

Anatomic Posterolateral Corner Reconstruction Using Semitendinosus and Gracilis Autografts: Surgical Technique



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Abstract: An anatomically based posterolateral corner (PLC) reconstruction has emerged as a viable and clinically effective surgical technique for midsubstance ligamentous injuries in both the acute and chronic settings. There are several surgical techniques for PLC reconstruction; however, the classic anatomic reconstruction technique (LaPrade technique) is now considered the gold standard and was originally described using an Achilles tendon allograft. In this article, we describe a modified LaPrade autograft technique, in which the same tunnel position, graft passage, and fixation are used to reproduce the 3 primary stabilizers of the PLC. Instead of allografts, hamstring autografts are used while tunnel diameters and fixation devices are adapted to them. With the use of autograft tendons, difficulties related to graft length or asymmetry are encountered. We consider this technique a good alternative for an anatomically based PLC reconstruction, especially given the lower availability and higher cost of allograft tissues in several countries.

Posterolateral corner (PLC) injuries of the knee are relatively uncommon and are most often combined with injuries to one or both cruciate ligaments. Only 28% of PLC tears occur in isolation, and they have been reported to account for up to 16% of all knee injuries.¹ Although the PLC has historically been known as “the dark side of the knee,” recent advances in our understanding of the PLC anatomy and biomechanics have resulted in improved clinical-surgical outcomes for PLC injuries. Midsubstance PLC tears predominate over bony avulsion tears, and reconstruction of either

chronic or acute cases has emerged as the technique of choice.²⁻⁴ Many PLC reconstruction techniques have been described; however, recent studies have reported that anatomic reconstructions best restore the native knee biomechanics.^{5,6} The classic LaPrade technique addresses the 3 primary stabilizing structures of the PLC: the fibular collateral ligament (FCL), the popliteus tendon (PLT), and the popliteofibular ligament (PFL).⁷ This technique, considered the gold standard for an anatomic PLC reconstruction, was first described using a split bone-tendon Achilles allograft to reconstruct the FCL, PFL, and PLT. However, in this article, we describe the LaPrade autograft technique for the treatment of PLC tears. In several countries where low allograft availability and higher costs are common challenges, this technique provides an additional option for surgeons to avoid these obstacles (Video 1).

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Diagnosis

The history of a PLC injury typically involves a direct varus stress trauma, hyperextension, or a twisting mechanism.⁸ The physical examination depends on the presence of combined injuries such as anterior cruciate ligament (ACL) and/or posterior cruciate ligament tears. Limb alignment and the gait pattern are assessed clinically, and radiographs are obtained. Increased varus, positive findings of the posterolateral drawer test, the dial test at 30°, and

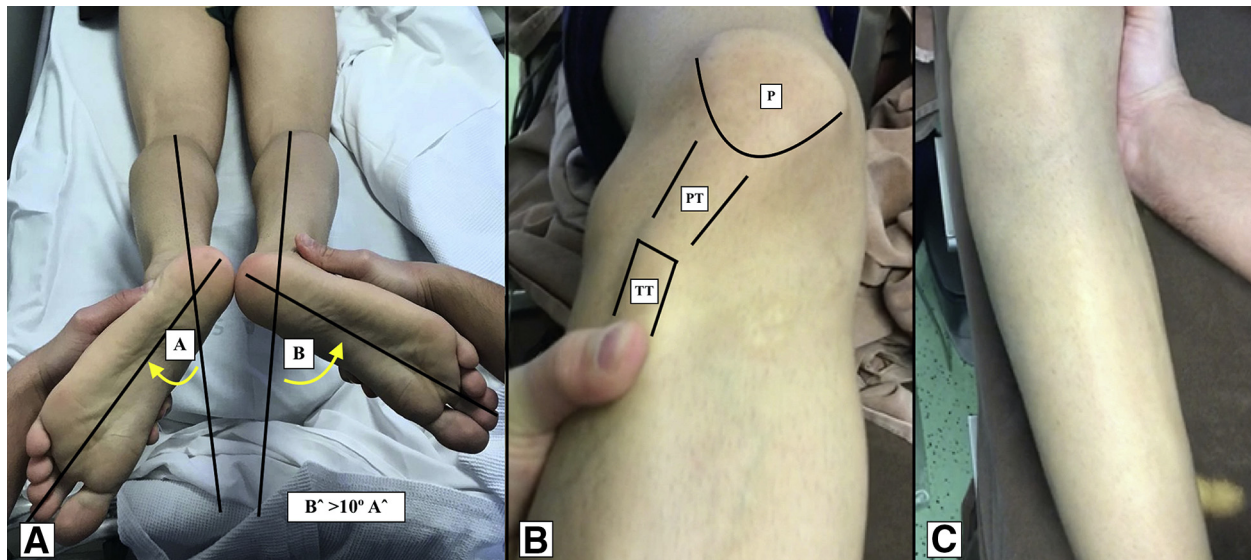


Fig 1. Physical examination of a posterolateral corner injury in a right knee with the patient under anesthesia. (A) The result of the dial test at 30° of knee flexion is deemed positive when an increase of more than 10° of external rotation is present on the operative side (B) compared with the contralateral side (A). (B) The reverse pivot-shift test result is positive when a subluxated lateral tibial plateau reduces from flexion to extension at 35° to 40° of knee flexion. (C) The varus stress test is performed, and lateral gapping is assessed compared with the contralateral side at 30° of knee flexion (fibular collateral ligament injury) and in full extension (combined fibular collateral ligament, posterolateral corner, and cruciate injury). At least 6 cm skin bridge should be maintained between incisions (dashed line). P, patella; PT, patellar tendon; TT, tibial tubercle.

the reverse pivot-shift test, and increased recurvatum laxity are also observed—the latter when combined with ACL tears (Fig 1).⁹ It is also crucial to assess the function of the common peroneal nerve (CPN), which has been reported to have an associated injury in 13% of cases. Workup studies include weight-bearing limb alignment, anteroposterior-view, and lateral-view radiographs. Increased varus alignment in a chronic PLC injury might be an indication for a concurrent or staged correction high tibial osteotomy.¹⁰ Bilateral varus stress radiography, a reliable and reproducible method, is also performed to objectively evaluate the severity of the lesion, with the presence of a side-to-side difference between 2.2 and 2.7 mm indicating a complete FCL tear.¹¹ A side-to-side difference in lateral-compartment gapping greater than 4 mm indicates a complete PLC tear. Magnetic resonance imaging is obtained to precisely localize the PLC tear and assess other concurrent ligamentous, meniscal, or chondral lesions (Fig 2). The surgical steps of anatomic PLC reconstruction using hamstring (HS) autografts are summarized in Table 1.

