

# Dual Postero-Medial Portal Technique for Posterior Cruciate Ligament Tibial Avulsion Fracture Fixations



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**Abstract:** The posterior cruciate ligament surgery invariably demands adequate posterior compartment visualisation and instrumentation. The addition of posteromedial (PM) portal during posterior cruciate ligament (PCL) surgeries remains essential. The further addition of one more proximal posteromedial (PM) portal further enhances the instrumentation including suture passage in the substance of PCL or screws insertion and more so obviates the need for trans-septal and posterolateral (PL) portals. This additional PM portal is created in the safe zone under direct visualisation utilising outside-in technique and is spaced to prevent crowding of instrument with arthroscope. The proximal higher PM portal serves as instrument portal and provides optimal trajectory for even arthroscopic screw fixation of PCL avulsion fractures.

## Introduction

Isolated posterior cruciate ligament (PCL) tibial avulsion fractures are uncommon injuries, and PCL tears account for 20% of all knee ligament injuries.<sup>1,2</sup> Being the central pivot of the knee, the main role of the PCL is to limit the posterior translation of the tibia at all positions of the knee.<sup>3</sup>

Multiple biomechanical studies have shown that PCL deficiency can lead to increased risk of meniscal tears, medial compartment, and patello-femoral osteoarthritis in the long run.<sup>4,5,6</sup> PCL avulsion fracture fixation was advocated strongly by Griffith et al.<sup>7</sup> to avoid the above complications, including nonunion and late degenerative osteoarthritis.

The posteromedial (PM) portal is quintessential in the PCL surgeries unless a 70° scope is used as standalone.

The visualization of the posterior compartment is necessary during PCL reconstruction, PCL avulsion fracture fixation, subtotal synovectomies, posterior loose body removal, and medial meniscus transplants and Ramp repairs.<sup>8</sup>

The addition of a trans-septal portal is useful during the posterior cruciate ligament and posterior compartment surgeries.<sup>9,10</sup> The most important structure to consider during posterior compartment surgeries is the popliteal vessels. The vessels are at high risk not only during creation of the posterior trans-septal portals, posteromedial and posterolateral portals, but also during the course of PCL surgery steps.<sup>11</sup> The posterior compartment viewing and working channel aid in the optimal visualization of PCL in entirety. The previous literature suggests the common usage of only single posteromedial portal or in addition, a trans-septal portal for the PCL surgeries.<sup>9,10</sup> As the creation of trans-septal portal and posterolateral portal involves additional risk, we have routinely started to use two posteromedial portals, wherein the one functions as viewing portal, and the other functions as a working portal.

The posterolateral compartment is smaller than posteromedial compartment by more than 1.5 times.<sup>12</sup> The cadaveric study by Pace and Wahl et al.<sup>13,14</sup> suggested a safe zone in relation to the saphenous vein. Injury to the saphenous nerve and vein have been documented by multiple studies, but the occurrence is uncommon. The studies strictly suggested knee flexion of 90° as mandatory position during the portal creation.

We have described a technique using two posteromedial portals<sup>15,16,17</sup> placed in the safe zone, with

