

# A Rare Case Report: Managing PCL Avulsion Fracture with a Fracture of the Proximal Tibial Shaft

Amrit Goyal<sup>1</sup>, Yuvraj Vimal<sup>1</sup>, Vivek Mittal<sup>1</sup>, Mayur Gupta<sup>1</sup>, Rajat Kapoor<sup>1</sup>, Ravikant Rohela<sup>1</sup>

## Learning Point of the Article:

This case report presents a novel surgical approach for addressing a proximal 1/3rd tibial shaft fracture with an ipsilateral PCL avulsion fracture, using ORIF with an LCP and advanced fixation techniques like a CC screw and spiked washer. It highlights the rarity of this injury combination and the need for tailored surgical strategies due to the lack of existing literature.

## Abstract

**Introduction:** Posterior cruciate ligament (PCL) avulsion fractures of the tibia with ipsilateral tibial shaft represent a rare but challenging orthopedic injury, necessitating careful consideration of surgical interventions for optimal outcomes. This case report presents the successful management of tibial shaft fracture (proximal 1/3rd junction) along with ipsilateral PCL avulsion fracture of tibia using a novel approach using open reduction internal fixation (ORIF) of tibial shaft with Locking compression plate (LCP) with cannulated cancellous screw and spiked washer fixation of PCL avulsion. There are no case reports or research articles available for the management of PCL avulsion fracture of tibia associated with ipsilateral tibial shaft fracture.

**Case Report:** The patient, 34-year old male, presented with significant pain, swelling, and limited range of motion following a road traffic accident. Radiographic evaluation revealed a comminuted fracture proximal tibia and fibula with PCL avulsion fracture of the tibia, prompting a comprehensive surgical intervention. We planned to manage both fractures in a two-stage surgery. The selected approach involved ORIF of the proximal tibia fracture by utilizing LCP, followed by open reduction and internal fixation of PCL avulsion using cannulated cancellous screws, supplemented by the innovative application of a spiked washer for enhanced stability.

Patients underwent monthly follow-ups during the initial 3 months. During each follow-up, both clinical and radiological assessments were conducted. Clinical evaluations focused on stability and range of motion (ROM), employing a drawer test for stability assessment. Radiological evaluations were based on the union shown in X-rays. The follow-up duration was up to 6 months, culminating in the calculation of the final functional outcome using the Lysholm knee scoring system.

**Conclusion:** This case report contributes valuable insights into the successful management of PCL avulsion fractures associated with ipsilateral tibial shaft fracture, emphasizing the importance of customized surgical techniques and the utilization of advanced fixation devices. The presented approach with cannulated cancellous screws and a spiked washer showcases a promising option for achieving stable fixation and promoting efficient healing in such challenging cases. Further, research and long-term studies are warranted to validate the efficacy and durability of this innovative surgical method.

**Keywords:** Posterior cruciate ligament avulsion, spiked washer fixation, novel technique, internal fixation.

## Introduction

Posterior cruciate ligament (PCL) avulsion fractures of the tibia represent a unique subset of orthopedic injuries, characterized

by the detachment of the ligament from its bony insertion site. PCL injuries are less prevalent compared to anterior cruciate ligament (ACL) injuries [1]. Due to the robust nature of the

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## Author's Photo Gallery



Dr. Amrit Goyal



Dr. Yuvraj Vimal



Dr. Vivek Mittal



Dr. Mayur Gupta



Dr. Rajat Kapoor



Dr. Ravikant Rohela

<sup>1</sup>Department of Orthopaedics, SN Medical College, Agra, Uttar Pradesh, India

### Address of Correspondence:

Dr. Yuvraj Vimal,  
Department of Orthopaedics, 5th Floor, New Surgery Building, SN Medical College, Agra, Uttar Pradesh - 282002, India.  
E-mail: yuvrajvimal@gmail.com

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**Figure 1:** X-ray (R) knee with leg shows comminuted fracture proximal tibia and fibula (R) with an ipsilateral avulsion fracture of the posterior cruciate ligament.



**Figure 2:** The sagittal section of the CT shows a fracture proximal tibia (R) with an ipsilateral avulsion fracture of the posterior cruciate ligament.



**Figure 3:** CT 3D reconstruction shows a fracture proximal tibia and fibula (R) with an ipsilateral avulsion fracture of the posterior cruciate ligament.

