Avulsion fracture of femoral attachment of posterior cruciate ligament: a case report and literature review

Yongwei Zhou, Qining Yang, Yang Cao

Department of Orthopedics, Jinhua Municipal Central Hospital, Jinhua Hospital of Zhejiang University, Jinhua 321000, China

Correspondence to: Yongwei Zhou. Department of Orthopedics, Jinhua Municipal Central Hospital, Jinhua Hospital of Zhejiang University, Jinhua 321000, China. Email: 15958961645@163.com.

Abstract: The avulsion fracture of the femoral attachment from the posterior cruciate ligament (PCL) is quite rare, particularly in adults. The patient we presented here was admitted to receive treatment in June 2017, whose knee injury resulted in avulsion fractures at three sites, the femoral attachment of the PCL, the tibial insertion of the anterior cruciate ligament (ACL), and the femoral attachment of the medial collateral ligament (MCL). We repaired PCL femoral attachment by arthroscopy and fixed MCL femoral insertion with cannulated screws.

Keywords: Posterior cruciate ligament (PCL); avulsion from femoral attachment; arthroscopic repair

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Introduction

Multiple injury patterns of posterior cruciate ligament (PCL) have been reported, such as ligament substance injuries, tibial insertion tears and avulsions from femoral attachment (1). For the avulsion of the PCL from femoral attachment, there are merely two reported cases in adults (2,3) repaired with arthroscopy, although several cases of patients under age have been reported during recent years (4-6).

Plentiful cases of arthroscopic repairs resolving this condition have been reported in the past few years (7-11). However, they were managed by open reduction as a standard remedy. In this article, we present an uncommon case of arthroscopically assisted fixation for an avulsion of the PCL from the femoral attachment.

Case presentation

A 52-year-old man hit his right knee, with swelling and pain appearing in the knee and then he had the problem of motion inability. On the fifth day after the accident, he sought the medical care in our department. He reported no radiating pain in the distant extremities and numbness. When treated in our hospital, he accepted roentgenographic examination which showed the avulsion fractures in right tibial plateau and right femoral inferior border (*Figure 1*). A computerized tomography (CT) scan was performed at the out-patient clinic, suggesting "fractures in the right femoral inferior border and the right tibia" (*Figure 2*). He was admitted with a tentative diagnosis of "an avulsion fracture in the right tibial plateau and a fracture in the medial epicondyle of the right femur". Physical examination demonstrated the swelling in right knee, fragility in femoral medial epicondyle(+), a valgus stress test(+) and anterior and posterior drawer tests(+). The magnetic resonance imaging (MRI) when taking on admission showed that "the fractures in the tibial plateau and the medial epicondyle of the right femur, a PCL avulsion from the femoral insertion, an avulsion of the anterior cruciate ligament (ACL) from the tibial attachment concomitantly with the peripheral soft tissue contusion and the spatium intermusculare effusion, which indicates further examinations are needed; the right medial meniscus posterior root tear; the effusion from the joint capsule of the right knee" (*Figure 3*). The plaster splint

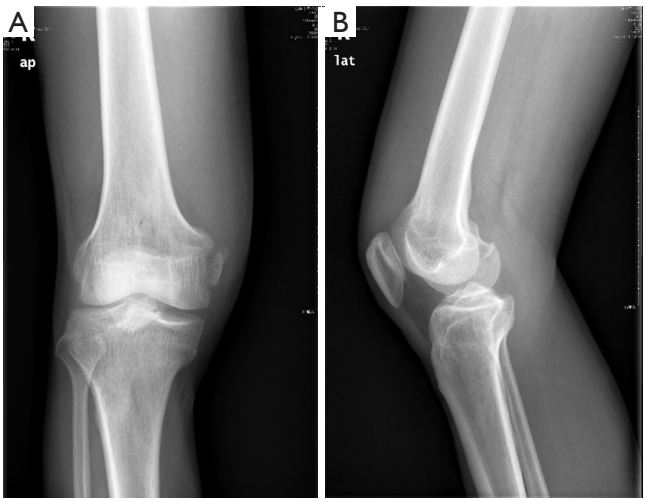

Figure 1 X-ray notch and lateral roentgenogram.

Figure 2 CT suggesting the fractures in the femoral medial epicondyle and the tibial eminence. CT, computerized tomography.

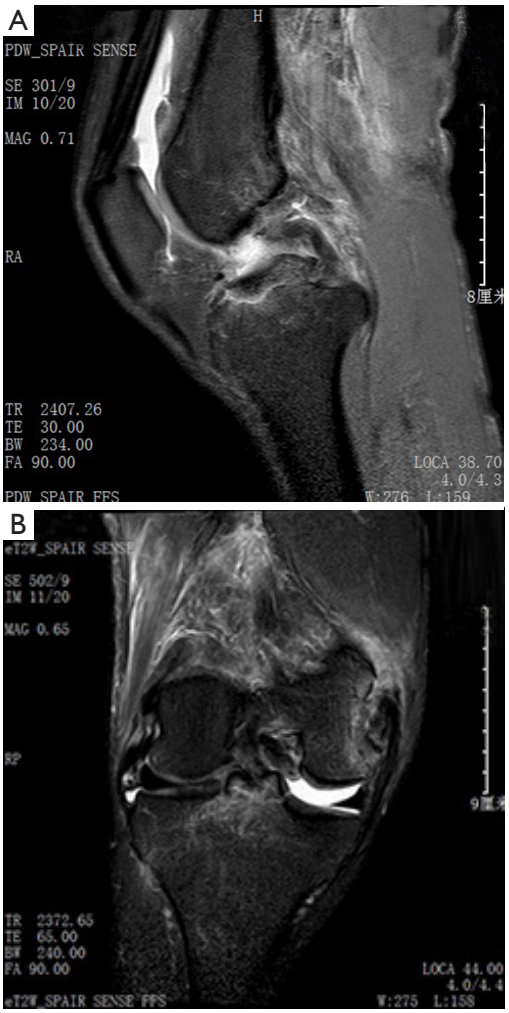

Figure 3 Sagittal and coronal MRI showing the avulsion fractures of the ACL from the tibial insertion and of the PCL from the femoral attachment. MRI, magnetic resonance imaging; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament.