Patient Positioning

The patient is positioned supine on the operating table, and the surgical limb is placed in a leg holder. An examination under anesthesia is performed to confirm the diagnosis. A well-padded pneumatic

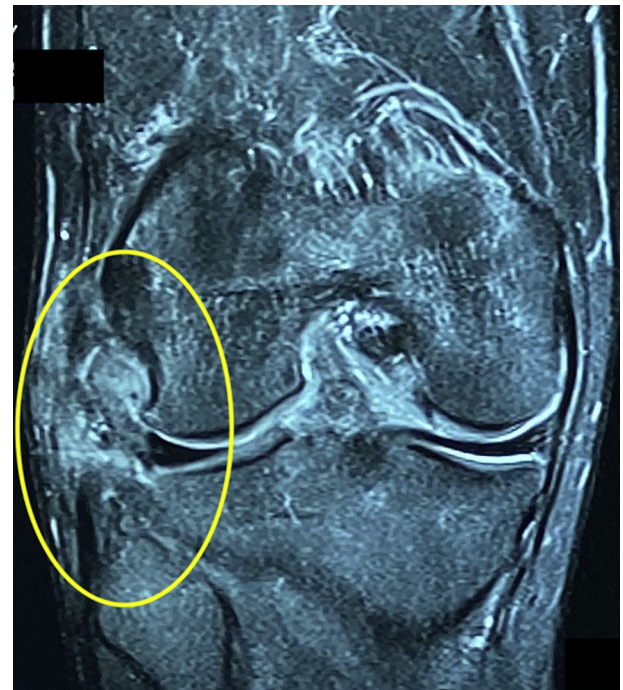


Fig 2. Magnetic resonance imaging is performed (and stress radiographs are obtained) to determine the location of the torn posterolateral corner structures and to assess for concurrent injuries in the right knee. In this case, an intra-substance tear of the posterolateral corner structures can be visualized (oval) on the coronal view, with a concurrent anterior cruciate ligament injury.

Table 1. Summarized Surgical Steps for Anatomic Posterolateral Corner Reconstruction Using Hamstring Autografts

1. Perform patient positioning and an examination under anesthesia.
2. Establish the surgical approach.
3. Perform common peroneal nerve neurolysis and posterolateral dissection between the lateral gastrocnemius and soleus muscle.
4. Identify the FCL remnant and attachment site at the fibular head.
5. Place the fibular and tibial guide pins. Verify the 1 × 1-cm posterior distance, and drill tunnels with 6- and 7-mm drills, respectively. Place the passing sutures.
6. Perform a longitudinal ITB incision anterior to the FCL. Identify the femoral insertions of the FCL and PLT.
7. Use femoral guide pins for FCL and PLT placement. Verify the 18.5-mm distance and 25-mm-deep sockets with a 6-mm drill.
8. Fix grafts on the femur with 7-mm screws. Pass both grafts under the ITB.
9. Fix the FCL in the fibular tunnel in neutral rotation, slight valgus, and 30° of knee flexion.
10. Fix the PFL and PLT segments of the grafts in the tibial tunnel in neutral rotation and at 60° of knee flexion.

FCL, fibular collateral ligament; ITB, iliotibial band; PFL, popliteofibular ligament; PLT, popliteus tendon.

tourniquet is placed on the upper thigh, which is then prepared and draped in a standard fashion. A cushion is placed under the contralateral free-hanging limb, or an abduction leg holder may be used.

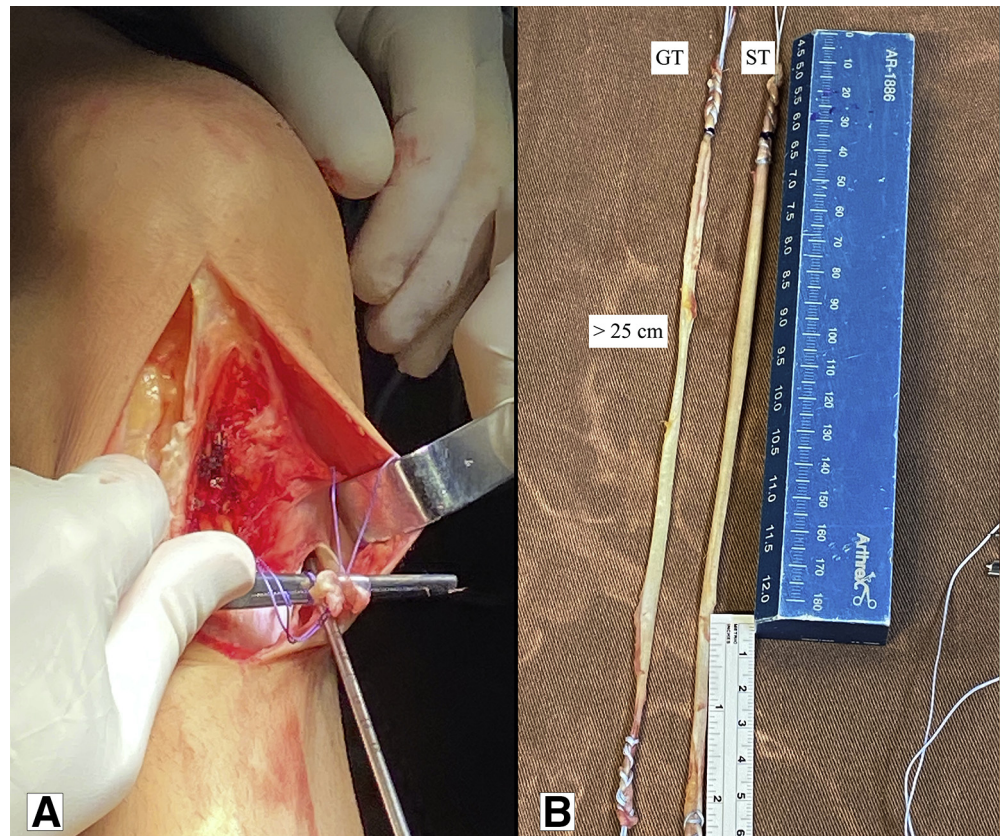
Surgical Approach

First, HS autografts are harvested. If a concurrent ACL reconstruction is performed with a bone-tendon-bone autograft, the same longitudinal skin incision is used for both grafts, being placed 1 cm more medially and with caution to maintain a 6-cm skin bridge between this and the posterolateral knee surgical approach. An open or closed HS tendon stripper (Arthrex) is used, aiming to obtain a graft as long as possible right from the tendon-bone interphase insertion. Both grafts are prepared on the back table individually, and a suture (FiberLoop, No. 2-0; Arthrex) is whipstitched on each end of each graft for graft passage (Fig 3).

Because most PLC tears are combined with cruciate ligament or meniscal tears, we first address the extra-articular phase for improved visualization of the posterolateral structures of the knee without extravasation fluid interposed. A lateral hockey-stick skin incision is performed along the iliotibial band (ITB) and distally between the fibular head and the Gerdy tubercle (Fig 4A). The subcutaneous tissue is dissected, and a posteriorly based skin flap is developed.

