

An Unusual Case of Anteriorly Displaced Posterior Cruciate Ligament Tibial Attachment Avulsion Injury

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Abstract

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BACKGROUND: Avulsion injury to the tibial attachment of posterior cruciate ligament (PCL) is frequently occur. The purpose of this report is to highlight an unusual variation of PCL avulsion injury.

CASE PRESENTATION: A 24-year-old female was suffered a motorcycle accident 1 day before admission. The patient complained of severe right knee pain. Plain radiograph and CT-scan revealed an anteriorly displaced tibial attachment PCL avulsion fracture. Open surgical fixation was done to the patient. A satisfactory outcome was observed until the final 1-year follow-up.

CONCLUSIONS: The bony fragment of the tibial attachment of posterior cruciate ligament avulsion injury can be displaced to the anterior compartment of the knee. Concomitant injury to other knee structures should be suspected when finding this case. Special consideration is also needed during the management of this unusual case.

Introduction

A posterior cruciate ligament (PCL) is one of the most important structures of knee stabiliser. It prevents tibia to posteriorly translated especially during knee flexion and rotation. PCL is a strong ligament. Therefore avulsion injury to the tibial attachment frequently occurred [1]. It may lead to chronic knee pain, instability, further injury to other knee structures and induced early joint arthrosis if left untreated [1], [2]. The treatment itself varied from conservative treatment, surgical open reduction-internal fixation to arthroscopically assisted fixation [2], [3], [4].

Rademakers *et al.*, [5] adapted the Meyers and McKeever classification [6] of anterior cruciate ligament (ACL) for into PCL avulsion injury. It was described that PCL Avulsion could be classified into

three grades: Grade I: non-displaced; Grade II: partially displaced; and Grade III: complete displaced [5]. We reported a case of grade III PCL avulsion injury which the bony fragment was displaced to the anterior compartment of the knee in a young female patient. To our knowledge, there has been no previous literature reporting this variation of the PCL avulsion injury. Informed consent was obtained from the patient before this publication.

Case Presentation

A 24-year-old female was suffered a motorcycle accident 1 day before admission. The patient complained of severe right knee pain. She was brought to emergency department at a district

hospital. Plain radiograph and CT-Scan of the knee was also performed at the district hospital. She then requested to be referred to Prof. Dr R. Soeharso Orthopaedic Hospital for further management.

Physical examination revealed a severely swollen knee, with the sign of skin brushing and excoriation at the anterior part of the knee (Figure 1A). There was tenderness both on the anterior and posterior part of the knee. Neurovascular status was normal. Knee joint range of motion was limited to 90 degrees. A positive result was obtained on the posterior drawer test. Anterior drawer, valgus-varus test were negative. The patient refused any other complaints on another part of the body. Plain radiograph of the knee revealed a large bony fragment at the anterior compartment of the knee (Figure 1B).

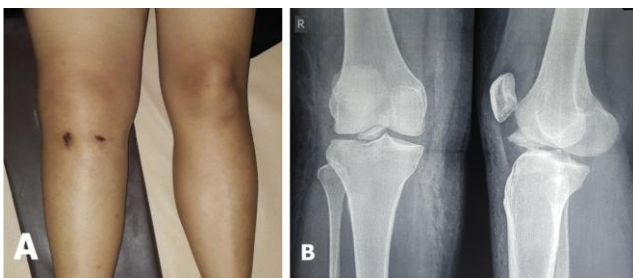


Figure 1: Clinical picture of the knee at 1 day after trauma. The right knee was swollen with skin brushing and excoriation on anterior part A); Preoperative plain radiograph of the knee. The displaced fragment located at anterior compartment of the knee, masquerading of an ACL fragment B)

An avulsion injury to the anterior cruciate ligament (ACL) was suspected based on the plain radiograph results. However, the result of CT was different. It was shown that the large anterior bony fragment was originated from a posterior part of the tibia which indicates a PCL avulsion injury (Figure 2A and 2B). We ask the patient to perform a magnetic resonance imaging (MRI) study of the knee for further evaluation of other soft tissue structures. However, it was rejected by the patient and family due to financial issue.