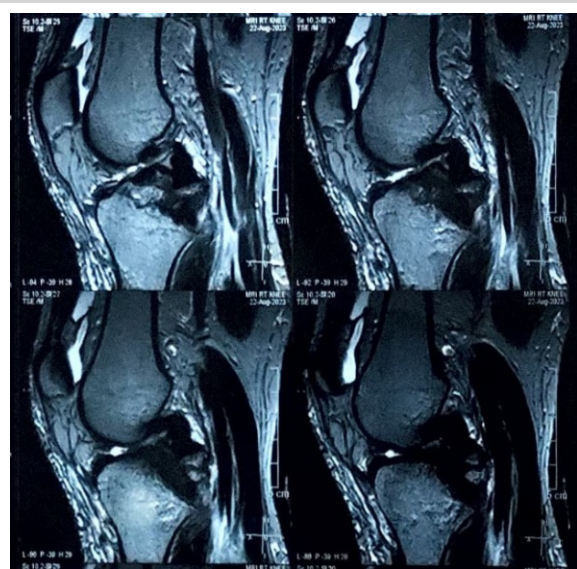
PCL, avulsion fractures at its attachment sites are frequently observed [2]. PCL avulsion fractures pose a distinct challenge to orthopedic surgeons due to the intricate anatomical and biomechanical characteristics of the PCL, as well as the complex nature of tibial avulsion fractures.

The PCL plays a crucial role in maintaining the stability of the knee joint by preventing posterior displacement of the tibia relative to the femur. Avulsion fractures occur when excessive force is applied to the ligament, leading to the detachment of a bony fragment from the posterior aspect of the tibia. It commonly results in an intra-substance tear; however, instances of avulsion fractures occurring at the femoral or tibial attachment sites have also been documented [3]. The clinical

presentation typically includes pain, swelling, and impaired range of motion, often necessitating prompt diagnosis and intervention.

Various surgical techniques have been proposed for the management of PCL avulsion fractures, ranging from conservative measures to surgical fixation. At present, there is a diverse range of materials accessible for internal fixation, such as hollow lag screws, steel wires, absorbable screws, suture anchors, and straddle nails [4, 5]. The choice of intervention depends on factors such as the size and displacement of the avulsed fragment, associated injuries, and the patient's functional demands.

This case report focuses on a specific approach to the



**Figure 4:** MR images show an avulsion fracture of the posterior cruciate ligament.



**Figure 5:** Post-operative X-ray after open reduction internal fixation of fracture proximal tibia by locking compression plate (R).

management of tibial shaft fracture (proximal 1/3rd junction) along with ipsilateral PCL avulsion fracture of tibia using a novel approach using open reduction internal fixation (ORIF) of tibial shaft with Locking compression plate (LCP) with cannulated cancellous screws and spiked washer fixation of PCL avulsion. This technique offers a novel solution to address the challenges associated with achieving stable fixation and promoting efficient healing. The



**Figure 6:** An inverted “L”-shaped incision was performed, starting from the medial aspect of the gastrocnemius and curving along the joint’s flexor crease toward the lateral side.



**Figure 7:** The capsule was reached through the space between the semimembranosus and gastrocnemius.

cannulated cancellous screws, supplemented by the innovative application of a spiked washer for enhanced stability.

Post-operative X-ray after open reduction and internal fixation of the proximal tibial fracture with an LCP (R) (Fig. 5). The implant is appropriately aligned, with satisfactory reduction and fixation of the fracture fragments, ensuring stability for healing.

The interval between the two surgeries was 10 days, allowing time for the skin incision to heal and the soft-tissue swelling to subside. Following the acquisition of informed consent, the patient was

planned for ORIF using cannulated cancellous screws and spiked washer, employing the modified posterior approach as detailed by Burks and Schaffer [6]. The patient underwent surgery under spinal anesthesia. He was placed in a prone position on a radiolucent operating table, ensuring adequate padding for pressure points. The lower extremity was positioned with a 30° flexion at the knee joint, supported by a bolster at the ankle, and a pneumatic tourniquet was applied to the patient.

### Case Report

A 34-year-old male was admitted to the emergency department at S N Medical College, Agra, as a case of comminuted fracture proximal tibia and fibula (R) with ipsilateral avulsion fracture of PCL (Fig. 1-4), due to motorcycle-motorcycle collision 3 days before the admission.