Next, neurolysis of the CPN is performed and the nerve is protected to prevent nerve irritation or a foot drop during postoperative soft-tissue swelling (Fig 4B). The nerve is located posteromedially to the long head of

Fig 3. Right knee. (A) When concurrent anterior cruciate ligament reconstruction and posterolateral corner reconstruction are performed, patellar tendon autograft (bone-tendon-bone) and hamstring autograft are used, respectively, via the same surgical incision. (B) When both tendons (semitendinosus tendon [ST] and gracilis tendon [GT]) measure more than 25 cm long, a good length for graft fixation on the tibia is achieved for posterolateral corner reconstruction.



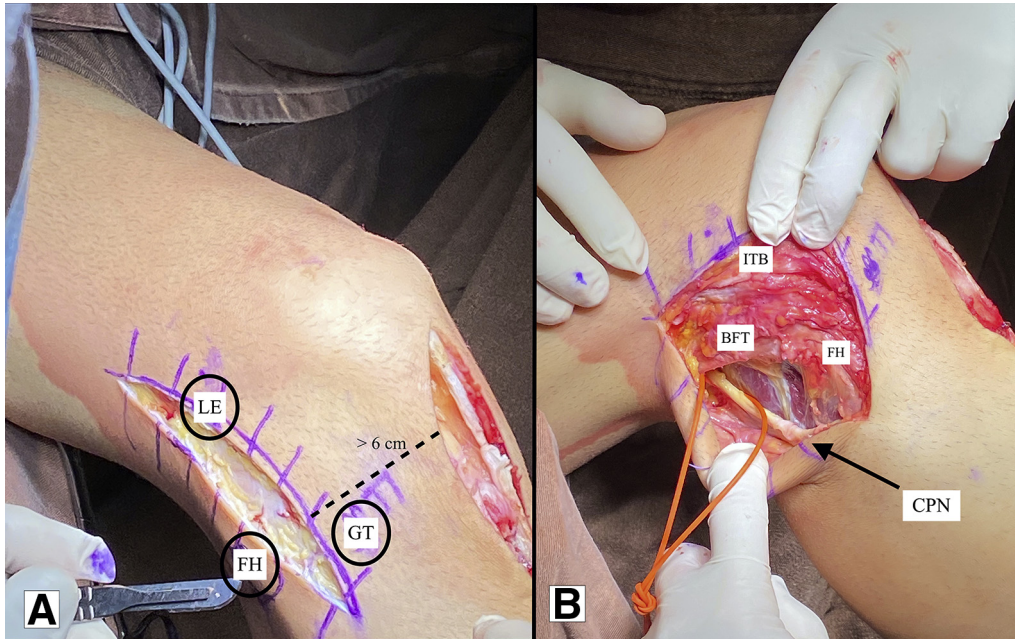


Fig 4. Surgical approach to posterolateral corner in right knee. (A) A lateral hockey-stick skin incision is performed along the iliotibial band (ITB) and the lateral epicondyle (LE) proximally and is extended distally, between the fibular head (FH) and the Gerdy tubercle (GT). (B) A posteriorly based flap is performed, followed by neurolysis of the common peroneal nerve (CPN), found under the biceps femoris tendon (BFT).

the biceps femoris and is dissected up to 6 cm proximally and 5 to 7 mm distally, incising the long peroneus fascia. Next, blunt dissection can be carried out posterior to the fibular head in the interval between the lateral gastrocnemius and soleus muscle. The musculotendinous portion of the popliteus muscle and the posteromedial aspect of the fibular styloid are palpated.

A horizontal incision is made over the long head of the biceps femoris (1 cm proximal to the fibular head), and the biceps bursa is then incised to identify the mid portion of the FCL remnant. Tag stitch suture is placed

on the FCL remnant at this time and pulled to precisely localize its anatomic femoral and fibular insertion sites to achieve anatomic tunnel positioning. It is worth noting that even with grade III FCL injuries, a remnant of continuous tissue can usually be found.

Subperiosteal dissection of the lateral aspect of the fibular head is performed from anterior to posterior, until the champagne glass drop-off, to identify the distal FCL insertion, avoiding injury to the CPN. A retractor is placed posterior to the fibular head to protect the neurovascular structures, and a collateral ligament

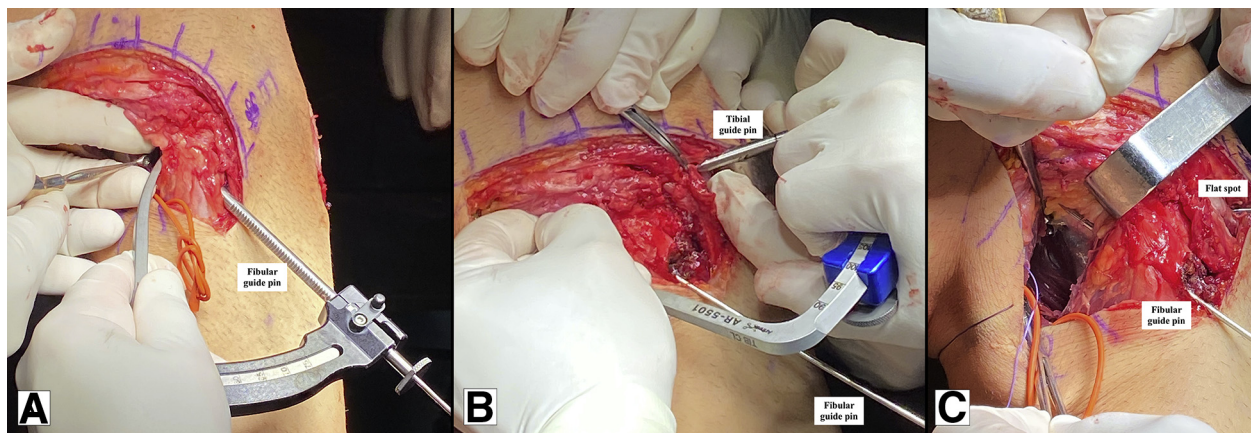


Fig 5. Posterolateral corner reconstruction in right knee: lateral view of fibular and tibial guide pin placement for subsequent tunnel reaming. (A) The fibular tunnel is drilled in an anterolateral to posteromedial direction, toward the posteromedial downslope of the fibular styloid. (B) The tibial guide pin is drilled from the tibial flat spot toward the tibial popliteal sulcus posteriorly. (C) The exit point should be 1 cm medial and 1 cm proximal to the exit of the fibular tunnel guide pin.

