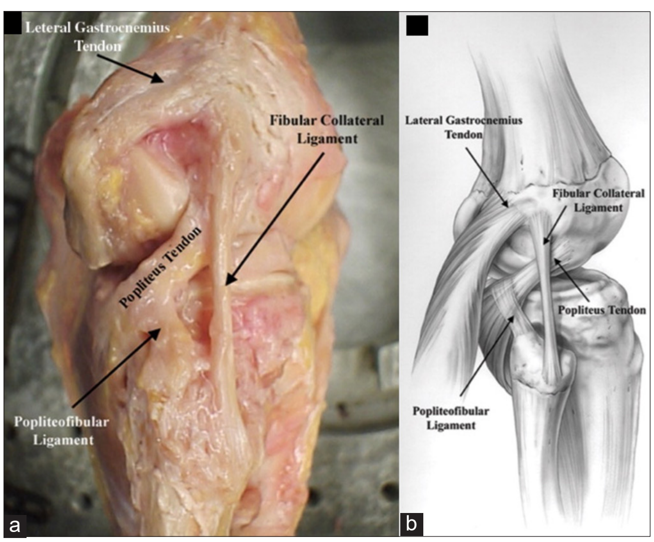


Figure 1: Photograph (a) and illustration (b) showcasing the isolated structures of the fibular collateral ligament, popliteus tendon, popliteofibular ligament, and lateral gastrocnemius tendon from a lateral perspective of the right knee (Reproduced with permission from LaPrade *et al.*).[21]

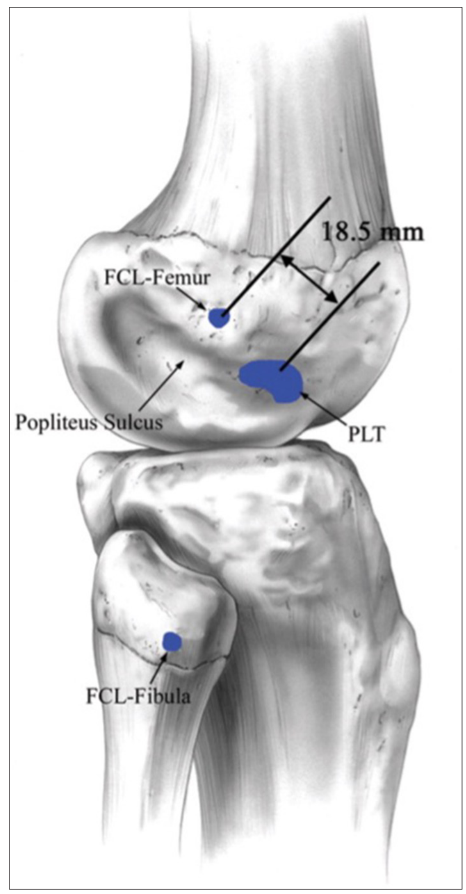


Figure 2: The lateral view of the right knee highlighting the attachment points of the fibular collateral ligament (FCL) on the femur and fibula, as well as the popliteus tendon (PLT) within the femoral popliteus sulcus. The average distance between the femoral attachment sites is also indicated. (Reproduced with permission from LaPrade *et al.*).[21]

styloid process with two divisions: One near the styloid tip and the other slightly distal,[20,22] forming an overall 83° angle with the PLT during surgery.[8,21] The PFL serves as a key static restraint for external knee rotation and a secondary stabilizer against varus rotation. Its role in stability becomes evident when injured with other PLC structures, as reconstructing the PFL along with the FCL and PLT significantly improves knee stability in grade III PLC injuries.[17,27]

Several secondary structures enhance posterolateral knee stability by reinforcing the restraints provided by the FCL, PLT, and PFL.[1] The biceps femoris complex serves as a key dynamic stabilizer. Its long head divides into direct and anterior arms, inserting near the fibular styloid and the FCL attachment, respectively, forming a supportive connection to the FCL.[22,26,28] The short head splits into components that attach to the lateral tibia and the posterolateral joint capsule, further stabilizing the knee.

The distal iliotibial band (ITB) contains deep fibers, known as Kaplan fibers, which play a critical role in stabilizing the distal femur and lateral knee structures.[22,26,28] These fibers are categorized into two bundles: proximal and distal Kaplan fibers.[29] The proximal fibers anchor to the proximal ridge of the distal femoral diaphysis, approximately 53.6 mm above the lateral epicondyle, while the distal fibers attach to the distal ridge on the supracondylar flare, located 31.4 mm proximal to the lateral epicondyle [Figure 3].[29] The ITB contributes significantly to posterolateral stability not only through its distal attachment but also through its dynamic interactions with other structures. The distal iliopatellar band connects the ITB to the patella, while the deep capsulo-osseous layer integrates with the lateral gastrocnemius muscle, biceps femoris tendon and tibia.[1,22,26] These connections create a robust network that reinforces the knee's lateral stability, particularly during rotational or valgus stress. The anterolateral ligament (ALL) contributes to rotational stability, particularly in controlling internal tibial rotation, and serves as a secondary restraint to anterior tibial translation in ACL-deficient knees.[30] Positioned between the LFC and proximal tibia, it plays a key stabilizing role.[30] The lateral joint capsule, with its meniscotibial ligament connecting the lateral meniscus to the posterior tibia, adds further support. Finally, the fabellofibular ligament, linking the fabella to the fibular head, supports external rotation and hyperextension while resisting varus forces by anchoring to the lateral gastrocnemius tendon and joint capsule.[22,26]

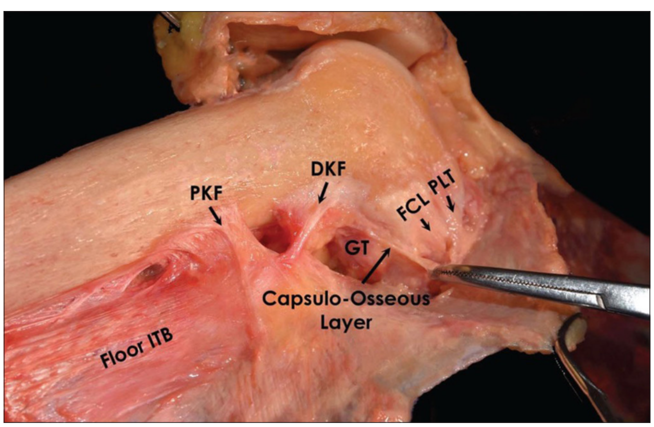


Figure 3: A lateral dissection of a right femur illustrating the orientation, origin, and insertion points of the proximal and distal Kaplan fibers. FCL: Fibular collateral ligament, GT: Lateral gastrocnemius tendon, ITB: Iliotibial band, PLT: Popliteus tendon, DKF: Distal Kaplan fibers, PKF: Proximal Kaplan fibers (Reproduced with permission from Godin *et al.*).[29]

The Hughston classification system

The Hughston classification subjectively assesses knee stability under varus stress with the knee fully extended, categorizing ligament injuries into three grades [Table 1].[31,32] Grade I indicates minimal tearing with no abnormal motion and a stable knee. Grade II involves partial tearing with mild-to-moderate abnormal motion, showing some instability that may require conservative or surgical treatment. Grade III represents a complete ligament tear with significant abnormal motion, typically necessitating surgery in active patients. While subjective and prone to overestimating lateral compartment gapping compared to anatomic studies, this classification remains a valuable tool for clinicians in assessing and communicating injury severity and guiding treatment.[31,32]