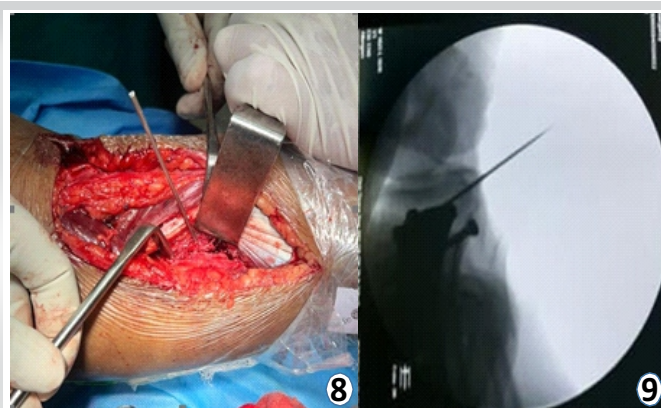
### Management

We planned to manage both fractures in a two-stage surgery. The selected approach involved open reduction internal fixation of fracture proximal tibia by LCP followed by open reduction and internal fixation of PCL avulsion using

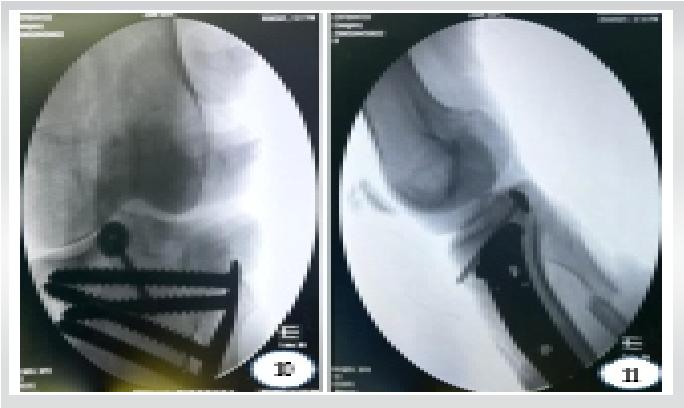
An inverted “L”-shaped incision was performed, starting from the medial aspect of the gastrocnemius and curving along the joint’s flexor crease toward the lateral side (Fig. 6). The fascia was cut following the path of the skin incision. The capsule was reached through the space between the semimembranosus and gastrocnemius (Fig. 7). A lengthwise incision was made, exposing the joint at the location of the

planned for ORIF using cannulated cancellous screws and spiked washer, employing the modified posterior approach as detailed by Burks and Schaffer [6]. The patient underwent surgery under spinal anesthesia. He was placed in a prone position on a radiolucent operating table, ensuring adequate padding for pressure points. The lower extremity was positioned with a 30° flexion at the knee joint, supported by a bolster at the ankle, and a pneumatic tourniquet was applied to the patient.

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**Figure 8 & 9:** Temporary fixation was achieved using a K-wire to maintain the reduction.



**Figure 10 & 11:** C-arm images showing fixation of avulsion of posterior cruciate ligament by cc screw with spiked washer.



**Figure 12:** Post-operative X-ray after ORIF by CC screw with spiked washer fixation of avulsion fracture of PCL.



**Figure 13:** Post-operative X-ray after 6 weeks follow-up.



**Figure 14:** Post-operative X-ray after 12 weeks follow-up.

avulsed fragment. The avulsed fragment was carefully refreshed and realigned. A slight flexion of the knee joint aided in the reduction process. Temporary fixation was achieved using a K-wire to maintain the reduction (Fig. 8 and 9).

The insertion site for the cannulated cancellous (CC) screw was located and subsequently drilled with a cannulated drill bit. Ultimately, the avulsed fragment was secured by employing a 4 mm cannulated cancellous screw along with a spiked washer, which was screwed in place over the guide wire. The K-wire used for temporary fixation was then removed (Fig. 10-12).

Following the closure of the incision and the application of an antiseptic dressing with appropriate padding, the limb was immobilized using an above-knee pop slab set at a 15° flexion angle for a duration of 6 weeks. The posterior support in place served to prevent any potential subluxation of the tibia [7, 8].

