

Surgical Management of Posterior Cruciate Ligament Avulsion Fracture: A Case Report

Komang Septian Sandiwiidayat¹⁾, Febyan²⁾, Dominicus Dimitri³⁾

¹⁾Orthopaedic Surgeon, Udayana University Educational Hospital,
Faculty of Medicine, Udayana University, Bali, Indonesia

²⁾Orthopaedic Surgery Resident, Prof. Dr. IGNG Ngoerah General Hospital,
Faculty of Medicine, Udayana University, Bali, Indonesia

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ABSTRACT

Background: Posterior Cruciate Ligament (PCL) avulsion fractures are relatively rare but significant injuries to the knee. The diagnosis and management of these injuries can be complex and require a comprehensive approach

Case Presentation: A 24-year-old female presented to the emergency department following a motorbike fall. She experienced significant pain in her knee and had a swollen popliteal fossa. Imaging studies, including X-ray and CT scan, revealed an avulsion fracture at the PCL insertion. The patient underwent successful surgical fixation of the avulsed fragment, following a positive posterior drawer, sag, and dial test suggesting an isolated PCL avulsion.

Conclusion: This case underscores the importance of a comprehensive and individualized approach to the management of PCL avulsion fractures. It further emphasizes the need for future research to delineate the long-term outcomes of different treatment strategies and to develop evidence-based guidelines for this unique and challenging injury.

Keywords: posterior cruciate ligament, avulsion fracture, knee injury, surgical fixation.

Correspondence:

Komang Septian Sandiwiidayat. Oncology Division, Department of Orthopaedic & Traumatology, Sanglah General Hospital, Faculty of Medicine, Udayana University, Bali, Indonesia. Email: drseptianortho@gmail.com. Mobile: 62-821-4725-2042.

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BACKGROUND

The Posterior Cruciate Ligament (PCL) serves as a vital stabilizer for the knee. Injuries to the PCL are generally infrequent and avulsion fractures are an even rarer occurrence (Katsman et al., 2018). The causative factors for such injuries include direct anterior blow to the proximal tibia

while knee is flexed (dashboard injury), and hyperextension (Nagashree et al., 2022). In pediatric patients, due to the ligament's elasticity and the physis and bone's relative weakness, they are more predisposed to osteochondral avulsion fractures than ligament injuries (Hurni et al., 2017).

These injuries can be categorised into three types based on radiographic findings: Type I (non-displaced fracture), Type II ("hinged" with superior displacement of only the posterior aspect of the avulsed fragment), and Type III (completely displaced) (White et al., 2013). Management strategies for PCL avulsion fractures range from nonoperative to surgical treatments, and the choice of approach depends on factors such as injury type, patient demographics, and surgeon preference (Hooper et al., 2017). For example, pediatric patients can often have satisfactory outcomes with conservative management of PCL tibial avulsion fractures (Hurni et al., 2017).

That is true that an isolated PCL injury will be able to heal by itself due to its intrinsic healing capabilities. However, when an avulsion happens, part of the bone will cause other issues for the knee joint such as ectopic ossification, hence requiring a precise surgical management. (Vaquero-Picado & Rodríguez-Merchán, 2017)

The aim of this paper is to delve deeper into PCL avulsion fractures, using the findings of recent studies. Therefore,

the author provides a case report of a PCL avulsion fracture managed by a very simple surgical procedure of screwing.

CASE PRESENTATION

A 24-year-old female patient presented to the emergency department following a fall from a motorbike. She reported significant pain localized to her knee, with no prior history of rheumatic or other chronic diseases. On physical examination, the popliteal fossa appeared swollen, suggesting a potential injury to the posterior aspect of the knee. Knee functional score was calculated and the result shows 25% for pre-operative IKDC score and 32% for his pre-operative Tegner-Lysholm score. A radiographic assessment was conducted, revealing a portion of posterior tibial bone detached from the main bone completely. In order to validate the diagnosis and evaluate the injury's magnitude, a computed tomography (CT) scan was carried out, which illustrated a more distinct avulsion with a hinged fragment of the posterior cruciate ligament (PCL) insertion (Figure 1).

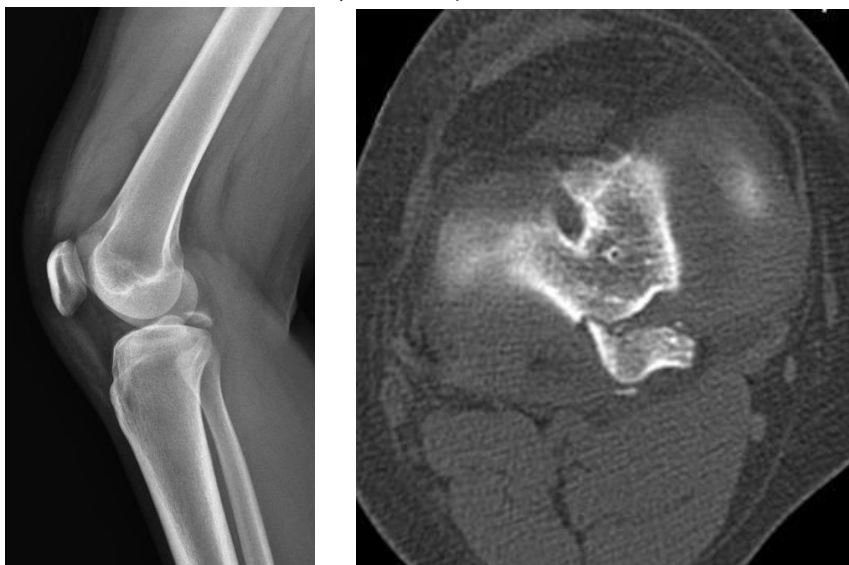


Figure 1. Patient's X-ray (left) reveals avulsion of posterior segment of the tibia which is the location of PCL insertion. CT-Scan (right) revealed a hinged fragment of the fracture.