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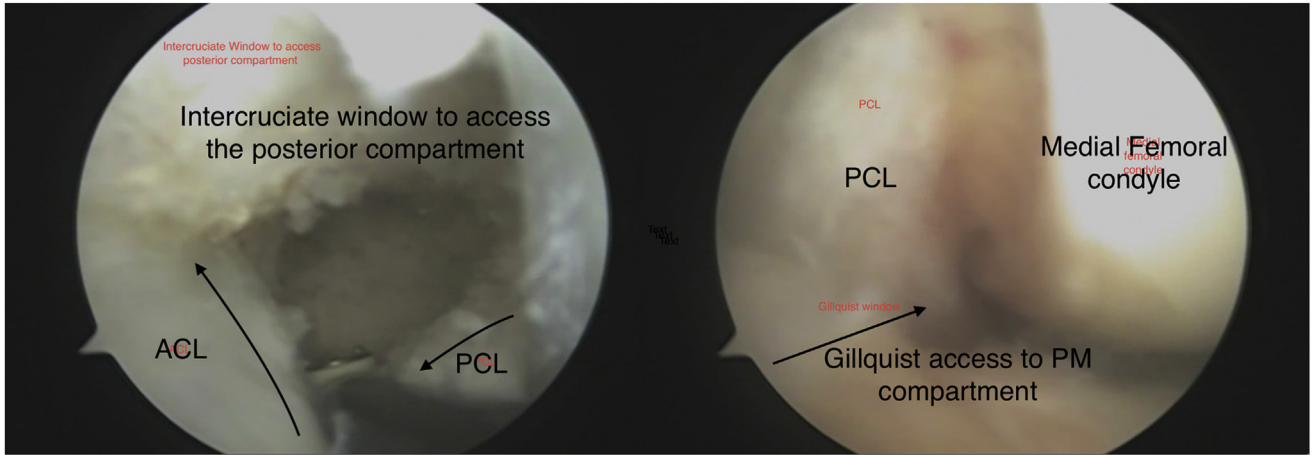
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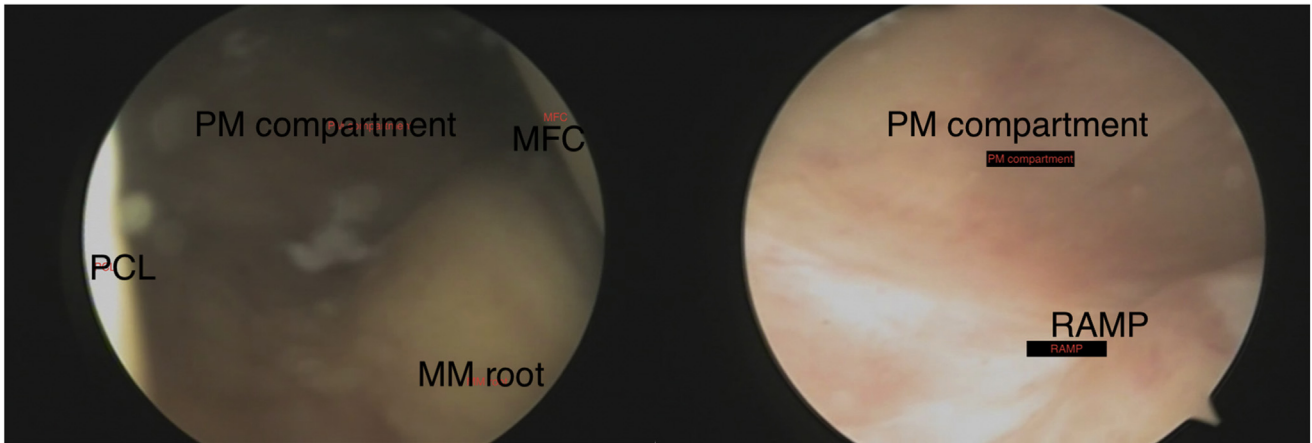
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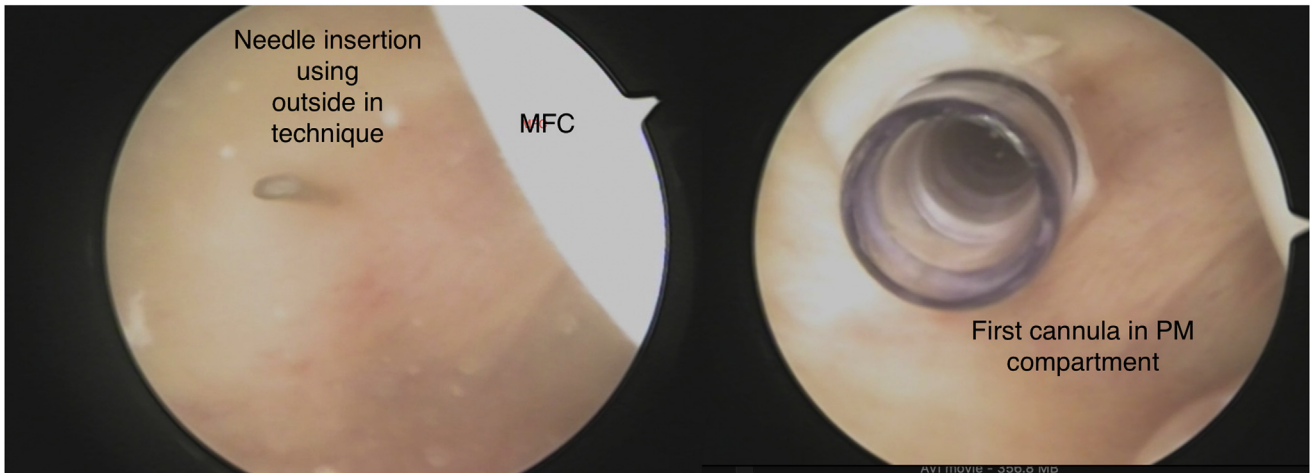
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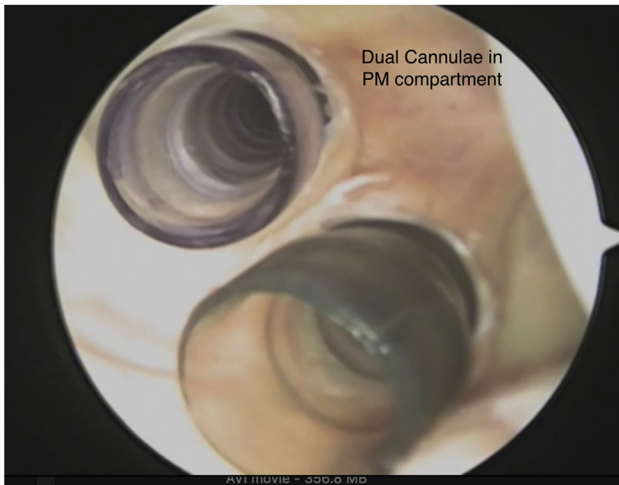
**Fig 1.** Passage of arthroscope in posteromedial compartment can be achieved either through the anterior cruciate ligament–posterior cruciate ligament (ACL PCL) intercruciate window or by performing a Gillquist maneuver using the window in-between the medial femoral condyle and PCL.