History and physical examination

Grade III PLC injuries often occur alongside other ligament injuries rather than in isolation.[4,33] Patients typically recall a specific traumatic event, such as hyperextension with twisting, a direct blow to the anteromedial tibia in extension, landing on an outstretched leg, or a high-energy impact.[1,34] Common symptoms include localized pain, swelling, tenderness on the lateral knee, instability near full extension, difficulty walking on uneven surfaces or navigating stairs, sometimes presenting as a varus thrust gait.[35] Injuries may also affect the common peroneal nerve, causing paresthesias or a foot drop.[33,36] A

Table 1: Hughston classification of posterolateral instability examined by varus or rotational instability.[32]

Classification	Varus or rotational instability	PLC injury
Grade I	0-5 mm or 0-5°	Minimal tearing with no abnormal motion
Grade II	5-10 mm or 6-10°	Partial tearing with mild-to-moderate abnormal motion
Grade III	>10 mm or >10° (soft endpoint)	Complete tearing with marked abnormal motion

PLC: Posterolateral corner

thorough physical examination is crucial, utilizing tests such as varus stress, dial, posterolateral drawer, reverse pivot shift, and external rotation recurvatum, performed bilaterally for comparison.[1,4]

The varus stress test evaluates lateral compartment gapping compared to the contralateral knee in full extension and at 20-30° of flexion.[4] Gapping at 20-30° suggests FCL and potentially other PLC injuries while gapping in full extension indicates possible cruciate ligament involvement.[4] The dial test measures rotational stability by comparing external rotation at 30° and 90° of knee flexion. Increased rotation at 30° with posteromedial subluxation suggests PLC injury, while continued rotation at 90° indicates combined PCL and PLC involvement.[4,34,37] A positive dial test with anteromedial subluxation may also indicate a grade III MCL tear.[38]

The reverse pivot shift test assesses rotational stability by applying valgus force and external rotation to a flexed knee during gradual extension. A reduction at 35-40° of flexion indicates PLC injury as the ITB transitions from a flexor to an extensor.[1,4,33,34] However, a study by Cooper found a positive sign in 35% of normal knees, highlighting the importance of contralateral comparison.[39] The external rotation recurvatum test involves lifting the leg by the great toe in a supine position and comparing heel height to the unaffected side. Increased heel height suggests a PLC injury and possible ACL tear [Figure 4].[34,40-42]

Imaging

When a PLC injury is suspected after a thorough history and physical examination, imaging is essential for confirmation.[4]

Figure 4: The external rotation recurvatum test evaluates the increased heel height commonly seen in patients with posterolateral corner (PLC) injuries. Initially used to gauge the severity of PLC tears, it is now recognized as a key indicator of combined injuries involving the anterior cruciate ligament (ACL) and PLC. A heel height difference exceeding 2.5 cm between sides suggests a combined ACL and fibular collateral ligament tear. During the test, the distal thigh is stabilized with one hand while the foot is lifted using the great toe with the other hand. In cases of combined PLC and ACL injuries, anterior tibial subluxation and external rotation lead to a noticeable increase in heel height.

Initial assessment typically includes standard anteroposterior, lateral, and flexed knee patellofemoral views to screen for fractures or avulsions, though these are often normal in acute PLC injuries.[1] For chronic cases, a standing long-leg anteroposterior alignment radiograph is recommended to detect varus malalignment, which should be corrected with a bi-planar osteotomy before or during PLC reconstruction.[4] Varus stress radiographs provide a reliable method to evaluate PLC and FCL integrity, particularly in grade III FCL tears. Taken bilaterally at 20° of knee flexion, they measure lateral compartment gapping as the shortest distance between the LFC and LTP.[4] A side-to-side difference (SSD) in varus gapping over 4mm indicates a complete PLC tear, while an SSD of 2.2-4 mm suggests an isolated FCL tear [Figure 5].[24,43] Stress radiographs, though challenging in acute settings, are more accurate than MRI for diagnosing chronic grade III FCL injuries.[44,45] MRI, with a sensitivity of 58% to 100% for PLC injuries, provides valuable insights into isolated FCL injuries and comprehensive PLC damage, especially in the acute phase, where its sensitivity is higher.[46,47] Acute PLC injuries on MRI often show anteromedial bone bruising.[12] In a study by Geeslin and LaPrade, 55% of acute PLC injuries displayed bruising on the anteromedial femoral condyle, and nearly 30% showed posteromedial tibial plateau bruising, frequently associated with ACL injuries.[2] Anteromedial bone bruising or medial tibial plateau fractures on MRI strongly suggest a PLC injury unless proven otherwise [Figure 6].[1]

Treatment

The treatment of PLC injuries varies based on the injury grade and the extent of the associated ligament damage. Non-operative management is typically reserved for grade I and II injuries, while surgical options are recommended for more severe injuries or when concurrent ligament damage is present.[48,49]

Non-operative treatment is indicated for injuries that only involve partial midsubstance tears without avulsions.

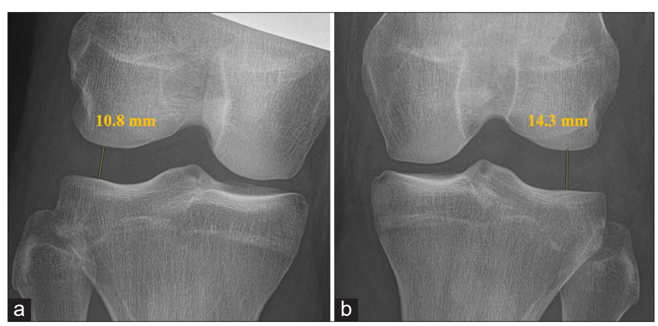


Figure 5: (a and b) Bilateral varus stress radiographs of the posterolateral corner (PLC). The left knee (b) exhibits 3.5 mm of additional lateral compartment separation. A side-to-side difference in varus gapping of more than 2.2 mm typically points to an isolated fibular collateral ligament tear, whereas a gap exceeding 4 mm suggests a complete rupture of the PLC.

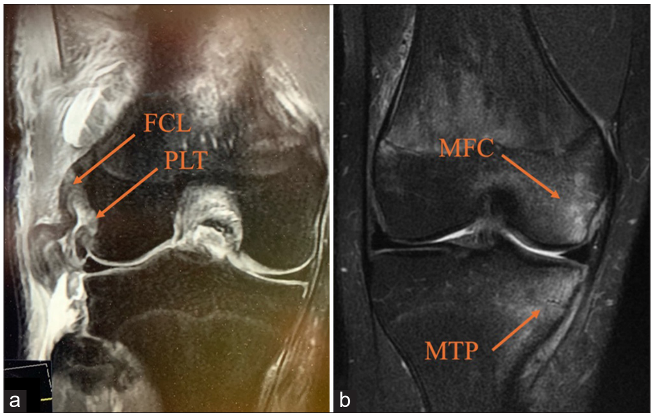


Figure 6: (a) A coronal magnetic resonance imaging (MRI) of the right knee displays fibular collateral ligament (FCL) attenuation and a popliteus tendon (PLT) avulsion, marked by arrows. (b) Acute posterolateral corner injuries frequently present with anteromedial bone bruising, observed in up to 55% of cases. This coronal MRI of the right knee shows increased signal intensity in the medial femoral condyle (MFC) and medial tibial plateau (MTP).