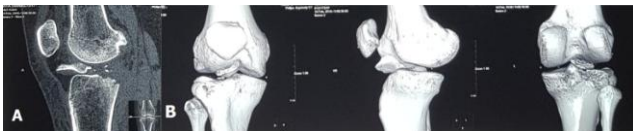


Figure 2: Sagittal CT image of the knee showed the fragment was originated from the posterior side of the tibial plateau A); Three-dimension CT showed the exact site of PCL avulsion fracture B)

Operative treatment was planned for the patient. Under general anaesthesia, the surgical procedure was performed to the patient in a prone position. Preoperative antibiotic with 2 g of Cefazolin was administered before skin incision. Burks and Schaffer approach [3] was utilised to expose the fracture site. Intraoperatively, reposition of the fracture

fragment from the anterior compartment was done with a mosquito clamp, then fixation of the fragment was performed with a 4.5 mm malleolar screw (Figure 3A). Rupture of the posterior root of lateral meniscus also observed and repaired with an absorbable suture. After irrigation with normal saline, the wound was then closed with a suction drain. Cefazolin injection was continued until 48 hours postoperatively, followed by oral cefadroxil for 5 days.

Postoperative rehabilitation includes the application of posterior knee splint which retained until 2 weeks, isometric quadriceps exercise and ankle pump exercise started at day 1 after surgery. The range of movement exercise of the knee started after 2 weeks and increased gradually to obtained full knee range of movement at 6 weeks after the surgery. Non-weight bearing ambulation was applied for the first 4 weeks, followed by partial weight-bearing as tolerated. Full weight-bearing ambulation was allowed after 8 weeks. The patient was followed monthly for progression of a range of motion and evaluation of knee stability. During follow-up, full knee range of movement was obtained at 6 weeks postoperatively and maintained until the final 1 year of follow-up (Figure 3B, and 3C). Posterior drawer test revealed some posterior laxity (grade 1). However, the patient has no subjective complaint about her knee. Plain radiograph also showed a complete bony union (Figure 3D).



Figure 3: Immediate postoperative radiograph A); Clinical outcome at 1-year follow-up (B, and C); Radiograph at 1 year follow-up D)

Discussion

This case report described an unusual variation of PCL avulsion injury. The PCL avulsion injury classification described by Rademakers *et al.*,

[5] did not mention whether the fragment is anteriorly displaced or remain in the posterior compartment. To the best of our knowledge, this was the first report describing this pattern of injury. We hope this report may give some different insight into the spectrum of PCL avulsion injury.

The main issue to discuss is about the mechanism of injury. There were three mechanisms for PCL injury, include 1. Hyperflexion injury which resulted in a mid substance rupture; 2. Dashboard injury which resulted in a substance rupture at the level of tibial plateau or avulsion injury; and 3. Hyperextension injury which resulted in a substance rupture at the proximal part of PCL [7]. In our recent case, the anteriorly displaced fragment was quite large (approximately 3 x 2 x 1 cm). A large anterior opening with frank posterior tibial translation and some distraction force may be needed to allow the large fragment migrated from posterior to the anterior compartment of the knee. This situation may be only possible when the knee joint is in flexion position. Also, there was an evidence of skin brushing and excoriation on the anterior part of the knee which indicates a previous posterior direct hit on the proximal part of the tibia. Therefore, the most possible mechanism of this case it might be a "Dashboard injury".

Another unusual variation of PCL avulsion injury has been reported by Ogawa *et al.*, [8]. They found a case of PCL avulsion injury associated with a lateral tibial condyle avulsion fracture. The authors believed that the mechanism of injury was not associated with the three previously described mechanism. An extension-distraction injury with more predominantly distraction believed to be the mechanism. That was due to no injury observed on the posterior capsule of the knee. Similarly to Ogawa's case, we also believed that some distraction mechanism also occurred in our recent case.