**Fig 2.** The hiatus between the medial femoral condyle and posterior cruciate ligament (PCL) serves a channel for accessing the posteromedial compartment.



**Fig 3.** Creation of posteromedial portals using a 18-gauge spinal needle by the outside-in technique. The first canula is placed using the outside-in technique.



**Fig 4.** Dual cannulae is inserted in posteromedial compartment.

consideration of the capsular folds for PCL tibial avulsion fixation with either suture or screw depending upon the size of the tibial avulsed fragment.

### Surgical Technique and Positioning

Reviewing patient history is of prime importance followed by a complete clinical examination to evaluate the posterior sag secondary to PCL tibial avulsion fracture, as well as the other ligaments sufficiency, which may need additional procedures. Preoperative planning involves finding out the size of the PCL tibial fragment by a CAT scan. The scan and the basic radiograph enable the fixation method to be chosen and also aids in excluding the extension in the tibial plateau, which can be missed on plain X-rays. The patient is explained the procedure along with the rehab protocol, and routine consent is obtained. This study was approved by the Royal Pune Independent Ethical Committee (DCGI registration no: ECR/45/Indt/MH/2013/RR-19).

The anaesthetized patient is positioned on the operation table with legs hanging within a thigh holder and unhindered motion up to 120° is checked. The thigh is slightly abducted to increase the space with the two thighs. The other thigh is widely abducted and supported with a leg holder after adequate padding. The position is of prime importance as any decrease in the space between the two thighs can increase the traffic of the arthroscope and various instruments utilized in PCL avulsion fracture fixation. The tourniquet is routinely used for bloodless visualization.

After prepping and draping the patient, the diagnostic arthroscopy is begun. The PCL surgery involves the anterior portals to be closer to the patellar tendon, as maximum work is through the intercondylar notch.