In fact, studies have shown good results for these lower-grade injuries when managed conservatively, with reports of minimal radiographic changes at an eight-year follow-up time.[50-53] This approach includes a period of knee immobilization that is followed by a controlled rehabilitation that focuses on gradual mobilization, strengthening, and stability exercises. However, non-operative management for complete grade III injuries is generally discouraged because it often leads to poor functional outcomes, persistent instability, and increased degenerative changes.[11,15] If these injuries are left untreated, excessive strain on concurrent PCL and ACL grafts can compromise their integrity.[5,6]

Surgical intervention becomes necessary for more severe PLC injuries, especially isolated acute grade II avulsions or grade III injuries with complete disruption of PLC structures.[4] Early surgical intervention, which is ideally within 2-3 weeks from the time of injury, is especially effective for isolated avulsions of the FCL and PLT without midsubstance damage.[4] In fact, early repair is indicated in acute settings where direct reattachment of avulsed structures is feasible and may offer biomechanical advantages over reconstruction by preserving native proprioception.[54] The technique involves anatomically reattaching the avulsed structures using suture anchors or screw fixation, depending on the site of detachment.[54] For FCL bony avulsions, fixation with cannulated screws or cortical buttons has shown favorable outcomes when performed within the acute window before scar formation and ligament retraction.[54]

For severe PLC injuries, the LaPrade anatomical reconstruction technique is widely regarded for its stability to restore the knee's native structure and function [Table 2].[1,20,55] This technique restores the FCL, PLT, and PFL with the use of an Achilles tendon allograft, which is split in length into two separate grafts. Each graft is prepared with a 9x20 mm bone plug on one end and tubularized on the other end.[17] Studies have also shown that hamstring autografts could be a viable option.[56] The procedure begins with a lateral hockey incision, followed by posterior dissection along the distal ITB and both the long and short biceps femoris muscles. In cases of long biceps tendon rupture, special care is advised as scar tissue or malalignment could obscure the potential altered course of the common peroneal nerve. A neurolysis is performed to decompress the nerve, which is gently retracted for protection. The distal FCL attachment to the lateral fibular head is identified by entering the biceps bursa between the anterior and direct arms of the long head of the biceps femoris. A traction suture can be placed in the distal FCL remnant to assess its integrity and help in localizing the femoral attachment which also assists in guiding the ITB splitting incision if some ligament continuity is present.[15] Retracting the injured biceps femoris tendon or creating a longitudinal incision through the anterior arm of the long head at approximately 1 cm proximal to the fibular head is needed to provide a clearer view of the distal FCL attachment [Figure 7].[4]

Using an elevator, the soleus muscle is carefully elevated from the posteromedial fibular head to expose the PLT and PFL musculotendinous junction. A guide pin is inserted at the FCL origin, positioned 8 mm posterior to the anterior margin of the fibular head, and directed in an anterolateral-to-posteromedial trajectory to exit just beneath the PFL attachment.[4,17] The fibular tunnel is reamed with a 7 mm reamer to facilitate proper graft placement.

For the transtibial tunnel, a guide pin is drilled starting from the flat surface just distal and medial to Gerdy's tubercle, extending to the posterior popliteus musculotendinous junction. The exit point is confirmed to be approximately 1 cm medial and 1 cm proximal to the posteromedial fibular tunnel opening.[4,17] A retractor is placed to protect the neurovascular structures during this process. Subsequently, the tibial tunnel is reamed with a 9 mm reamer.

The longitudinal incision of the ITB is essential to locate the femoral FCL attachment, which lies approximately 1.4 mm proximal and 3.1 mm posterior to the lateral epicondyle.[21] After identifying the sulcus, any remaining FCL fibers at the attachment site are removed. An eyelet guide is drilled at a proximal and 35° anterior angle to avoid convergence with ACL reconstruction tunnels.[57] This trajectory reduces risks associated with tunnel interference.

Finally, the PLT attachment is identified within the popliteus sulcus and lies 18.5 mm anterior to the FCL attachment, serving as a critical anatomical reference point for reconstruction [Figure 8].[21]

A second eyelet guide pin is placed parallel to the first pin or instead, the PLT pin can be placed first through a small

Table 2: Surgical pearls, pitfalls, and improved recommendations.

Step	Pearls	Pitfalls	Improved recommendations
Anatomic exposure	Begin with a posterolateral approach to clearly visualize anatomy before fluid extravasation	Scarring or an avulsed BF tendon makes the common peroneal nerve location unpredictable. Proceed slowly with neurolysis	Use intraoperative nerve monitoring to further reduce the risk of nerve damage
Identifying fibular attachments	Incise the biceps bursa to locate the FCL attachment (28 mm distal to fibular styloid, 8 mm posterior to the anterior fibular head)	Reaming the fibular head tunnel too proximally risks fracture or blowout	Confirm fibular head positioning with fluoroscopic guidance to reduce the risk of misplacement
Tagging ligaments	Tag any remnant FCL tissue to assist in identifying the femoral FCL origin accurately	Incorrect femoral pin placement (<18.5 mm apart for FCL and PLT pins) risks tunnel convergence	Double-check pin spacing using intraoperative calipers before proceeding with reaming
Tibial tunnel preparation	Use an obturator inside the fibular head tunnel to guide the trajectory of the tibial PLC tunnel	A lateral PLC tibial guide pin can pierce the anterior compartment or the proximal tibiofibular joint, especially in obese patients	Preoperatively mark guide pin trajectories on fluoroscopy to minimize lateral deviation
Tunnel exit strategy	Ensure the tibial tunnel exits 1 cm medial and 1 cm proximal to the posteromedial exit of the fibular tunnel	Incorrect trajectory during tunnel creation can result in failed graft alignment	Use a calibrated tibial guide system to maintain consistent exit points
Soft tissue handling	Make femoral ITB incision anteriorly to simplify retraction during tunnel preparation	Posterior or inferior incisions make soft tissue retraction more challenging	Place a tensioning device to maintain a clear surgical field during ITB handling
Neurovascular protection	Protect neurovascular structures using a large Chandler retractor with a finger behind it during drilling	Insufficient retraction risks damage to the neurovascular bundle	Reinforce retraction with an assistant holding a secondary retractor for added safety
Locating the femoral origin	Perform a small arthrotomy to identify the PLT femoral origin; measure 18.5 mm posterior to locate the FCL origin	Difficulty in visualizing landmarks can delay surgery	Pre-mark potential insertion points on radiographs before the procedure for quicker localization
Femoral tunnel trajectory	Aim femoral tunnels 35-40° proximal and posterior to prevent tunnel convergence with ACL tunnels	Tunnel convergence reduces graft stability and leads to reconstruction failure	Use an angled guide specific to PLC reconstructions to ensure accurate femoral tunnel trajectories
Graft passage	Pass grafts under the ITB, ensuring the PLT is deep to the FCL graft.	Improper graft passage can compromise graft function.	Test graft tension and alignment intraoperatively to verify correct placement.
Graft fixation	The FCL should be fixated at 20° of flexion and the PLT and PFL should be fixated at 60° of flexion.	Fixating the grafts at incorrect fixation angles can lead to loose grafts and decreased biomechanical function.	A slight varus force during fixation can help ensure grafts are properly tensioned.
Repair of BF tendon	Repair the BF tendon in full extension post-reconstruction to avoid convergence between anchors and fibular tunnel	Improper repair can result in limited knee extension postoperatively	Anchor placement should be finalized after trial graft tensioning to confirm non-interference zones

FCL: Fibular collateral ligament, BF: Biceps tendon, PLC: Posterolateral corner, PLT: Popliteus tendon, ITB: Iliotibial tendon, PFL: Popliteofibular ligament

arthrotomy to locate the PLT tendon in the anterior fifth of the popliteal sulcus. Before starting to ream, one should ensure that the pins are spaced roughly 18.5 mm apart. Both pins are then over-reamed with 9 mm reamers to a depth of 25 mm [Figure 9].

To ensure precise graft placement, passing stitches are first inserted using eyelet guide pins, which facilitate the smooth threading of the grafts into their designated femoral tunnels. Once positioned, the bone plugs of both the PLT and FCL grafts are secured within their respective tunnels.