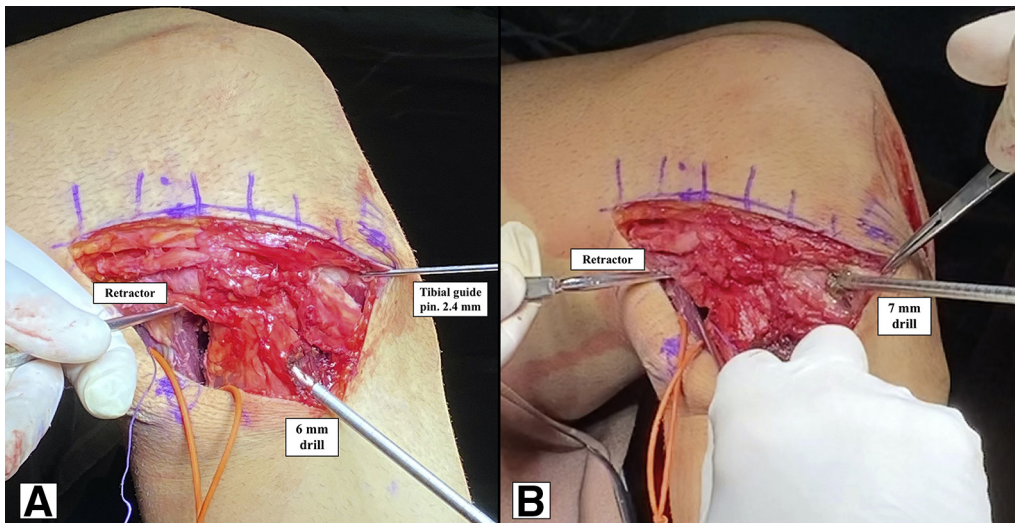


Fig 6. Posterolateral corner reconstruction in right knee: lateral view of fibular tunnel reaming. (A) The fibular tunnel is created by reaming over the guide pin with a 6-mm drill. (B) The tibial tunnel is created by over-drilling its guide pin with a 7-mm drill. A retractor is placed posteriorly (anterior to the lateral gastrocnemius muscle) to protect the neurovascular structures.

aiming device (or ACL guide) is used to pass a 2.4-mm guide pin (Arthrex), drilled in an anterolateral (FCL insertion) to posteromedial direction (posteromedial downslope of fibular styloid) (Fig 5A). To decrease the risk of a fibular head fracture, it is crucial to avoid aiming the guide pin too proximally.

The Gerdy tubercle is localized, and the tibial flat spot, located distally and medially, is identified without detachment of the ITB insertion site. This will be the starting point for the tibial tunnel (Fig 5B). Next, the popliteus musculotendinous junction is localized by palpating the tibial popliteal sulcus posteriorly. The posterior aperture of the tibial tunnel will be aimed to this point. A soft-tissue retractor is placed posterior to the tibia and anterior to the lateral gastrocnemius, and another 2.4-mm guide pin (Arthrex) is drilled in an anterior to posterior direction, using a PLC tibial aiming guide. The exit point should be 1 cm medial and 1 cm proximal to the posteromedial exit of the fibular tunnel guide pin (Fig 5C). It is useful to first position the guide pins and then make sure they are in the correct position posteriorly before reaming the tunnels. Typically, a 6-mm-diameter drill bit is used to ream the FCL fibular tunnel, and a passing suture is then placed with a loop anteriorly to facilitate later graft passage (Fig 6A). Depending on the size of the gracilis and semitendinosus (ST) tendons together, a 7- to 8-mm drill bit is used to ream the tibial tunnel and a passing suture is placed with a loop posteriorly for future graft passage (Fig 6B).

Now, attention is put on the femoral tunnels. The FCL suture tag is tensioned to localize the femoral attachment site first; then, the PLT femoral insertion is identified. A longitudinal 4-cm incision in line with the ITB fibers is performed slightly anterior to the FCL insertion

site (Fig 7A). If the FCL insertion is not identified, the lateral epicondyle is palpated and used as a guide landmark. The FCL femoral attachment is localized 1.4 mm and 3.1 mm proximal and posterior, respectively, to the lateral epicondyle. By use of a collateral ligament reconstruction aiming sleeve (Arthrex), a guide pin is drilled through the femoral FCL footprint at a 35° angulation anterior and slightly proximal to avoid tunnel convergence with a possible concurrent ACL reconstruction.¹² It should exit anteromedially about 5 cm proximal and anterior to the adductor tubercle. Before this guide pin is over-reamed, a small vertical incision into the lateral knee capsule is performed to identify the PLT insertion site (Fig 7B); it is located on the anterior fifth of the popliteal sulcus.⁵ Another guide pin is drilled parallel to the FCL guide pin, exiting on the medial cortex. The distance between the 2 guide pins should be 18.5 mm, which is the normal distance between the centers of the FCL and PLT attachment sites (Fig 7C).⁵ Next, 2 femoral closed-socket tunnels of 25 mm in depth are created with a 6-mm reamer over both the FCL and PLT guide pins. It is important to avoid deeper sockets to achieve a sufficient depth of the HS autografts for future fixation on the tibial side. Two passing sutures are placed in the femoral tunnels for future graft passage. The graft length should ideally be greater than 22 cm to achieve direct tibial fixation with a bioabsorbable screw; if this is not possible, suture post fixation should be performed.

Next, knee arthroscopy is performed to address other concurrent cruciate ligament tears and meniscal and/or chondral lesions. Concurrent cruciate ligament graft fixation is performed first on the femoral side and subsequently on the tibial side depending on the combined lesions present.¹³