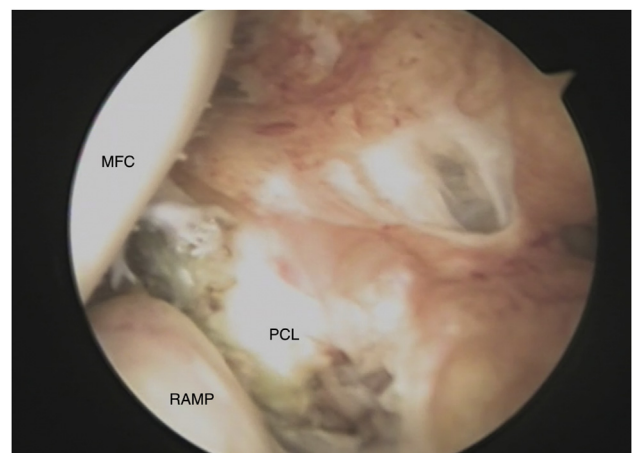
The meniscal pathologies are tackled, and steps are ensured for further creation of the posteromedial portals.

The 30° arthroscope can be advanced in the posteromedial compartment through two windows. The first window is either through the Gillquist portal or modified Gillquist maneuver or using the window through the anterior cruciate ligament (ACL)–PCL intercruciate interval. If the knee is extremely tight, then the modified Gillquist technique can be difficult. Alternatively, the interval between the cruciates, which is approximately 60° and is adequate for the visualization after removal of synovium above the PCL femoral insertion. (Figs 1 and 2).

Once the posteromedial space is entered, the synovial folds and the safe zone is identified for dual portal creation.<sup>18</sup> The safe zone between the gastrocnemius fold and the semimembranosus capsular fold is chosen. Care is taken to avoid being too inferior in the PM compartment, so as to protect saphenous nerve or its sartorial branch. All of the needles and instruments are always directed from posterior to anterior to avoid neurovascular injury. The spinal 18 gauge needle is inserted from outside in, and both the portals are created under good visualization. The portals are not at the same level. The second portal will be about 1 cm proximal and anterior (Figs 3 and 4).

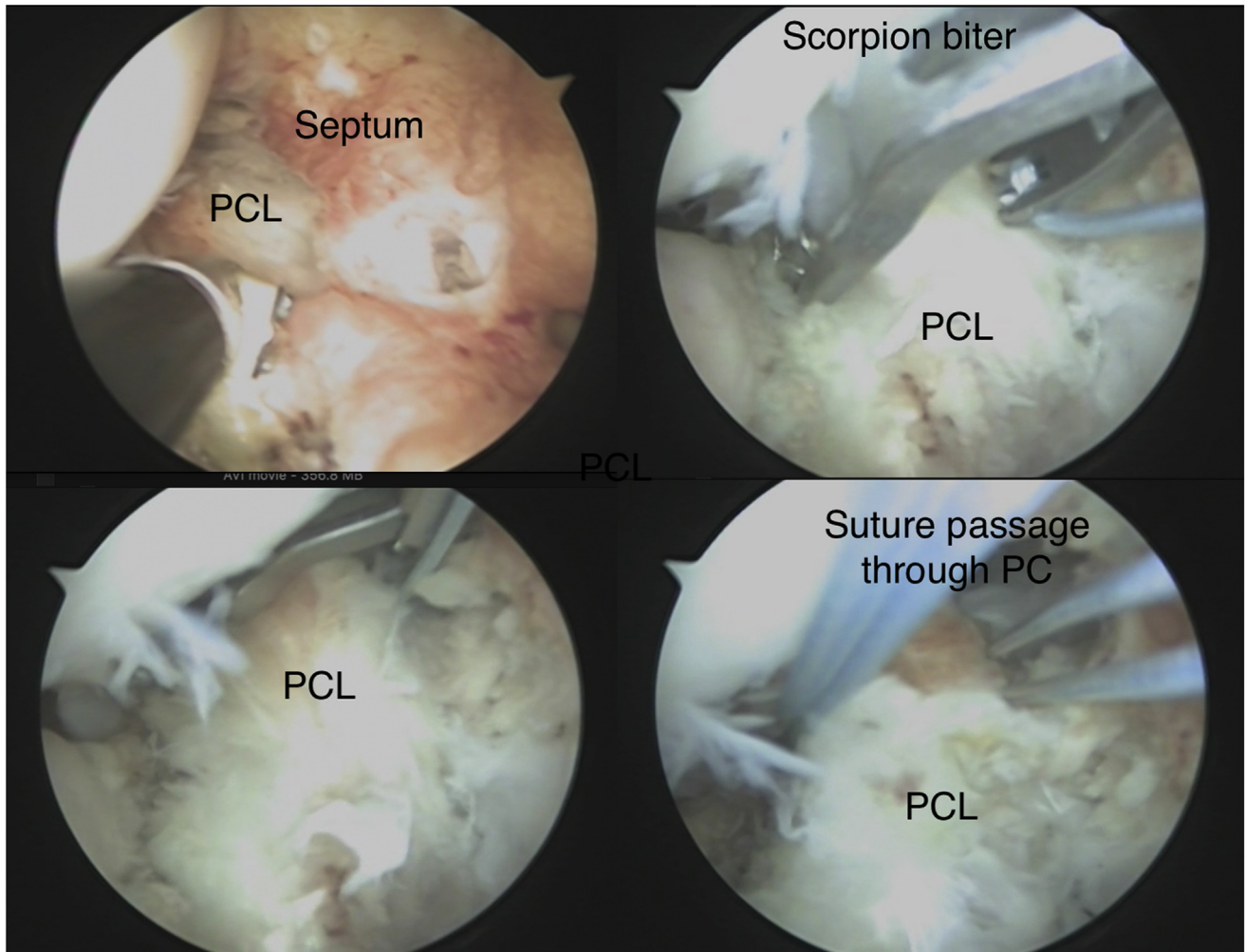
The arthroscope is exchanged to the first distal PM portal, and the proximal portal serves as the working portal. The higher proximal portal gives us adequate trajectory for the suture instruments and drills to pass the PCL facet (Fig 5).