The PLT graft is carefully routed through the popliteal hiatus, maintaining a posterior and distal trajectory to align with

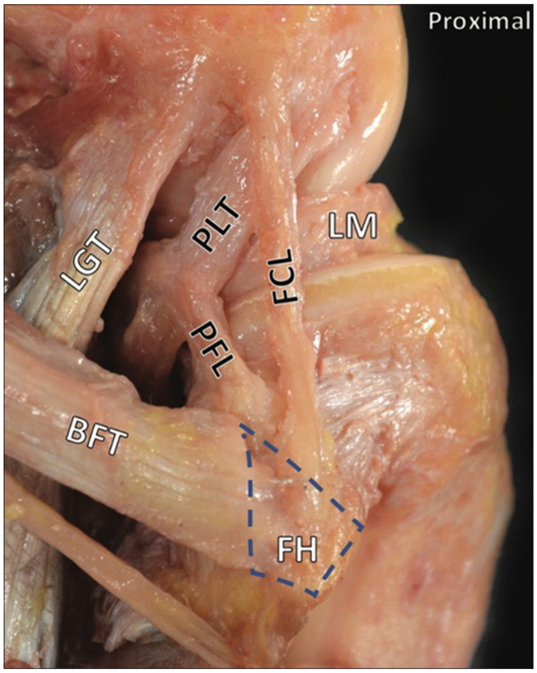


Figure 7: The fibular collateral ligament (FCL), popliteus tendon (PLT), and popliteofibular ligament (PFL) serve as the primary stabilizing structures of the posterolateral corner. Additional structures shown include the lateral gastrocnemius tendon (LGT), lateral meniscus (LM), and the long head of the biceps femoris tendon (BFT), which inserts on the lateral side of the fibular head (FH). Typically, the anterior arm of the BFT conceals the distal attachment of the FCL. However, in this image, the anterior arm has been removed to provide a clear view of the distal FCL attachment, which is normally situated within a bursa between the anterior and direct arms of the biceps femoris tendon (Reproduced with permission from LaPrade *et al.*).[1]

the native ligament's anatomical course. Meanwhile, the FCL graft is passed superficial to the PLT graft but remains deep to the ITB, preserving the biomechanical relationships between the reconstructed structures.

For the fibular head tunnel, the FCL graft is directed from lateral to medial and anchored securely within the tunnel using a 7 × 20 mm bioabsorbable interference screw. This critical step is performed with the knee positioned at approximately 20° of flexion, maintained in neutral rotation, and with a controlled valgus force applied to replicate the native ligament tension. These intraoperative adjustments enhance the restoration of knee stability while minimizing the risk of over-tightening the graft.

Emerging from the posteromedial aperture of the fibular tunnel, the continuation of the graft serves as the PFL graft. Alongside the PLT graft, this segment is carefully passed from posterior to anterior through the tibial tunnel. Ensuring proper alignment in the tibial tunnel is vital to

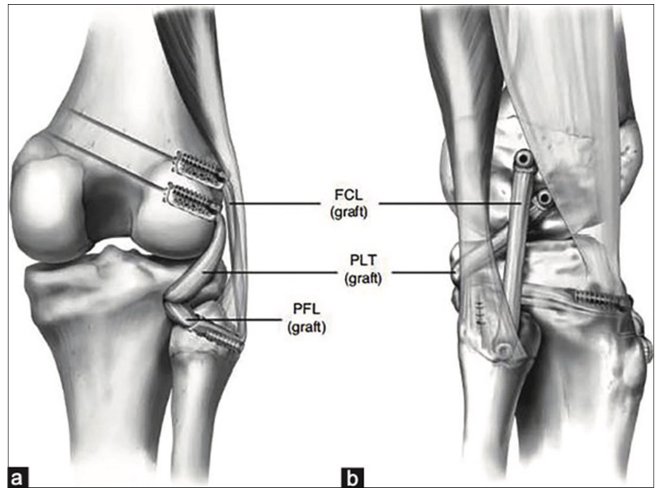


Figure 8: (a and b) Anatomical reconstruction of the posterolateral corner (PLC). These images showcase the completed appearance of a PLC reconstruction, designed to restore the natural structure of the fibular collateral ligament (FCL), popliteofibular ligament (PFL), and popliteus tendon (PLT). The procedure utilizes a longitudinally split Achilles tendon allograft, secured with a fibular head tunnel, a transtibial tunnel, and interference screws for fixation (Reproduced with permission from LaPrade *et al.*).[20]

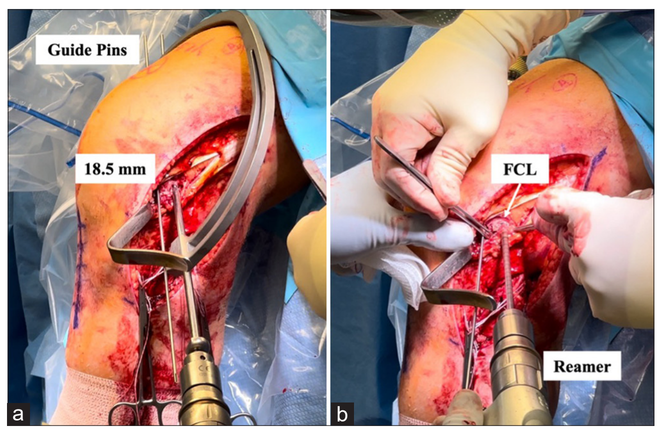


Figure 9: (a and b) Creating femoral tunnels for the fibular collateral ligament (FCL) and popliteus tendon (PLT) grafts. The FCL attaches anatomically near the lateral epicondyle located approximately 18.5 mm posterior to the PLT attachment within the popliteal sulcus (a). In reconstructing the posterolateral corner (PLC), the process begins with the placement of a guide pin at the PLT's femoral attachment. After verifying the correct spacing, a second guide pin is positioned for the FCL tunnel. Once both guide pins are accurately placed, a 9 mm reamer is used to drill femoral tunnels for the grafts, each reaching a depth of 25 mm (b).

preventing tunnel convergence and achieving consistent load distribution across the grafts.

To improve procedural efficiency, pre-tensioning of the grafts can be performed before final fixation to account for potential slack and optimize post-operative ligament tension. The final fixation is performed with the use of a 9 × 20 mm

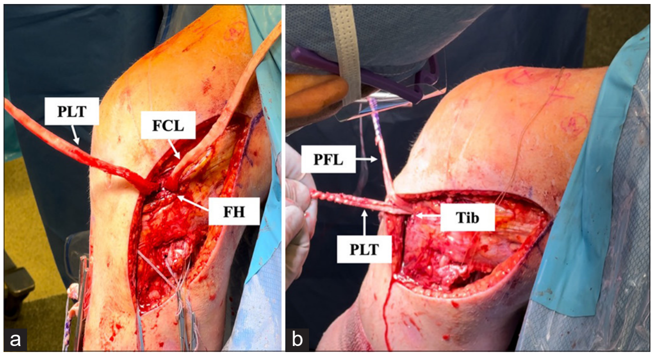


Figure 10: An intraoperative image demonstrating an anatomic reconstruction of the posterolateral corner. This approach utilizes two grafts to restore the function of three key structures: (a) The fibular collateral ligament (FCL), popliteus tendon (PLT), and popliteofibular ligament (PFL). (b) The FCL graft is routed anterolaterally to posteromedially through a tunnel in the fibular head (FH) and, together with the PLT graft, is passed from posterior to anterior through a tibial tunnel. After securing the FCL graft at the fibular head, its remaining segment functions as the PFL graft, contributing to the stabilization of the proximal tibiofibular joint.