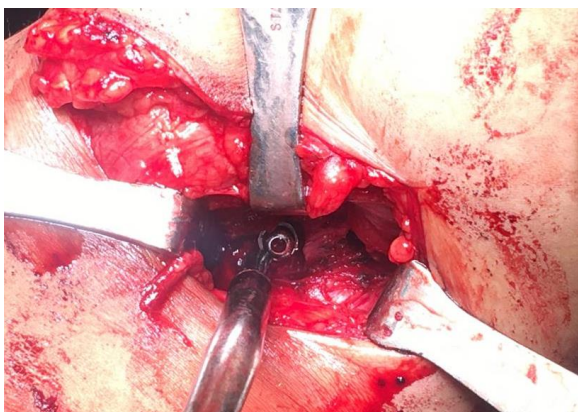


Figure 2. Intraoperative view of screw placement of the avulsed fragment

Subsequent to the evaluation, a surgical plan was established to address the avulsed fragment. The plan involved using screws to fixate the fragment, a procedure

was then performed to stabilize the injury and facilitate healing (Figure 2).

RESULTS

Based on the results of physical and imaging examinations, the patient was diagnosed with a type II posterior tibial avulsion fracture and a possible PCL rupture. In preparation for surgery, the patient underwent a preoperative assessment that included a posterior drawer test, posterior sag sign, dial test, and ACL tests (Lachman test and anterior drawer test) while under general anesthesia. The findings from all PCL tests were affirmative, indicating an isolated PCL avulsion with attached bony fragment.



Figure 3. Post-operative X-ray in AP (left) and lateral (right) position showing good placement of screw.

The surgery was done without any remarkable complication. Post-fixation PCL test was done, and the result shows a stable knee on previously unstable knee. Post-

operatively an additional X-ray was conducted to review the screw placement and it shows a satisfactory result (Figure 3).



Figure 4. Post-operative clinical picture showing full range of motion of extension (left) and flexion (right).

The patient undergoes physical therapy and hinged braced for 2 months. Upon follow up of 6 months after surgery, no pain was felt, and the patient can walk effortlessly with a very good range of motion (Figure 4). Patient's post-operative functional score was improved significantly, IKDC score shows three-fold increment from 25% to 85%, while Tegner-Lysholm scores show significant improvement from 32% to 94%.

DISCUSSION

PCL avulsion fractures, while infrequent, are significant knee injuries. Diagnosing such injuries involves a detailed clinical examination and the use of suitable imaging techniques (Katsman et al., 2018). In the case presented, the diagnosis was enabled by X-ray and CT scan, which provided clear images of the avulsion at the PCL insertion. The etiology of PCL avulsion injuries can be varied, including knee hyperflexion, a dashboard injury, or hyper-extension (Nagashree et al., 2022).

In this case, the patient's motorbike fall could have led to any of these mechanism, resulting in the observed PCL avulsion fracture. PCL avulsion fractures can be categorised into three types based on radiographic findings: Type I, Type II, and Type III (White et al., 2013). Grasping this classification is key as it can aid in deciding

the most suitable treatment approach. Treatment options for PCL avulsion fractures can vary from conservative methods to surgical intervention (Phatama et al., 2021). The choice is informed by factors such as the nature of the injury, patient factors, and the surgeon's preference (Hooper et al., 2017). Traditional approach to this condition would be an open reduction and internal fixation with screw (Joshi et al., 2017), however these days there are other minimal invasive option, such as small (3-4cm) incision through popliteal fossa or arthroscopic approach which leaves less than 1 cm wound (Guo et al., 2023).

In the case presented, the decision was made to surgically fixate the avulsed fragment, which aligns with the literature suggesting that surgical repair can yield satisfactory outcomes. While pediatric patients can often be managed conservatively with good results (Hurni et al., 2017), adults like the patient in this case might require a more proactive approach, such as surgery, for optimal recovery and functional outcomes. Our case shows a good result of knee functional score that increased threefold postoperatively compared to pre-operative state.

Given the rarity and complexity of PCL avulsion fractures, this case empha-

sizes the importance of thorough imaging and physical examination to accurately diagnose and appropriately manage such injuries. The eventual outcome for this patient would be dependent on successful surgical intervention, followed by a comprehensive rehabilitation program to restore knee function.

In conclusion, this case report emphasizes the complexities associated with diagnosing and managing PCL avulsion fractures. A comprehensive clinical examination and suitable imaging techniques are essential for an accurate diagnosis. Understanding the mechanisms and classification of such injuries can guide the choice of treatment approach. In the case discussed, the preferred approach was surgical fixation of the avulsed fragment, which aligns with the consensus in the literature that this approach can yield satisfactory outcomes in adults. This case highlights the importance of a personalized approach in managing PCL avulsion fractures and calls for ongoing research to improve our understanding of long-term outcomes and to develop evidence-based treatment guidelines for this specific and challenging injury.

AUTHOR CONTRIBUTION

Komang Septian Sandiwidayat is an Expert, Conceptual, Editing, Reviewing. Febyan Searches for literature, Editing, Reviewing. Dominicus Dimitri Editing, Reviewing, Templating

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CONFLICT OF INTEREST

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest

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