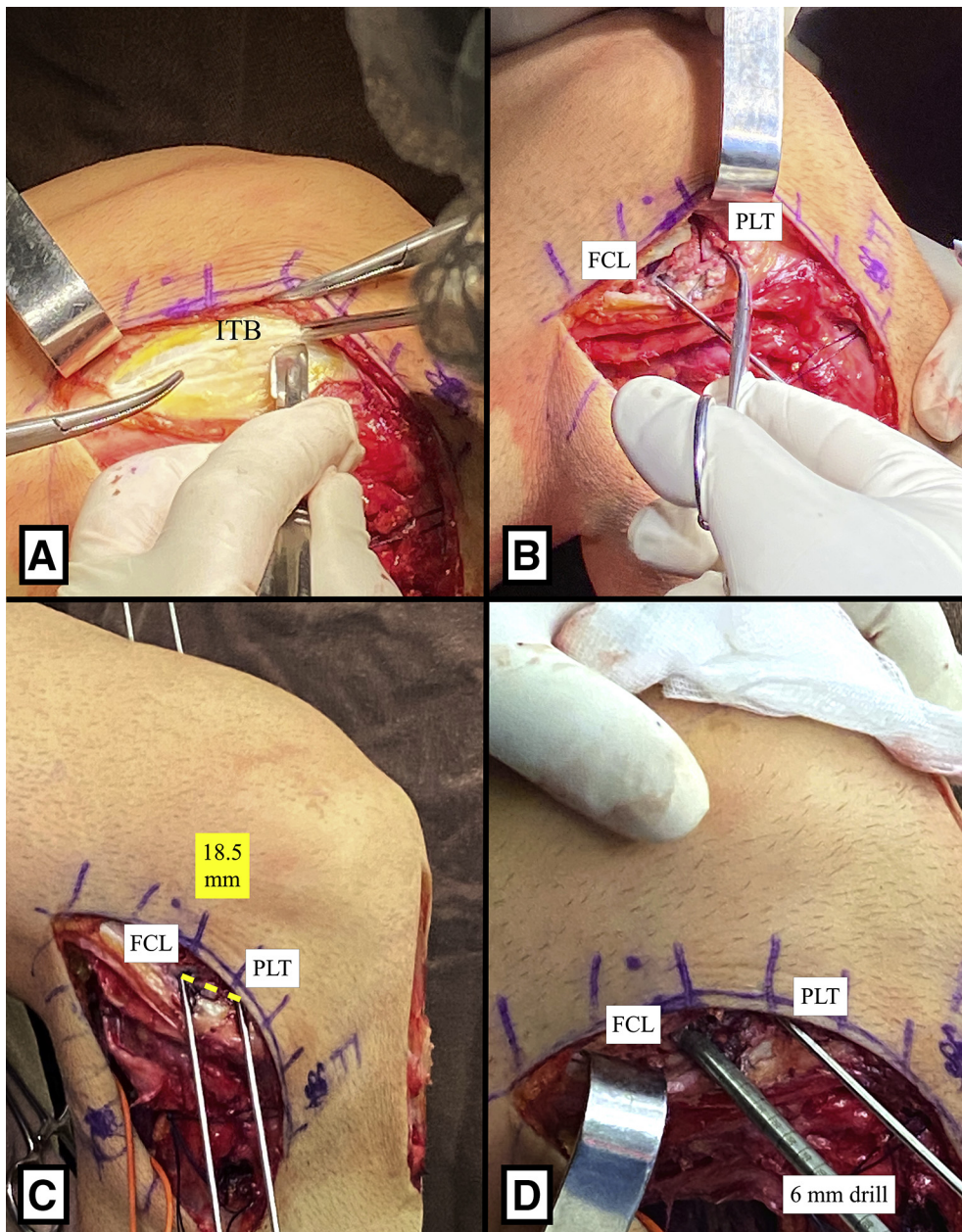


Fig 7. Posterolateral corner reconstruction in right knee: femoral tunnel guide pin placement and tunnel reaming. (A) A longitudinal 4-cm incision in line with the iliotibial band (ITB) fibers is performed slightly anterior to the fibular collateral ligament (FCL) insertion site. (B) After the FCL femoral insertion is identified, a guide pin is drilled through the femoral FCL footprint at a 35° angulation anterior and slightly proximal, aiming 5 cm proximal to the adductor tubercle. Next, the popliteus tendon (PLT) footprint is located on the anterior fifth of the popliteal sulcus. (C) A guide pin is drilled through the PLT footprint, parallel to the FCL guide pin. The distance between the 2 guide pins should be approximately 18.5 mm (dashed line). (D) Both tunnel sockets are reamed with a 6-mm drill and to a 25-mm depth.

The PLC grafts are now passed. The ST tendon autograft is first pulled into the FCL socket and fixed with a 7 × 23-mm bioabsorbable screw (Arthrex) (Fig 8A). Next, the gracilis tendon autograft is pulled into the PLT socket and fixed with another 7 × 23-mm bioabsorbable screw (Fig 8B). It is important to differentiate both grafts given that the ST is normally longer and must represent the FCL to achieve good tibial fixation. Next, the PLT graft is passed down through the popliteal hiatus, exiting at the popliteal sulcus posterolaterally (Fig 9A). The FCL graft is passed under the ITB (superficial to the PLT graft) and any remnants of the biceps femoris tissue to exit into the biceps bursa (Fig 9A).

Now, fibular and tibial PLC graft passage and fixation take place. The FCL graft is passed through the fibular tunnel from anterior to posterior (Fig 9B) and is fixed at 30° of knee flexion, in neutral rotation, and with a slight valgus force with a 6 × 23-mm bioabsorbable screw (Arthrex) (Fig 10A). After this, both the PFL and PLT grafts are passed from posterior to anterior through the tibial tunnel, by use of the previously placed passing suture (Fig 10B). Subsequently, the latter structures are fixed together at 60° of knee flexion and neutral rotation with a 7 × 23-mm bioabsorbable screw (Fig 11A). Any excess remaining graft exiting the tibial

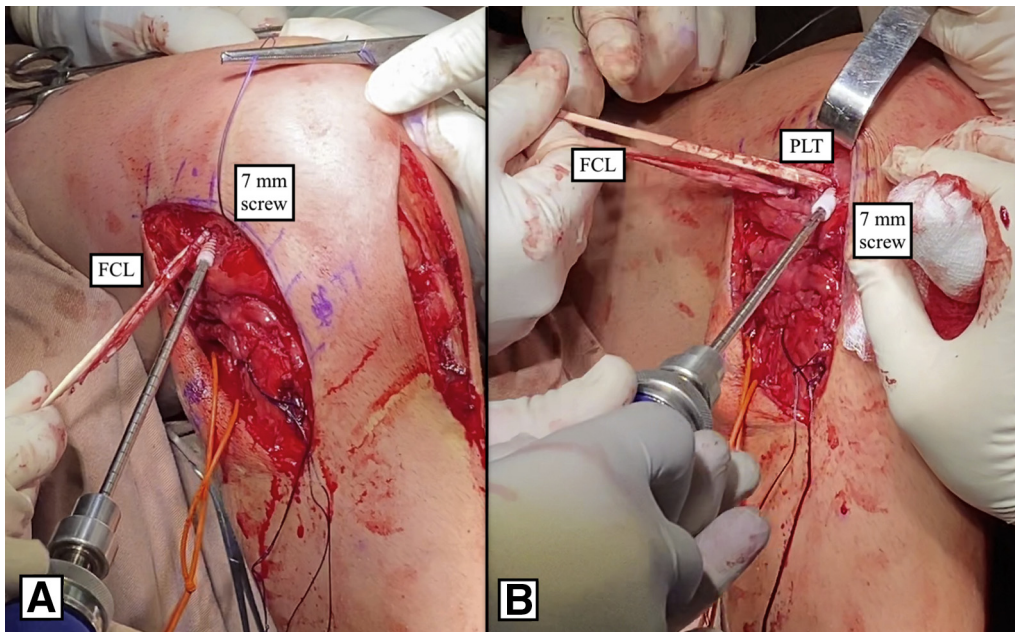


Fig 8. Posterolateral corner reconstruction in right knee: hamstring graft insertion. (A) The semitendinosus autograft is first pulled into the fibular collateral ligament (FCL) socket and fixed with a 7×23 -mm bioabsorbable screw. (B) The gracilis tendon autograft is subsequently pulled into the popliteus tendon (PLT) socket and fixed with another 7×23 -mm bioabsorbable screw.

aperture may be cut after final fixation (**Fig 11B**). The knee is assessed for stability and range of motion (ROM).

