

Case Report

Transverse patellar fracture with avulsion fracture of the tibial posterior cruciate ligament attachment: a case report

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Abstract: We present a case of patellar fracture with avulsion fracture of the tibial posterior cruciate ligament (PCL) attachment; to our knowledge, this is the first report of its kind. Patellar fracture is often accompanied by anterior knee pain, which can make it difficult to perform the draw test and thereby mask the PCL injury. Moreover, cases of avulsion fracture of the tibial PCL attachment are rarely encountered, which probably indicates that it is frequently undiagnosed. Undiagnosed avulsion fractures can have serious sequelae. We present the case of a 23-year-old man with patellar fracture and avulsion fracture of the tibial PCL attachment after sustaining a direct contact injury of the left knee due to a fall on the ground with the knee flexed. The patellar fracture was treated with implantation of three percutaneous cannulated screws. The avulsion fracture of the tibial PCL attachment was accessed via a posteromedial approach between the semitendinosus and the medial head of the gastrocnemius and fixed with cannulated screws (4.0 mm). After recovery, the patient was completely pain free and satisfied with the outcome. This case highlights the importance of ruling out avulsion fracture of the tibial PCL attachment in patients with a patellar fracture.

Keywords: Avulsion fracture, posterior cruciate ligament, patellar fracture

Introduction

Patellar fractures comprise 1% of the fractures in adults [1]. Posterior cruciate ligament (PCL) disruption occurs in up to 20% of all knee ligament injuries [2]. Avulsion fracture of its tibial insertion is one of the manifestations of a spectrum of PCL injuries [2]. The tibial origin lies in a fovea 1 cm below and behind the tibial surface [3]. Undiagnosed avulsion fracture of the tibial insertion of the PCL can lead to arthritis, meniscal tears, and quadriceps atrophy [4-7]. The combination of patellar fracture and avulsion fracture of the tibial PCL attachment has never been reported in the literature. Patellar fracture is often accompanied by anterior knee pain, making it difficult to perform posterior drawer test and thereby masking the PCL injury. Moreover, avulsion fractures of the tibial attachment of the PCL are rarely encountered by orthopedic surgeons, suggesting that these lesions may frequently remain undiagnosed.

Herein, we present a case of patellar fracture and avulsion fracture of the tibial PCL attachment.

Case report

A 23-year-old man was brought to the emergency room with a swollen knee. He had a history of a fall on the ground with his knee flexed, after which he experienced a sudden snap and pain in the anterior aspect of his left knee. Within a few minutes of the fall, the knee was swollen, and he could not flex or extend his knee due to increasing severity of pain. The findings of physical examination were hemarthrosis and tenderness over the patella. The posterior drawer test could not be performed because of the severe pain. The anteroposterior view radiograph showed irregularities in the central part of the proximal tibial plateau (**Figure 1A**), while the lateral view radiograph showed fractures of both the patella and the posterior part of the proxi-

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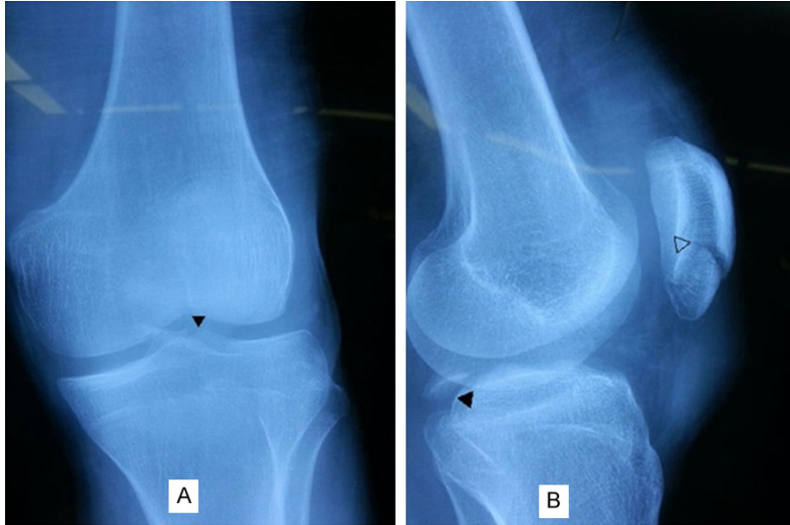


Figure 1. A. Anteroposterior view of the affected knee. Black arrowhead indicates avulsion fracture of the tibial attachment of the posterior cruciate ligament; B. Lateral view of the affected knee. Black arrowhead indicates avulsion fracture of the tibial attachment of the posterior cruciate ligament. White arrowhead indicates patellar fracture.



Figure 2. Three-dimensional computed tomography views of the affected knee. Black arrowhead indicates avulsion fracture of the tibial attachment of the posterior cruciate ligament.

mal tibial plateau (**Figure 1B**). Computed tomography (CT) clearly showed the avulsion fracture of the tibial PCL attachment (**Figure 2**).