The investigation is another important issue. A missed diagnosis to an ACL avulsion injury might happen if the plain radiograph is the only available imaging study. As the bony fragment is completely located in the anterior compartment of the knee and masquerading an ACL avulsion injury (Figure 1B). A preoperative CT and/or MRI is mandatory to prevent missed and incomplete management. The intraoperative combined procedure with arthroscopy diagnostic and treatment also could be recommended.

Consideration of concomitant injury to other knee structures are also crucial. Liu *et al.*, [9] reported a series of 21 cases of PCL avulsion injury associated with posterior root meniscal repair with a satisfactory outcome. Conversely, Ogawa *et al.*, [8] did not find any other injured part of the knee including ACL, both meniscus and cartilage. In our recent case, we found

a posterior root of lateral meniscus rupture which also has been repaired. The patient has no complained of persistent pain, snapping or locking of the knee until the final follow-up. The presence of concomitant injury to other structure of the knee should be suspected when there was a complete displaced fragment, especially if the bony fragment is large (> 20 mm).

In conclusion, the bony fragment of the tibial attachment of posterior cruciate ligament avulsion injury can be displaced to the anterior compartment of the knee. Concomitant injury to other knee structures should be suspected when finding this case. Special consideration is also needed during the management of this unusual case.

References

1. Hashemi SA, Salehi N, Azarifar F, Jahanshahi A, Mohammadi H. Evaluation of Knee Joint after Open Reduction and Internal Fixation Surgery of Posterior Cruciate Ligament in Patients with Avulsion Fracture. *Open Access Maced J Med Sci.* 2019; 7(6):982-986. <https://doi.org/10.3889/oamjms.2019.185> PMID:30976345 PMCid:PMC6454159
2. Katsman A, Strauss EJ, Campbell KA, Alaia MJ. Posterior Cruciate Ligament Avulsion Fractures. *Curr Rev Musculoskelet Med.* 2018; 11(3):503-509. <https://doi.org/10.1007/s12178-018-9491-2> PMID:29869136 PMCid:PMC6105473
3. Khatri K, Sharma V, Lakhota D, Bhalla R, Farooque K. Posterior Cruciate Ligament Tibial Avulsion treated with Open Reduction and Internal Fixation through the Burks and Schaffer Approach. *Malays Orthop J.* 2015; 9(2):2-8. <https://doi.org/10.5704/MOJ.1507.004> PMID:28435601 PMCid:PMC5333651
4. Chen LB, Wang H, Tie K, Mohammed A, Qi YJ. Arthroscopic fixation of an avulsion fracture of the tibia involving the posterior cruciate ligament: a modified technique in a series of 22 cases. *Bone Joint J.* 2015; 97-B(9):1220-5. <https://doi.org/10.1302/0301-620X.97B9.35765> PMID:26330588
5. Rademakers MV, Kerkhoffs GM, Kager J, Goslings JC, Marti RK, Raaymakers EL. Tibial spine fractures: a long-term follow-up study of open reduction and internal fixation. *J Orthop Trauma.* 2009; 23(3):203-7. <https://doi.org/10.1097/BOT.0b013e31819b08ba> PMID:19516095
6. Meyers MH, McKeever FM. Fracture of the intercondylar eminence of the tibia. *J Bone Joint Surg Am.* 1959; 41-A(2):209-20. <https://doi.org/10.2106/00004623-195941020-00002>
7. Janousek AT, Jones DG, Clatworthy M, et al: Posterior cruciate ligament injuries of the knee joint. *Sports Med.* 1999; 6:429-441. <https://doi.org/10.2165/00007256-199928060-00005> PMID:10623985
8. Ogawa H, Sumi H, Shimizu K. Posterior cruciate ligament mediated avulsion fracture of the lateral tibial condyle: a case report. *J Orthop Surg Res.* 2010; 5:67. <https://doi.org/10.1186/1749-799X-5-67> PMID:20825638 PMCid:PMC2945975
9. Liu Y, Li G, Zhang K, Ni J, Sun X. Arthroscopically assisted treatment of posterior cruciate ligament avulsion fracture with meniscus posterior horn tear. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi.* 2016; 30(10):1205-1209.