Next, the soft tissues are irrigated, and the lateral capsule and ITB are closed with a No. 0 Vicryl suture

(Ethicon). The superficial layers are closed in a similar fashion using subcutaneous skin sutures (**Fig 11C**). Pearls and pitfalls of this technique are summarized in **Table 2**, and advantages and disadvantages are summarized in **Table 3**.

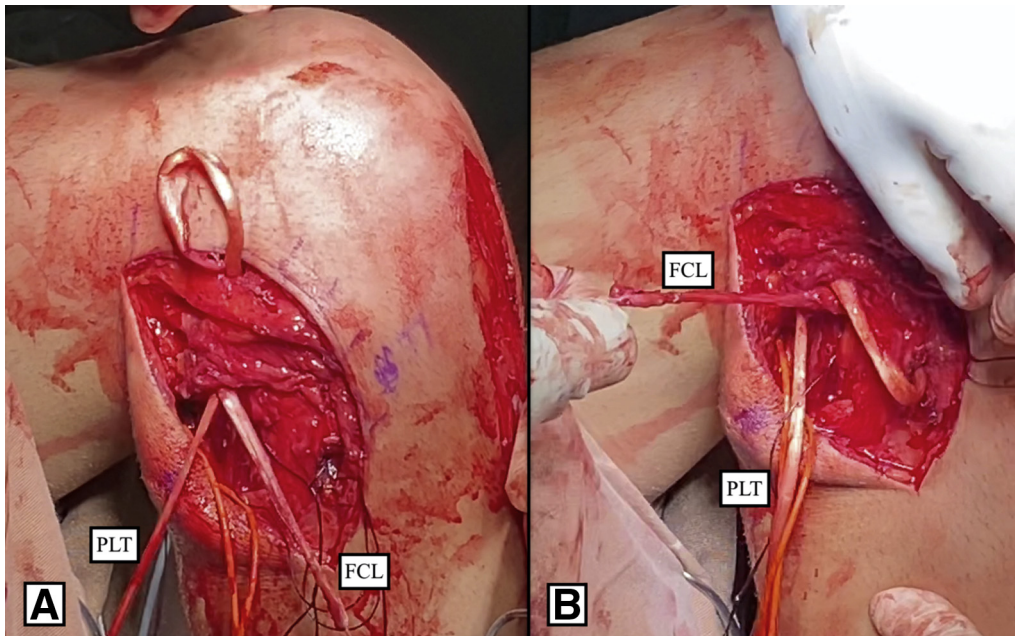


Fig 9. Posterolateral corner reconstruction in right knee. (A) Both grafts are passed under the iliotibial band. The popliteus tendon (PLT) (gracilis autograft) is first passed in a posterior direction through the popliteal hiatus and exits at the popliteal sulcus posterolaterally. Then, the fibular collateral ligament (FCL) (semitendinosus graft) is passed superficially to the PLT to reproduce the normal anatomic relation. (B) The FCL graft is subsequently passed through the fibular tunnel from anterior to posterior.

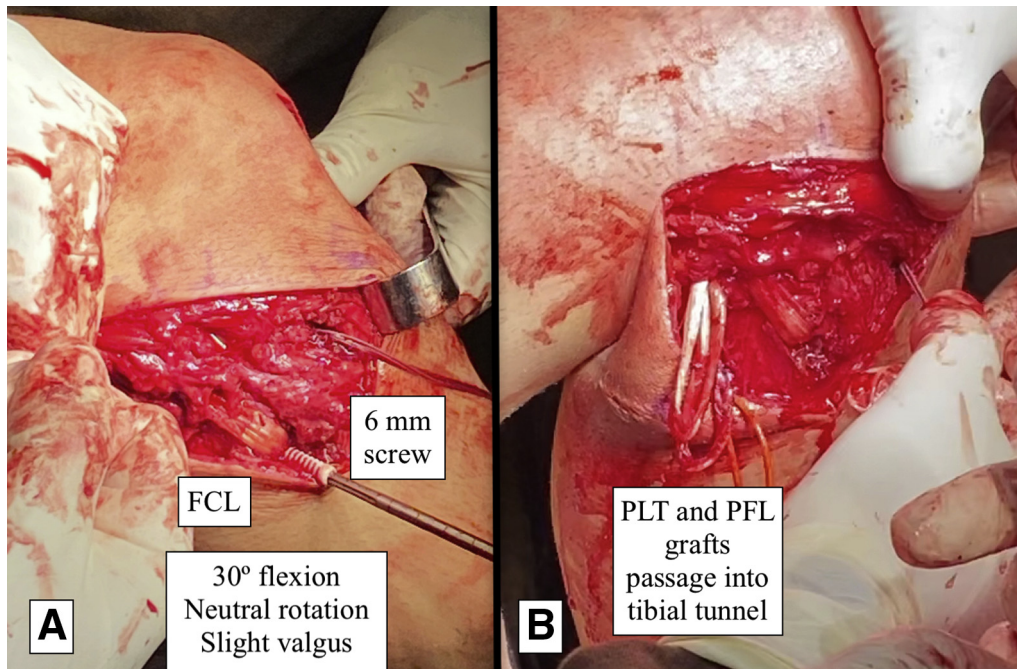


Fig 10. Posterolateral corner reconstruction in right knee. (A) Fibular collateral ligament (FCL) fixation in the fibular head tunnel is performed at 30° of knee flexion, in neutral rotation, and with a slight valgus force with a 6 × 23-mm bioabsorbable screw. (B) Both grafts are next passed into the tibial tunnel from posterior to anterior using the looped passing suture. (PFL, popliteofibular ligament; PLT, popliteus tendon.)