The PCL guide (Arthrex) is always introduced from the anteromedial portal for tibial tunnel drilling when

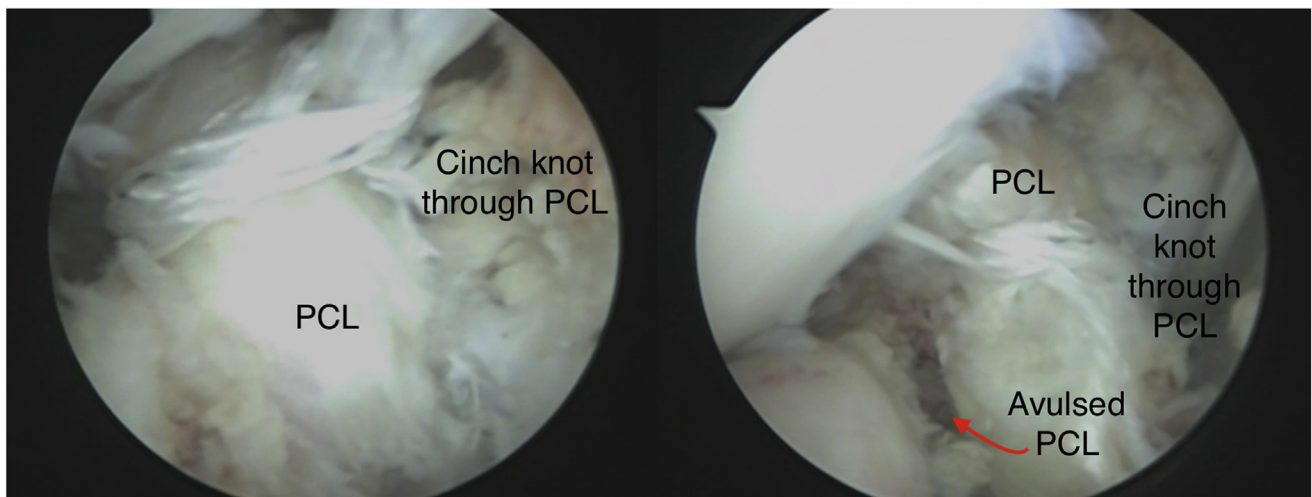


**Fig 5.** Identification of structures, namely, the posterior cruciate ligament (PCL) and posterior aspect of medial femoral condyle with arthroscope in posteromedial (PM) portal.