bioabsorbable interference screw with the knee flexed at 60° and in neutral rotation [Figure 10].[1] This precise placement and fixation method restores both the varus and the rotational stability of the knee, which allows for an effective load-bearing while reducing the risk of recurrent instability or graft stretching.[1] The LaPrade anatomical reconstruction technique has been reported to be biomechanically validated in restoring the stability of the knee and provides favorable outcomes in the management of PLC injuries.[17,27]

Tunnel convergence

In PLC reconstructions, it is essential to avoid tunnel convergence to maintain the integrity of the grafts and provide an effective fixation. Tunnel convergence occurs when drilled tunnels intersect within the bone which would potentially compromise the graft stability and increase the risk of fixation failure.[57] Proper planning of tunnel trajectories, especially for the FCL, PLT, and ACL, is critical to ensure structural separation and prevent complications in complex knee reconstructions. In studies by Moatshe *et al.*, it was reported that angling the FCL and PLT tunnels 35-40° anteriorly and maintaining a neutral vertical angle (0° proximally) on the femur can help avoid convergence with the ACL tunnel [Figure 11].[57-59] When the FCL tunnel is drilled at 0° in both coronal and axial planes, the risk of convergence with the ACL tunnel reaches 100%.[57,58]

In lateral multi-ligament reconstructions, the FCL and PLT tunnels are at the highest risk of colliding with the single ACL tunnel.[60] For complex injuries involving both cruciate and collateral ligaments, where multiple tunnels are required in the distal femur, and proximal tibia, the risk of tunnel convergence is significantly elevated.[61] LaPrade *et al.*

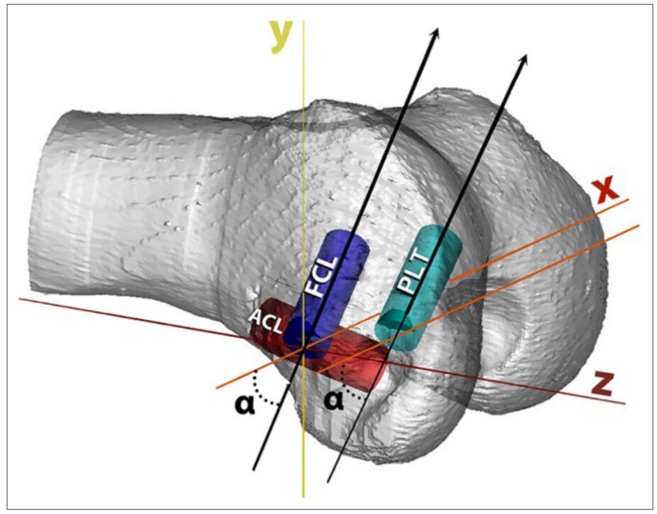


Figure 11: To prevent tunnel convergence with the anterior cruciate ligament (ACL) reconstruction, the femoral tunnel for the fibular collateral ligament (FCL) should be drilled at a 35° anterior angle. When the patient is positioned supine, the surgeon lowers their hand while angling the reamer upward to achieve this trajectory. The tunnel for the popliteus tendon (PLT) is aligned parallel to the FCL tunnel. The anterior angle from the horizontal plane (X-axis) is represented as $\alpha = 35°$ (Reproduced with permission from Moatshe *et al.*).[57]

reported that for patients with combined ACL, PCL, and PLC injuries, reconstructing the three main PLC stabilizers using two allografts helps restore varus and rotational stability, especially in chronic cases.[17] Gursoy *et al.* also noted that special care is also needed when repairing meniscus root tears in conjunction with PLC reconstructions, as additional transtibial space is required.[62] Drilling the guide pins for the PLC tibial tunnel first allows for careful planning and potential adjustments to avoid convergence with other tunnels, maintaining structural integrity and optimal fixation.[60]

The presence of a proximal fibular fracture affects ligament reconstruction, which requires adjustments in tunnel placement to prevent fixation failure. If the fracture involves the fibular head, the fibular tunnel may need to be positioned more anteriorly or distally to avoid drilling through the fracture site. In cases where tunnels are contraindicated due to fracture instability, alternative fixation methods such as cortical buttons, suture anchors, or suspensory fixation should be considered.[63-68]

Post-operative rehabilitation

Post-PLC reconstruction, a structured rehabilitation protocol is essential for optimal recovery. During the first 6 weeks, the patient remains non-weight-bearing and wears a knee immobilizer, removed only for range of motion (ROM) exercises, dressing changes, and bathing.[1] Early rehabilitation focuses on restoring tibiofemoral and patellofemoral

ROM, managing pain and edema, and reactivating the quadriceps.[4,69-71] ROM is initially limited to 0-90° of passive flexion for 2 weeks and gradually progresses to full flexion as tolerated.[4] At 6 weeks, patients may begin stationary cycling, start weaning off crutches, and transition from a knee immobilizer to a hinged knee brace, depending on quadriceps control.[4] Full weight-bearing allows progression to closed-chain strengthening exercises, initially focusing on muscular endurance before advancing to strength and power training. Resisted hamstring exercises are avoided for at least 4 months to protect the grafts.[1,72] Running and agility exercises are typically introduced around 6 months, depending on strength and power levels. Return to sports or high-demand activities occurs between 6 and 9 months once the affected knee demonstrates comparable strength, stability, and ROM to the unaffected side. Recovery timelines may vary if concurrent ligament injuries are addressed.[4]

Outcomes and assessment

Studies comparing PLC repair to reconstruction consistently favor reconstruction for better outcomes. Stannard *et al.*[53] and Levy *et al.*[51] reported higher reoperation rates for repairs, while Black and Stannard[73] found significantly lower failure rates with reconstruction. Stannard *et al.*[53] evaluated 56 patients with PLC injuries and reported a significantly higher failure rate for primary repair compared to ligament reconstruction (37% vs. 9%, $P = 0.03$). Moreover, reconstruction also resulted in better stability, with 64% of patients showing no varus laxity compared to 54% in the repair group. Although post-revision outcomes were similar, initial reconstruction reduced the need for revision surgery, further highlighting its superior long-term stability compared to primary repair. Similarly, Levy *et al.*[51] evaluated 83 patients with PLC injuries and reported a significantly higher failure rate for primary repair compared to reconstruction (40% vs. 6%, $P < 0.001$). In addition, reconstruction resulted in better stability with lower rates of residual varus and external rotation instability at follow-up. Finally, primary repair failures often require revision with reconstruction surgery, which further reinforces reconstruction as the preferred initial technique. Moreover, Black and Stannard[73] reviewed two high-quality comparative studies and found a significantly higher failure rate for repair compared to reconstruction (38.5% vs. 7.5%, $P < 0.05$). Despite similar Lysholm (86.5 vs. 89.5, $P = 0.92$) and IKDC subjective (70.4 vs. 68.6, $P = 0.92$) scores at final follow-up, the higher failure rate in repairs often required revision surgery. Further adding to the findings of previous studies, they emphasized that while primary repair may be an option in acute settings (<3 weeks post-injury) with good tissue quality, reconstruction remains the preferred technique due to its superior long-term stability and lower risk of complications.[73] Geeslin *et al.*[74] conducted a systematic review and reported IKDC scores ranging from 78.1 to 91.3 and Lysholm scores from 87.5 to 90.3 in patients treated within 3 weeks of injury. They also noted an overall failure rate of 19%, which increased to 38% in staged repairs.[74] Moulton *et al.*[18] reported a 90% success rate for chronic PLC injuries managed with reconstruction, as determined by varus stress testing and radiographic assessment. Postoperatively, Lysholm scores ranged from 65.5 to 91.8, with 9 out of 10 studies reporting scores above 80, which indicated favorable functional outcomes. Similarly, IKDC scores ranged from 62.6 to 86.0. Notably, 59% of patients had concomitant PCL injuries, while only 12% had isolated PLC injuries, which highlights the strong association between PLC instability and other ligamentous deficiencies. Despite variations in surgical techniques, the study emphasized that anatomic-based reconstructions that include fibular sling techniques and tibial tunnel-based approaches consistently yielded favorable outcomes.