Rehabilitation

After PLC reconstruction, patients start ROM on postoperative day 1. Between ROM exercises, a knee immobilizer is worn. Straight-leg raises are also performed, and non-weight bearing for 6 weeks is encouraged. A goal of at least 90° of knee flexion is

encouraged at 2 weeks postoperatively. At 6 weeks, patients start weight bearing and using a stationary bike. Once they are fully weight bearing, closed kinetic chain exercises are begun. Muscular endurance followed by muscular strength and power development is slowly progressed. It is crucial to avoid isolated HS

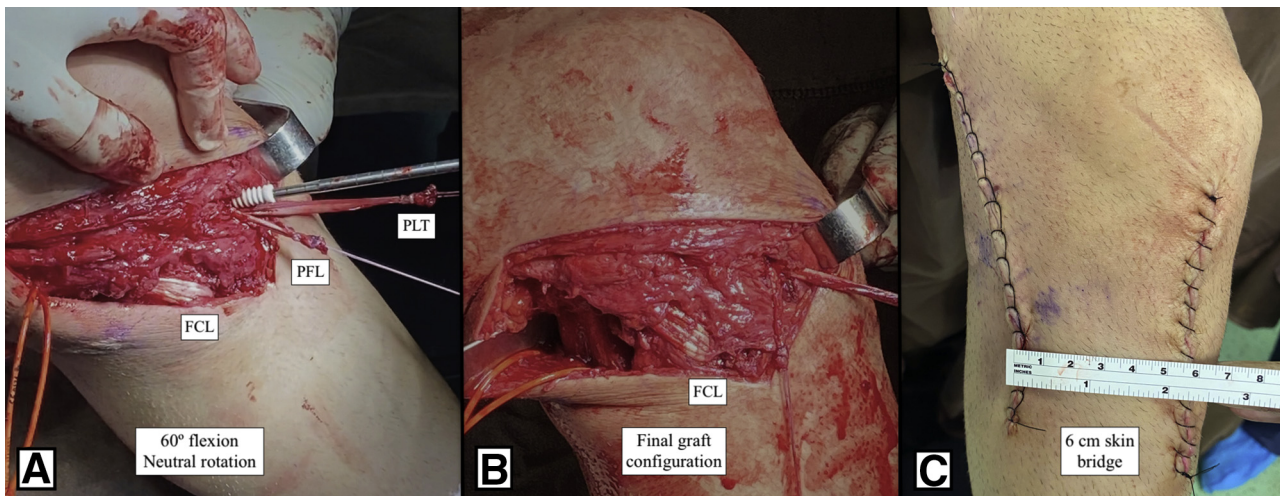


Fig 11. Posterolateral corner reconstruction in right knee. (A) Tibial fixation of the popliteus tendon (PLT) and popliteofibular ligament (PFL) grafts is performed at 60° of knee flexion and neutral rotation with a 7 × 23-mm bioabsorbable screw. (B) Final graft configuration of posterolateral corner reconstruction. (C) The approach is closed by layers, and a good skin bridge (>6 cm) should be maintained between incisions. (FCL, fibular collateral ligament.)

Table 2. Pearls and Pitfalls of Anatomic Posterolateral Corner Reconstruction Using Hamstring Autografts

Pearls	Pitfalls
In case of chronic PLC tears, limb-alignment radiographs should be obtained. If varus alignment is present, a staged or concomitant corrective osteotomy should be performed.	If a knee with varus alignment is underdiagnosed in the chronic setting, both the PLC and eventual concurrent cruciate ligament reconstructions are predisposed to failure.
When there is a concurrent ACL reconstruction, a single incision should be performed in the approach for both BTB harvest and hamstring harvest slightly medially.	If skin incisions are performed too closely (skin bridge < 6 cm), there is an increased risk of skin necrosis.
The surgeon should make sure to harvest both the gracilis and semitendinosus autografts as close as possible to the periosteal insertion to increase the length by 2 cm.	To avoid accidental nerve retraction, a hemostat should not be placed on the elastic band after performing the CPN neurolysis.
The surgeon should identify and release the soft tissue surrounding the CPN to avoid neurapraxia or nerve injury during surgery but especially from postoperative swelling.	Placing the fibular tunnel too high—or in an excessive oblique direction—can fracture the fibular head.
When the CPN cannot be found behind the biceps femoris tendon, the surgeon should gently palpate and subsequently dissect it 2-3 cm distal to the lateral aspect of the fibular head.	The surgeon should not ream the tibial tunnel before making sure the tibial guide pin is 1 cm medial and 1 cm proximal to the fibular tunnel on the posterior tibial tunnel aperture. This anatomic relation will reproduce the PFL function.
The surgeon should identify the anatomic insertions of both the FCL and PLT on the femur and measure the distance between the 2 guide pins prior to reaming to achieve an anatomic reconstruction (18.5 mm).	Reaming the PLC femoral tunnels perpendicular to the axial plane can cause protrusion into the intercondylar notch and/or result in tunnel convergence with a concurrent ACL reconstruction.
A dermatographic pen should be used to mark the graft ends at 25 mm to make sure they are properly inserted into the corresponding femoral tunnels.	To avoid improper biomechanical consequences and knee function, the surgeon should not pass the FCL graft deep to the PLT graft in the soft-tissue tunnel under the ITB.
Placing passing sutures into each tunnel after it is made can help to speed up later graft passage.	The surgeon should not leave soft tissue interposed in the tunnels, especially the tibial tunnel posterior aperture, to avoid graft passage difficulties.
The surgeon should verify that there is no collision of the ACL femoral tunnel with the PLC tunnels through arthroscopic visualization.	Tensioning and fixation of the grafts in internal rotation or external rotation may lead to improper biomechanical consequences and knee function.
An early mobilization protocol from day 1 is imperative to avoid knee arthrofibrosis.	In the case of concurrent PLC and PCL reconstruction, tensioning and fixation of the PLC grafts before the PCL grafts may result in internal rotation of the tibia.

ACL, anterior cruciate ligament; BTB, bone-tendon-bone; CPN, common peroneal nerve; FCL, fibular collateral ligament; ITB, iliotibial band; PCL, posterior cruciate ligament; PFL, popliteofibular ligament; PLC, posterolateral corner; PLT, popliteus tendon.

strengthening for the first 4 months, so no stress is put on the PLC reconstruction grafts. Typically, running exercises start at 6 months after surgery and return to

play, at 9 months postoperatively, once normal strength, stability, and ROM are achieved and are comparable to those of the contralateral limb.

Table 3. Advantages and Disadvantages of Anatomic Posterolateral Corner Reconstruction Using Hamstring Autografts

Advantages	Disadvantages
The technique is anatomic and reproduces the 3 primary stabilizers of the PLC: FCL, PLT, and PFL.	The surgical approach requires posterolateral dissection at the knee, thus being technically demanding compared with other techniques for PLC injuries.
The technique has been biomechanically validated using allograft tissue.	Damage to the common peroneal nerve can potentially occur when careful dissection is not performed and retractors are used.
The technique is based on using hamstring autografts, without the need for allograft tissue, which is expensive and not available in several countries.	The technique uses thinner grafts than the original LaPrade technique. Most biomechanical and clinical studies were reported with allograft tissue.
The technique does not require special materials other than smaller drills and screws from the original LaPrade allograft technique.	Clinical studies are needed to compare both techniques.
There is no risk of disease transmission due to allograft tissue techniques.	Donor-site morbidity can occur. In multiligament injuries with concurrent PLC and medial-side injuries, the contralateral knee might be used for graft harvesting.