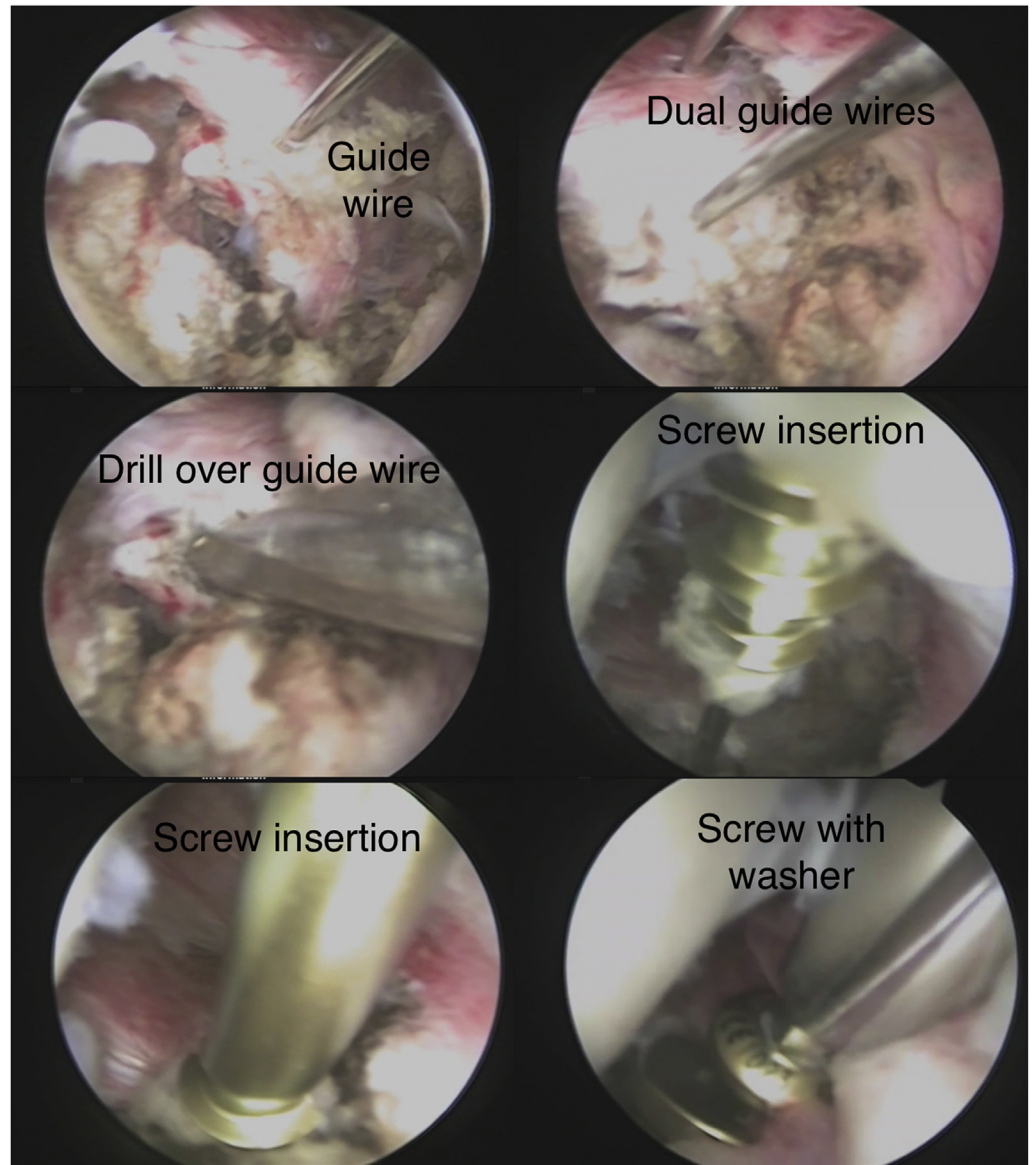




**Fig 6.** Passage of instruments and sutures from high posteromedial (PM) portal. Various techniques of instrumentation that can be achieved from high PM portal with arthroscope viewing from low PM portal. Radiofrequency (VoidAware Pressure Routing Depuy made) device to clear the synovial tissue for adequate visualization. Suture passing device (Scorpion biter / Arthrex made) from high PM portal for passing suture through posterior cruciate ligament (PCL). Passing the cinch suture.