Furthermore, the LaPrade anatomical reconstruction technique has demonstrated superior results, restoring stability and reducing laxity. Varus stress radiographs showed an improvement in laxity from a 6.2 mm pre-operative SSD to 0.1 mm at follow-up.[15] Patient-reported outcomes also improved significantly, with Cincinnati scores rising from 21.9 to 81.4 and IKDC subjective scores from 29.1 to 81.5.[5] These findings underscore the importance of timely anatomical reconstruction to achieve optimal recovery and prevent further knee degeneration.[1,4]

Although the LaPrade anatomical reconstruction technique has demonstrated superior outcomes in restoring PLC stability, certain aspects remain subject to debate. One notable concern is the role of the PFL in stabilizing the proximal tibiofibular (PTF) joint. The PFL plays a key role in external rotation restraint and varus stability; however, its direct contribution to proximal tibiofibular stabilization remains unclear. Some studies suggest that reconstructing the PFL in isolation may be insufficient to restore stability to the PTF joint, especially in cases where PTF instability coexists with PLC injuries.[75] In their study, Jabara *et al.* demonstrated a 9% incidence rate of PTF joint instability in the setting of multiligament knee injuries.[76] In addition, excessive tensioning of the reconstructed PFL could alter the biomechanics of the fibular head, potentially leading to altered joint kinematics or discomfort.[77] Further biomechanical research is warranted to determine whether additional stabilization techniques, such as fibular-based augmentations or alternative graft placements, are needed to optimize outcomes in patients with concomitant PLC and PTF joint instability.

While studies consistently favor reconstruction over repair for PLC injuries, several limitations must be considered when interpreting these findings. One major limitation is the variability in surgical techniques across studies, including differences in graft type (allograft vs. autograft), tunnel placement, and fixation methods. In addition, the heterogeneity in patient populations, particularly in the proportion of isolated PLC injuries compared to combined PLC-PCL or PLC-ACL injuries, further complicates the generalizability of the findings across studies.

Moreover, rehabilitation protocols also varied significantly among studies, with differences in postoperative weight-bearing restrictions, bracing protocols, and return-to-play criteria. This inconsistency in rehabilitation strategies may influence clinical outcomes and could contribute to differences in reported success rates. Another important limitation in the literature is the lack of high-level evidence, with most studies being retrospective cohort studies or case series (Level III and IV evidence). The absence of randomized controlled trials limits the ability to draw definitive conclusions regarding the superiority of reconstruction over repair. In addition, long-term outcomes beyond 5-10 years remain underreported, making it difficult to assess the durability of different surgical approaches over time. Despite these limitations, current evidence strongly supports reconstruction as the superior approach with lower failure and revision rates and better long-term stability compared to repair. However, future research should focus on standardizing surgical techniques and conducting high-quality prospective studies to further refine treatment strategies for PLC injuries. Moreover, standardization of rehabilitation protocols is another important area for improvement with prospective studies comparing accelerated rehabilitation programs to traditional staged approaches needed to determine the optimal strategy to improve recovery and improve long-term functional outcomes while minimizing complications such as graft failure and arthrofibrosis.

CONCLUSION

The FCL, PLT, and PFL are key stabilizers of the PLC, primarily resisting varus stress and external rotation while providing secondary support against anterior tibial translation. These injuries often occur with cruciate ligament tears and are frequently missed in acute settings. Over the past three decades, reconstruction has been shown to be superior to repair, with the early surgical intervention offering better outcomes. Anatomical reconstruction techniques, supported by biomechanical and clinical studies, have proven most effective in restoring knee stability and achieving optimal subjective and radiographic results at follow-up.

Author contributions: JEN, BS, LVT, RFL: Concept and design of the study; JEN, BS: Literature review; JEN, BS: Analysis and interpretation of literature; JEN, BS, LVT, RFL: Drafting of the article or revising, final approval, and accountable for all aspects.

Ethical approval: The Institutional Review Board approval is not required since it was a narrative review.

Declaration of patient consent: Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship: Nil.

Conflicts of interest: Robert F. LaPrade reports a relationship with Ossur Americas that includes: consulting or advisory. Robert F. LaPrade reports a relationship with Smith and Nephew Inc that includes: consulting or advisory. Robert F. LaPrade reports a relationship with Linvatec Europe that includes: consulting or advisory. Robert F. LaPrade reports a relationship with Responsive Arthroscopy that includes: consulting or advisory. Robert F. LaPrade reports a relationship with Ossur Americas Inc that includes: funding grants. Robert F. LaPrade reports a relationship with Smith and Nephew Inc that includes: funding grants. Robert F. LaPrade reports a relationship with Arthroscopy Association of North America that includes: funding grants.

Robert F. LaPrade reports a relationship with American Orthopedic Society for Sports Medicine that includes: funding grants.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. LaPrade RF, Floyd ER, Carlson GB, Moatshe G, Chahla J, Monson J. The posterolateral corner: Explanations and outcomes. J Arthrosc Surg Sports Med 2021;2:108-18.
2. Geeslin AG, LaPrade RF. Location of bone bruises and other osseous injuries associated with acute grade III isolated and combined posterolateral knee injuries. Am J Sports Med 2010;38:2502-8.
3. LaPrade RF, Wentorf FA, Fritts H, Gundry C, Hightower CD. A prospective magnetic resonance imaging study of the incidence of posterolateral and multiple ligament injuries in acute knee injuries presenting with a hemarthrosis. Arthroscopy 2007;23:1341-7.
4. Chahla J, Moatshe G, Dean CS, LaPrade RF. Posterolateral corner of the knee: Current concepts. Arch Bone Jt Surg 2016;4:97-103.
5. Harner CD, Vogrin TM, Höher J, Ma CB, Woo SL. Biomechanical analysis of a posterior cruciate ligament reconstruction. Deficiency of the posterolateral structures as a cause of graft failure. Am J Sports Med 2000;28:32-9.
6. LaPrade RF, Resig S, Wentorf F, Lewis JL. The effects of grade III posterolateral knee complex injuries on anterior cruciate ligament graft force. A biomechanical analysis. Am J Sports Med 1999;27:469-75.
7. LaPrade RF, Muench C, Wentorf F, Lewis JL. The effect of injury to the posterolateral structures of the knee on force in a posterior cruciate ligament graft: A biomechanical study. Am J Sports Med 2002;30:233-8.
8. Falaas KL, Rodriguez AN, LaPrade RF. Posterolateral corner injury. In: Espregueira-Mendes J, Karlsson J, Musahl V, Ayeni OR, editors. Orthopaedic sports medicine: An encyclopedic review of diagnosis, prevention, and management. Berlin: Springer International Publishing; 2023. p. 1-19.
9. LaPrade RF, Chahla J. Evidence-based management of complex knee injuries e-book: Restoring the anatomy to achieve best outcomes. Netherlands: Elsevier Health Sciences; 2020. p. 112-26.
10. Nannaparaju M, Mortada S, Wiik A, Khan W, Alam M. Posterolateral corner injuries: Epidemiology, anatomy, biomechanics and diagnosis. Injury 2018;49:1024-31.
11. LaPrade RF, Hamilton CD, Engebretsen L. Treatment or acute and chronic combined anterior cruciate ligament and posterolateral knee ligament injuries. Sports Med Arthrosc Rev 1997;5:91.
12. Pacheco RJ, Ayre CA, Bollen SR. Posterolateral corner injuries of the knee: A serious injury commonly missed. J Bone Joint Surg Br 2011;93:194-7.
13. Griffith CJ, Wijdicks CA, Goerke U, Michaeli S, Ellermann J, LaPrade RF.