FCL, fibular collateral ligament; PFL, popliteofibular ligament; PLC, posterolateral corner; PLT, popliteus tendon.

Discussion

Although anatomic reconstruction of the PLC (known as the LaPrade technique) has been shown to restore nearly native knee biomechanics in cadaveric studies, as well as to provide improved clinical objective and subjective results, autograft use for this technique is at its beginning.¹⁴ We have described a surgical technique that reproduces the classic LaPrade technique using HS autografts while adapting the corresponding tunnel diameters and fixation devices.

Anatomically based PLC reconstruction has been shown to obtain significantly better results in chronic as well as acute cases, in midsubstance tears, or when osteosynthesis cannot be performed as in some avulsion fractures (arcuate fracture).^{15,16} Other anatomic PLC reconstruction techniques using autograft tissue have been described. Franciozi et al.¹⁷ described an anatomic PLC reconstruction using both HS and the same tunnel positioning as the LaPrade allograft technique. Larger thicknesses of both the FCL and PLT are obtained, and significantly improved subjective and objective clinical outcomes have recently been reported in a series of 29 patients.¹⁸ Meanwhile, Wood et al.¹⁹ have recently published another anatomic PLC technique using an isolated ST autograft that reproduces the FCL and PLT with the native ST graft diameter. However, inadequate asymmetrical strands of the ST tendon mounted onto a large fixation suspensory device (when retrograde drilling is not used) could be a potential pitfall.

The cross-sectional area of the native FCL was reported to be between 0.43 and 0.48 cm² (between 6.5 and 7.0 mm wide), compared with the 6.0- to 7.0-mm autograft obtained.⁵ Although the original LaPrade allograft technique is performed with larger-diameter grafts and Franciozi et al.¹⁷ gave emphasis to this with a doubled autograft for the FCL and PLT, no studies to date have reported greater clinical failures with smaller-diameter grafts. Moreover, we have not found any difficulties with autograft length for satisfactory tibial fixation, and studies based on HS tendons have reported average lengths greater than 27 cm.²⁰ Regarding the controversial aspects of PLC tears, such as minimally invasive techniques without peroneal neurolysis, no consensus has been reached, but generally, a conventional open invasive approach with peroneal neurolysis and protection is preferred.²¹

We believe that our proposed anatomic PLC reconstruction technique represents a passage from the classic and renowned LaPrade allograft technique to a modified LaPrade autograft technique, in which 2 completely separate grafts are used. Nonetheless, although several techniques for anatomic PLC reconstruction have recently been described, larger clinical series and comparisons with the classic allograft

technique are required to assess the clinical results; in addition, a comparison of graft diameters is needed.

References

1. Dean RS, LaPrade RF. ACL and posterolateral corner injuries. *Curr Rev Musculoskelet Med* 2020;13:123-132.
2. Stannard JP, Brown SL, Farris RC, McGwin G, Volgas DA. The posterolateral corner of the knee. *Am J Sports Med* 2005;33:881-888.
3. 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;38:804-809.
4. Hodax JD, Cohen BH, DeFroda SF, Sobel AD, Fadale PD. Comparison of three fixation techniques for arcuate fractures. *Injury* 2020;51:478-482.
5. LaPrade RF, Ly TV, Wentorf FA, Engebretsen L. The posterolateral attachments of the knee. *Am J Sports Med* 2003;31:854-860.
6. Kennedy MI, Bernhardson A, Moatshe G, Buckley PS, Engebretsen L, LaPrade RF. Fibular collateral ligament/posterolateral corner injury. *Clin Sports Med* 2019;38:261-274.
7. LaPrade RF, Johansen S, Wentorf FA, Engebretsen L, Esterberg JL, Tso A. An analysis of an anatomical posterolateral knee reconstruction. *Am J Sports Med* 2004;32:1405-1414.
8. Chahla J, Moatshe G, Dean CS, LaPrade RF. Posterolateral corner of the knee: Current concepts. *Arch Bone Jt Surg* 2016;4:97-103.
9. LaPrade RF, Ly TV, Griffith C. The external rotation recurvatum test revisited. Reevaluation of the sagittal plane tibiofemoral relationship. *Am J Sports Med* 2008;36:709-712.
10. Arthur A, LaPrade RF, Agel J. Proximal tibial opening wedge osteotomy as the initial treatment for chronic posterolateral corner deficiency in the varus knee. *Am J Sports Med* 2007;35:1844-1850.
11. Kane PW, Cinque ME, Moatshe G, et al. Fibular collateral ligament: Varus stress radiographic analysis using 3 different clinical techniques. *Orthop J Sport Med* 2018;6:232596711877017.
12. Moatshe G, Brady AW, Slette EL, et al. Multiple ligament reconstruction femoral tunnels: Intertunnel relationships and guidelines to avoid convergence. *Am J Sports Med* 2017;45:563-569.
13. Moatshe G, Chahla J, Brady AW, et al. The influence of graft tensioning sequence on tibiofemoral orientation during bicruciate and posterolateral corner knee ligament reconstruction: A biomechanical study. *Am J Sports Med* 2018;46:1863-1869.
14. Geeslin AG, LaPrade RF. Outcomes of treatment of acute grade-III isolated and combined posterolateral knee injuries. *J Bone Joint Surg Am* 2011;93:1672-1683.
15. Moulton SG, Geeslin AG, LaPrade RF. A systematic review of the outcomes of posterolateral corner knee injuries, part 2. *Am J Sports Med* 2016;44:1616-1623.

16. Geeslin AG, Moulton SG, LaPrade RF. A systematic review of the outcomes of posterolateral corner knee injuries, part 1. *Am J Sports Med* 2016;44:1336-1342.
17. Franciozi CE, Albertoni LJB, Gracitelli GC, et al. Anatomic posterolateral corner reconstruction with autografts. *Arthrosc Tech* 2018;7:e89-e95.
18. Franciozi CE, Albertoni LJB, Kubota MS, et al. A hamstring-based anatomic posterolateral knee reconstruction with autografts improves both radiographic instability and functional outcomes. *Arthroscopy* 2019;35:1676-1685.e3.
19. Wood R, Robinson J, Getgood A. Anatomic posterolateral corner reconstruction using single graft plus adjustable-loop suspensory fixation device. *Arthrosc Tech* 2019;8:e301-e309.
20. Janssen RPA, van der Velden MJF, van den Besselaar M, Reijman M. Prediction of length and diameter of hamstring tendon autografts for knee ligament surgery in Caucasians. *Knee Surg Sports Traumatol Arthrosc* 2017;25:1199-1204.
21. Chahla J, Murray IR, Robinson J, et al. Posterolateral corner of the knee: An expert consensus statement on diagnosis, classification, treatment, and rehabilitation. *Knee Surg Sports Traumatol Arthrosc* 2019;27:2520-2529.