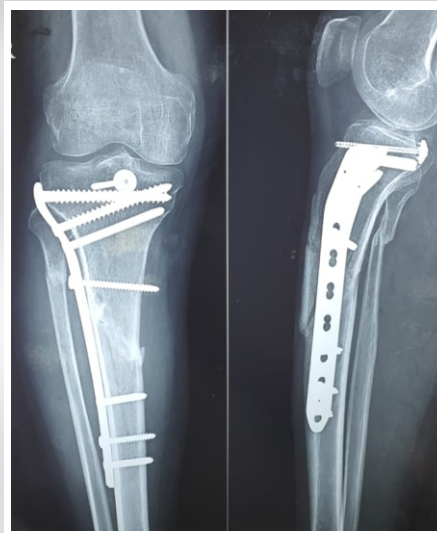
Quadriceps strengthening exercises were introduced on the second day post-surgery. Suture removal was performed 10–12 days after the operation. Passive knee bending in the prone position commenced at the 2-week mark. Active mobilization of the knee was initiated approximately 3 weeks post-surgery. After 6 weeks of surgery, partial weight-bearing was permitted, and full weight-bearing was allowed after 12 weeks. It was also at this point that the brace was discontinued.

Patients underwent monthly follow-ups during the initial 3 months. During each follow-up, both clinical and radiological assessments were conducted. Clinical evaluations focused on stability and range of motion (ROM), employing a drawer test for stability assessment. Radiological evaluations were based on the union shown in X-rays. The follow-up duration was up to 6 months, culminating in the calculation of the final functional

outcome using the Lysholm knee scoring [9] system. The Lysholm knee scoring scale evaluates eight criteria: pain (0–25 points), swelling (0–10 points), limp (0–5 points), need for support using a cane or crutches (0–5 points), ability to climb stairs (0–10 points), instability (0–25 points), ability to squat (0–5 points), and locking sensation in the knee (0–15 points). Treatment outcomes are classified as “excellent” for scores above 85 points, “good” for scores between 70 and 85 points, “intermediate” for scores between 60 and 69



**Figure 15:** Showing 10–90° range of motion at 12 weeks follow-up.



**Figure 16:** Post-operative X-ray after 6 months follow-up showing union of fracture.



**Figure 17:** Showing 0–120° of range of motion and patient doing SLR at 6 months follow-up.

points, and “poor” for scores below 60 points.

### Results

At 6 weeks after surgery, the ROM was 20–60°. No instability was present in the posterior drawer test (Fig. 13).

At 12 weeks after surgery, the ROM was 10–90°. The posterior drawer test showed no instability (Fig. 14 and 15).

At 6 months after surgery, the ROM was 0–120°. The posterior drawer test showed no instability. Patient was able to do straight leg raise and was able to walk without support. Lysholm knee score was 95 showing excellent result (Fig. 16 and 17).

### Discussion

Current surgical choices for tibial avulsion fractures of the PCL include arthroscopic repair, open reduction, and internal fixation (ORIF). Arthroscopic treatment of these fractures, first reported in 1995, has gained considerable attention with advancements in arthroscopic techniques [10-13]. Despite its minimally invasive nature and the ability to address concurrent injuries such as meniscal and synovial damage, arthroscopic

repair is a complex procedure with high technical demands, a prolonged learning curve, and specific equipment requirements. Furthermore, achieving reduction and fixation is often more challenging with arthroscopic methods compared to open surgery.

The open posteromedial approach, introduced to avoid complications related to nerves and blood vessels, offers the potential for a clearer view of the fractured bone ends. It allows for complete fracture reduction and the effective fixation of bone fragments. In a study conducted by Sasaki et al. [14] in 2007, examining 20 knee specimens to compare the mechanical properties of tibias with PCL avulsion fractures fixed either with ORIF or arthroscopic sutures, no significant differences in tibial backward shift were observed between the two treatments. The advantages of the open posteromedial approach become evident, especially for primary-level hospitals facing challenges in accessing arthroscopic techniques. (Video 1).

### Conclusion

There are no case reports or research articles available for the management of PCL avulsion fracture of tibia associated with ipsilateral tibial shaft fracture. This case report contributes valuable insights into the successful management of PCL avulsion fractures complicated by ipsilateral fracture of the tibial shaft, emphasizing the importance of customized surgical techniques and the utilization of advanced fixation devices. The presented approach with cannulated cancellous screws and a spiked washer for the management of PCL avulsion fractures showcases a promising option for achieving stable fixation and promoting efficient healing in such challenging cases. Further research and long-term studies are warranted to validate the efficacy and durability of this innovative surgical method.

### Clinical Message

This case report contributes valuable insights into the successful management of PCL avulsion fractures associated with ipsilateral tibial shaft fracture, emphasizing the importance of customized surgical techniques and the utilization of advanced fixation devices. The presented approach with cannulated cancellous screws and a spiked washer showcases a promising option for achieving stable fixation and promoting efficient healing in such challenging cases.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

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## How to Cite this Article

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