Outcomes of untreated posterolateral knee injuries: An *in vivo* canine model. Knee Surg Sports Traumatol Arthrosc 2011;19:1192-7.
14. LaPrade RF, Wentorf FA, Crum JA. Assessment of healing of grade III posterolateral corner injuries: An *in vivo* model. J Orthop Res 2004;22:970-5.
15. Geeslin AG, LaPrade RF. Outcomes of treatment of acute grade-III isolated and combined posterolateral knee injuries: A prospective case series and surgical technique. J Bone Joint Surg Am 2011;93:1672-83.
16. Laprade RF, Griffith CJ, Coobs BR, Geeslin AG, Johansen S, Engebretsen L. Improving outcomes for posterolateral knee injuries. J Orthop Res 2014;32:485-91.
17. LaPrade RF, Johansen S, Agel J, Risberg MA, Moksnes H, Engebretsen L. Outcomes of an anatomic posterolateral knee reconstruction. J Bone Joint Surg Am 2010;92:16-22.
18. Moulton SG, Geeslin AG, LaPrade RF. A systematic review of the outcomes of posterolateral corner knee injuries, part 2: Surgical treatment of chronic injuries. Am J Sports Med 2016;44:1616-23.
19. LaPrade RF, Spiridonov SI, Coobs BR, Ruckert PR, Griffith CJ. Fibular collateral ligament anatomical reconstructions: A prospective outcomes study. Am J Sports Med 2010;38:2005-11.
20. LaPrade RF, Johansen S, Wentorf FA, Engebretsen L, Esterberg JL, Tso A. An analysis of an anatomical posterolateral knee reconstruction: An *in vitro* biomechanical study and development of a surgical technique. Am J Sports Med 2004;32:1405-14.
21. LaPrade RF, Ly TV, Wentorf FA, Engebretsen L. The posterolateral attachments of the knee: A qualitative and quantitative morphologic analysis of the fibular collateral ligament, popliteus tendon, popliteofibular ligament, and lateral gastrocnemius tendon. Am J Sports Med 2003;31:854-60.
22. James EW, LaPrade CM, LaPrade RF. Anatomy and biomechanics of the lateral side of the knee and surgical implications. Sports Med Arthrosc Rev 2015;23:2-9.
23. LaPrade RF, Hamilton CD. The fibular collateral ligament-biceps femoris bursa. An anatomic study. Am J Sports Med 1997;25:439-43.
24. Kane PW, Cinque ME, Moatshe G, Chahla J, DePhillipo NN, Provencher MT, *et al.* Fibular collateral ligament: Varus stress radiographic analysis using 3 different clinical techniques. Orthop J Sports Med 2018;6. Available from: http://dx.doi.org/10.1177/2325967118770170.
25. LaPrade RF, Wozniczka JK, Stellmaker MP, Wijdicks CA. Analysis of the static function of the popliteus tendon and evaluation of an anatomic reconstruction: The "fifth ligament" of the knee. Am J Sports Med 2010;38:543-9.
26. Moorman CT 3rd, LaPrade RF. Anatomy and biomechanics of the posterolateral corner of the knee. J Knee Surg 2005;18:137-45.
27. McCarthy M, Camarda L, Wijdicks CA, Johansen S, Engebretsen L, Laprade RF. Anatomic posterolateral knee reconstructions require a popliteofibular ligament reconstruction through a tibial tunnel. Am J Sports Med 2010;38:1674-81.
28. Moatshe G, Dean CS, Chahla J, Serra Cruz R, LaPrade RF. Anatomic fibular collateral ligament reconstruction. Arthrosc Tech 2016;5:e309-14.
29. Godin JA, Chahla J, Moatshe G, Kruckeberg BM, Muckenhirn KJ, Vap AR, *et al.* A Comprehensive reanalysis of the distal iliotibial band: Quantitative anatomy, radiographic markers, and biomechanical properties. Am J Sports Med 2017;45:2595-603.
30. Sonnery-Cottet B, Lutz C, Daggett M, Dalmay F, Freychet B, Niglis L, *et al.* The involvement of the anterolateral ligament in rotational control of the knee. Am J Sports Med 2016;44:1209-14.
31. Hughston JC, Andrews JR, Cross MJ, Moschi A. Classification of knee ligament instabilities. Part II. The lateral compartment. J Bone Joint Surg Am 1976;58:173-9.
32. Figueroa F, Figueroa D, Putnis S, Guiloff R, Caro P, Espregueira-Mendes J. Posterolateral corner knee injuries: A narrative review. EFORT Open Rev 2021;6:676-85.
33. LaPrade RF, Terry GC. Injuries to the posterolateral aspect of the knee. Association of anatomic injury patterns with clinical instability. Am J Sports Med 1997;25:433-8.
34. Ranawat A, Baker CL, Henry S, Harner CD. Posterolateral corner injury of the knee: Evaluation and management. J Am Acad Orthop Surg 2008;16:506-18.
35. Cooper JM, McAndrews PT, LaPrade RF. Posterolateral corner injuries of the knee: Anatomy, diagnosis, and treatment. Sports Med Arthrosc Rev 2006;14:213-20.
36. Veltri DM, Deng XH, Torzilli PA, Warren RF, Maynard MJ. The role of the cruciate and posterolateral ligaments in stability of the knee. A biomechanical study. Am J Sports Med 1995;23:436-43.
37. Bae JH, Choi IC, Suh SW, Lim HC, Bae TS, Nha KW, *et al.* Evaluation of the reliability of the dial test for posterolateral rotatory instability: A cadaveric study using an isotonic rotation machine. Arthrosc J Arthrosc Relat Surg 2008;24:593-8.
38. Vosoughi F, Rezaei Dogahe R, Nuri A, Ayati Firoozabadi M, Mortazavi J. Medial collateral ligament injury of the knee: A review on current concept and management. Arch Bone Jt Surg 2021;9:255-62.
39. Cooper DE. Tests for posterolateral instability of the knee in normal subjects. Results of examination under anesthesia. J Bone Joint Surg Am 1991;73:30-6.
40. LaPrade RF, Ly TV, Griffith C. The external rotation recurvatum test revisited: Reevaluation of the sagittal plane tibiofemoral relationship. Am J Sports Med 2008;36:709-12.
41. Hughston JC, Norwood LA. The posterolateral drawer test and external rotational recurvatum test for posterolateral rotatory instability of the knee. Clin Orthop 1980;147:82-7.
42. Cinque ME, Geeslin AG, Chahla J, Moatshe G, Pogorzelski J, DePhillipo NN, *et al.* The heel height test: A novel tool for the detection of combined anterior cruciate ligament and fibular collateral ligament tears. Arthrosc J Arthrosc Relat Surg 2017;33:2177-81.
43. LaPrade RF, Heikes C, Bakker AJ, Jakobsen RB. The reproducibility and repeatability of varus stress radiographs in the assessment of isolated fibular collateral ligament and grade-III posterolateral knee injuries. An *in vitro* biomechanical study. J Bone Joint Surg Am 2008;90:2069-76.
44. Moatshe G, Chahla J, LaPrade RF, Engebretsen L. Diagnosis and treatment of multiligament knee injury: State of the art. J ISAKOS 2017;2:152-61.
45. Kane PW, DePhillipo NN, Cinque ME, Moatshe G, Chahla J, Carpenter E, *et al.* Increased accuracy of varus stress radiographs versus magnetic resonance imaging in diagnosing fibular collateral ligament grade III tears. Arthrosc J Arthrosc Relat Surg 2018;34:2230-5.
46. Bonadio MB, Helito CP, Gury LA, Demange MK, Pécora JR, Angelini FJ. Correlation between magnetic resonance imaging and physical exam in assessment of injuries to posterolateral corner of the knee. Acta Ortop Bras 2014;22:124.
47. Theodorou DJ, Theodorou SJ, Fithian DC, Paxton L, Garelick DH, Resnick D. Posterolateral complex knee injuries: Magnetic resonance imaging with surgical correlation. Acta Radiol Stockh Swed 1987 2005;46:297-305.
48. Kannus P. Nonoperative treatment of grade II and III sprains of the lateral ligament compartment of the knee. Am J Sports Med 1989;17:83-8.
49. Krukhaug Y, Mølster A, Rodt A, Strand T. Lateral ligament injuries of the knee. Knee Surg Sports Traumatol Arthrosc 1998;6:21-5.
50. Clancy WG, Sutherland TB. Combined posterior cruciate ligament injuries. Clin Sports Med 1994;13:629-47.
51. Levy BA, Dajani KA, Morgan JA, Shah JP, Dahm DL, Stuart MJ. Repair versus reconstruction of the fibular collateral ligament and posterolateral corner in the multiligament-injured knee. Am J Sports Med 2010;38:804-9.
52. Insall & Scott Surgery of the Knee; 2011. Available from: https://shop.elsevier.com/books/insall-and-scott-surgery-of-the-knee/scott/978-1-4377-1503-3 [Last accessed on 2024 Nov 10].
53. Stannard JP, Brown SL, Farris RC, McGwin G, Volgas DA. The posterolateral corner of the knee: Repair versus reconstruction. Am J Sports Med 2005;33:881-8.
54. Gilmer BB. Double-row suture anchor repair of posterolateral corner avulsion fractures. Arthrosc Tech 2017;6:e997-1001.
55. Nassar JE, Sleem B, Tollefson LV, Shoemaker EP, LaPrade RF, Moatshe G. Strategies for preventing tunnel convergence in multiligament knee injury reconstructions. Indian J Orthop 2024;58:1528-36.
56. Franciozi CE, Albertoni LJ, Kubota MS, Abdalla RJ, Luzo MV, Cohen M, *et al.* A hamstring-based anatomic posterolateral knee reconstruction with autografts improves both radiographic instability and functional outcomes. Arthrosc J Arthrosc Relat Surg 2019;35:1676-85.e3.
57. Moatshe G, Brady AW, Slette EL, Chahla J, Turnbull TL, Engebretsen L, *et al.* Multiple ligament reconstruction femoral tunnels: Intertunnel relationships and guidelines to avoid convergence. Am J Sports Med 2017;45:563-9.
58. Moatshe G, Slette EL, Engebretsen L, LaPrade RF. Intertunnel relationships in the tibia during reconstruction of multiple knee ligaments: How to avoid tunnel convergence. Am J Sports Med 2016;44:2864-9.
59. Moatshe G, LaPrade RF, Engebretsen L. How to avoid tunnel convergence in a multiligament injured knee. Ann Jt. 2018;3:93.