**Fig 7.** Cinching of posterior cruciate ligament. The suture technique using FiberWire (Depuy) or Ethibond no. 2 is commonly employed with suture fixation of PCL avulsion fractures.



**Fig 8.** The posterior cruciate ligament avulsion fracture screw fixation can be achieved even with sequential passage of instruments like guide wire, drill bits, and finally screws with washer passing through the high posteromedial portal.

the suture fixation method is used for comminuted or small avulsed fragments. The PCL fragment can also be fixed by 4-mm cancellous cannulated screws over washers via the working proximal portal, as well after sequential drilling of guide wire and 3.2-mm drill bit. (Figs 6-8 and Video 1).

### Discussion

The dual PM portal technique obviates the need for risky trans-septal portal. The retention of synovium

between the cruciates does not violate the blood supply and aids in less surgical trauma. Although systematic studies prove that there is no significant long-term difference between open modified Burk Schaffer's approach and arthroscopic PCL avulsion fracture fixation, although the immediate postoperative recovery is faster and less painful with arthroscopic approach (Table 1). Table 2 cites the pearls and pitfalls of the technique.

**Table 1.** Advantages and Disadvantages of Dual Posteromedial Portal Technique for PCL Avulsion Fracture Fixations

Advantages	Disadvantages
Obviates the creation of risky trans-septal portal	Need for removal of synovium and osteophytes to create window between cruciates or between Gillquist portal for access to posteromedial compartment
Obviates additional posterolateral portal creation	Viewing portal is distal just at the level of equator of medial femoral condyle, thereby, slightly restricting the visualization well below the PCL tibial facet.
Adequate visualization of the posteromedial compartment	Need for two cannulae for the PM portals
In line working portal trajectory for screw fixation of PCL avulsion fixation arthroscopically	The proximal portal may need long cannula in high body mass index patients.
A Wissinger rod can be placed in the distal PM portal to function as a hook to negotiate the killer turn under visualization from the proximal PM portal, while passing the PCL graft passage	Dual PM portals will have slightly higher risk of saphenous nerve injury compared with single portal technique. But following the safe zone technique with respect to synovial folds completely minimizes the saphenous nerve injury
Early mobilization as compared to open techniques	Adequate space is needed in between the thighs for two portals and the various drills and arthroscope to be passed. Both the working and viewing portals posteromedially can lead to congestion during various steps of PCL avulsion fracture fixation.
	Particular difficulty can be noted if the posterior sag is not reduced during dual portal creation. Posterior sag reduces the effective space and obliterates the synovial folds in posteromedial compartment.

PCL, posterior cruciate ligament; PM, posteromedial.

**Table 2.** Pearls and Pitfalls of Dual Posteromedial Portal Technique for PCL Avulsion Fracture Fixations

Pearls	Pitfalls
The nonsurgical thigh should be widely abducted, while the affected knee is slightly abducted to increase the space with the two thighs.	Avoid being too inferior in PM portal creation. Saphenous nerve or its sartorial branch injury is a possibility.
Using two cannulae can make the passage of instruments and implants easy.	Fragment screw fixation cannot be bicortical. Fragment malrotation should be controlled before fixation.
To obtain fragment reduction it is possible to use a small serrated punch to push the PCL avulsion fracture toward the PCL facet, a cannulated drill bit with serrations, a PCL guide, a temporary suture passer, or two guide wires.	Arthroscope and various instruments can jam during PCL avulsion fracture fixation.

PCL, posterior cruciate ligament; PM, posteromedial.

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