The patient was scheduled for open reduction and internal fixation of the PCL avulsion 1 day after admission. When clinical examination was

performed with the patient under anesthesia, the posterior drawer sign was found to be positive. The patient was placed in the supine position. The patellar fracture was treated with reduction and internal fixation. Provisional fixation of the fracture was achieved using Kirschner wires of diameter 1.2 mm, followed by screw fixation with three cannulated screws (OsteoMed, Addison, Texas) of diameter 4.0 mm. The fixation procedure was completed percutaneously.

Then, the patient was placed in the prone position. The fracture site was approached via the posteromedial aspect of the gastrocnemius with lateral mobilization of the medial head of gastrocnemius in order to avoid damage to the neurovascular structures. The intact capsule of the posterior knee was incised, and the avulsed fragment of the posterior tibia, which was noncomminuted and remained attached to the intact PCL, was identified. The fragment was more than 3-cm long. The point of the attachment of the fragment was prepared, and the fragment was mobilized towards it. Provisional fixation of the avulsion fracture was achieved with a 1.6-mm Kirschner wire, followed by screw fixation with two 4.0-mm cannulated screws (**Figure 3A, 3B**). The normal posterior drawer and sag signs were reestablished at the end of the surgery. The knee was immobilized in a cylindrical cast for 1 week, and the patient was allowed partial weight-bearing. After removal of the cast, the patient commenced physical training with range-of-motion exercises followed by light-resistance exercises. Partial weight bearing of 20 kg was allowed for 4 weeks, and knee flexion was restricted to up to 90° for 4 weeks.

At a follow up 3 months after the surgery, the patient had a stable knee with no motion restriction, and physical examination showed a negative posterior drawer sign. There was no pain or swelling on his left knee. Examination of the quadriceps of both sides by using the

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Figure 3. A. Postoperative lateral views; B. Postoperative anteroposterior views.

Cybox 6000 isokinetic dynamometer (Cybex, Ronkonkoma, N.Y.) showed that the muscle strength on the affected side was almost the same as that of the contralateral side. Isokinetic strength assessment was performed in the sitting position, with test speeds of 90 and 180°/s. The average peak strength at 90°/s extension concentric contraction of the affected knee was lower than that recorded for the contralateral knee (15%), but higher than the flexion concentric contraction recorded for the uninvolved knee (5%). Informed consent has been obtained from the patient for publication, including any necessary photographs. This study was approved by the Ethical Committee of our hospital.

Discussion

Only a few cases of patellar fractures with soft tissue injuries have been reported thus far [8-11]. Patellar fractures have been reported to occur in combination with open bicondylar Hoffa fracture [12]. Similarly, an avulsion fracture of the PCL may not be an isolated finding; tears of the PCL have been reported to be associated with femoral and patellar chondral defects as well as tears of the anterior cruciate ligament and menisci [13, 14]. However, no case of patellar fracture with avulsion fracture

of the tibial PCL attachment has been reported thus far.

We believe that the fractures in this case might have been caused by the direct forces such as a fall on the anterior aspect of the knee; in such cases, the posteriorly directed blow to the anterior aspect of the proximal tibia with the knee in flexion drives it backwards resulting in the avulsion fracture of the tibial PCL attachment. Avulsion fracture of the tibial PCL attachment is an uncommon lesion among the spectrum of PCL injuries in adults. Improper treatment of PCL injury has been associated with an increased

risk of articular cartilage degeneration (particularly, in the medial and patellofemoral compartments), with subsequent development of arthritis, meniscal tears, and quadriceps atrophy [4-7]. The treatment method for avulsions of the PCL depends on the nature of the injury. In cases of non-displacement or minimal displacement of the avulsed fragment, non-operative management with a concentration on quadriceps strengthening may be sufficient [15, 16]. However, in cases with excessive displacement of the avulsed fragment or failure of the nonoperative treatment, surgical reduction and fixation may be considered [6, 15, 17-19]. Implantation of cannulated screws [20-24] and/or multiple wires [25, 26] and placement of sutures [23, 27, 28] have been proven to be effective in the treatment of PCL avulsion fractures. Kim et al. [25] proposed different ways for fixing avulsion fragments of different sizes. They suggested the use of cannulated screws for large bony fragments (>20 mm), use of multiple pins for medium-sized fragments (10 to 20 mm), and use of wire sutures and multiple sutures for small fractures (<10 mm) without and with comminution. In this case, the avulsed fragment was large and displaced; therefore, we treated the patient operatively with implantation of cannulated screws.

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Non-operative, conservative treatment may be indicated for patellar fractures with fragment displacement of less than 3 mm or articular incongruity of less than 2 mm and intact extensor mechanism. However, because avulsion fracture of the tibial PCL attachment would require a surgical approach for restoration, the fracture of the patella can also be treated in parallel, via a minimally invasive approach. The fixation of the patella can prevent its displacement when treating the tibial fracture and allow for early postoperative mobilization of the knee.

Conclusion

In conclusion, avulsion fracture of the tibial PCL attachment should be ruled out in cases of patellar fracture after a direct injury to the knee. Both lesions require distinct treatment strategies.

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Disclosure of conflict of interest

None.

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