60. Floyd ER, Carlson GB, Monson J, LaPrade RF. Multiple ligament reconstructions of the knee and posterolateral corner. Arthrosc Tech 2021;10:e1269-80.
61. Yuen WL, Loh SY. Reduction of collision risk in multi-ligament knee injury KD-III-M and KD-IV surgery-superficial medial collateral ligament reconstruction with suture anchors. Arthrosc Tech 2023;12:e413-20.
62. Gursoy S, Perry AK, Brady A, Dandu N, Singh H, Vadhera AS, *et al*. Optimal tibial tunnel placement for medial and lateral meniscus root repair on the anteromedial tibia in the setting of anterior and posterior cruciate ligament reconstruction of the knee. Am J Sports Med 2022;50:1237-44.
63. Beck EC, Gowd AK, Nabor D, Waterman BR. Cortical button fixation for proximal tibiofibular instability: A technical report. Arthrosc Tech 2020;9:e1415-21.
64. Kruckeberg BM, Cinque ME, Moatshe G, Marchetti D, DePhillipo NN, Chahla J, *et al*. Proximal tibiofibular joint instability and treatment approaches: A systematic review of the literature. Arthrosc J Arthrosc Relat Surg 2017;33:1743-51.
65. Solan MC, Davies MS, Sakellariou A. Syndesmosis stabilisation: Screws versus flexible fixation. Foot Ankle Clin 2017;22:35-63.
66. Thornes B, Shannon F, Guiney AM, Hession P, Masterson E. Suture-button syndesmosis fixation: Accelerated rehabilitation and improved outcomes. Clin Orthop 2005;431:207-12.
67. Chen B, Chen C, Yang Z, Huang P, Dong H, Zeng Z. To compare the efficacy between fixation with tightrope and screw in the treatment of syndesmotic injuries: A meta-analysis. Foot Ankle Surg 2019;25:63-70.
68. Sanders D, Schneider P, Taylor M, Tieszer C, Lawendy AR, Canadian Orthopaedic Trauma Society. Improved reduction of the tibiofibular syndesmosis with tightrope compared with screw fixation: Results of a randomized controlled study. J Orthop Trauma 2019;33:531-7.
69. Shelbourne KD, Urch SE, Gray T, Freeman H. Loss of normal knee motion after anterior cruciate ligament reconstruction is associated with radiographic arthritic changes after surgery. Am J Sports Med 2012;40:108-13.
70. Sit RW, Chan KK, Zou D, Chan DC, Yip BH, Zhang DD, *et al*. Clinic-based patellar mobilization therapy for knee osteoarthritis: A randomized clinical trial. Ann Fam Med 2018;16:521-9.
71. Shelbourne KD, Gray T. Minimum 10-year results after anterior cruciate ligament reconstruction: How the loss of normal knee motion compounds other factors related to the development of osteoarthritis after surgery. Am J Sports Med 2009;37:471-80.
72. Müller SA, Todorov A, Heisterbach PE, Martin I, Majewski M. Tendon healing: An overview of physiology, biology, and pathology of tendon healing and systematic review of state of the art in tendon bioengineering. Knee Surg Sports Traumatol Arthrosc 2015;23:2097-105.
73. Black BS, Stannard JP. Repair versus reconstruction in acute posterolateral instability of the knee. Sports Med Arthrosc Rev 2015;23:22-6.
74. Geeslin AG, Moulton SG, LaPrade RF. A systematic review of the outcomes of posterolateral corner knee injuries, part 1: Surgical treatment of acute injuries. Am J Sports Med 2016;44:1336-42.
75. Warner BT, Moulton SG, Cram TR, LaPrade RF. Anatomic reconstruction of the proximal tibiofibular joint. Arthrosc Tech 2016;5:e207-10.
76. Jabara M, Bradley J, Merrick M. Is stability of the proximal tibiofibular joint important in the multiligament-injured knee? Clin Orthop 2014;472:2691-7.
77. Poffenberger A, Homan M, Dirnberger J, LaPrade RF. Reconstruction of the posterolateral corner of the knee. In: Doral MN, Karlsson J, editors. Sports injuries: Prevention, diagnosis, treatment and rehabilitation. Berlin: Springer; 2020. p. 1-20.

How to cite this article: Nassar JE, Sleem B, Tollefson LV, LaPrade RF. Anatomic reconstruction techniques for posterolateral corner injuries: Current concepts in management and rehabilitation. J Arthrosc Surg Sports Med. doi: 10.25259/JASSM_63_2024