immobilization was performed before swelling treatment. After swelling reduction, the PCL femoral insertion was arthroscopically repaired, with cannulated screws secured at the femoral attachment of the MCL.

In the arthroscopic examination, the anteromedial and anterolateral portals were established as always conducted, confirming an intact ACL and a tibial insertion avulsion, but the displacement was not dealt with because it was not evident. It also showed a loose PCL, a partial avulsion of the femoral collateral periosteum and the cortical bone, and insufficient tension (*Figure 4*). Firstly, the damaged tissues were debrided. Based on the observation from the anteromedial portal, an absorbable 4.5-mm rivet was then inserted from right anterolateral portal opening and was secured in the medial surface of the femoral medial epicondyle. The PCL femoral attachment was fixed in the footprint by employing a suture hook. In the intraoperative test, the insufficiency of PCL tension was found, therefore, a tunnel of 4.0 mm was made at the femoral attachment (*Figure 5*). PCL was suspended and reattached at the femoral attachment with Ethibond sutures, followed

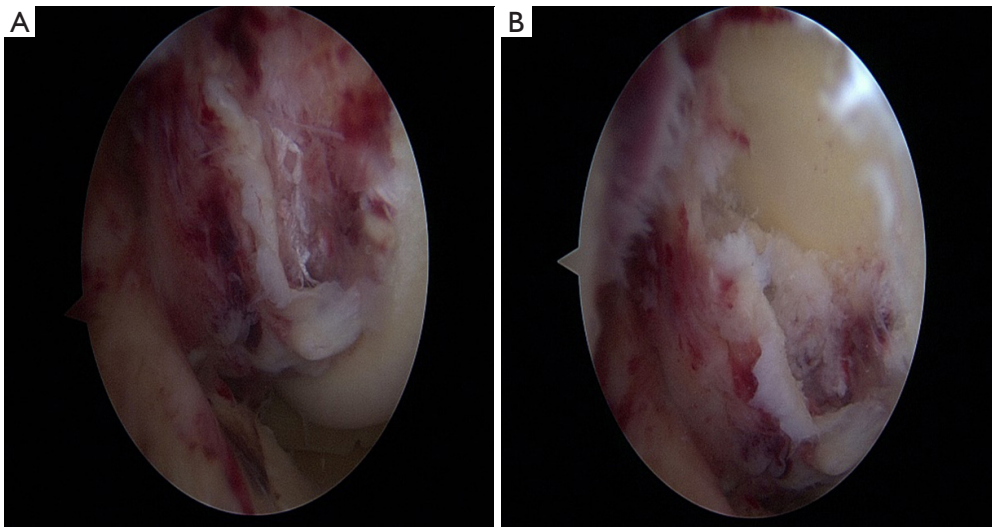

Figure 4 View during arthroscopy: an avulsion fracture of the PCL from the femoral attachment. PCL, posterior cruciate ligament.

Figure 5 The tunnels were established at femoral attachment to tighten PCL. PCL, posterior cruciate ligament.

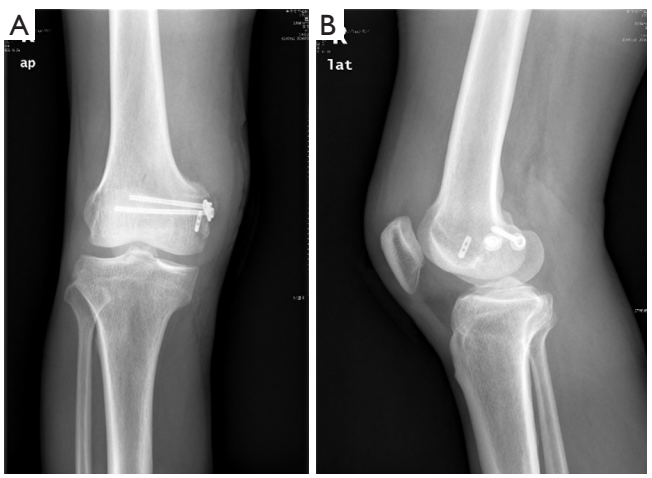

Figure 6 Two-month follow-up, X-ray indicated good reduction.

by PCL tensioning. Then, the endobutton was used to firmly secure the femoral cortex of the tunnel. A posterior drawer test was carried out during surgery. The traditional procedure was done subsequently, the open reduction for the medial femoral epicondyle. Two gasketed cannulated screws were applied to fix the tibial insertion of the medial collateral ligament. The reliable fixation indicated a successful surgery. The patient was then transferred to the regular care unit after operation. After 2-month follow-up, the patient accepted an X-ray examination (*Figure 6*) which shows his leg remains pain-free with stable brace support.

Discussion

There are multiple ligaments of a knee joint which are complicated in anatomy. PCL is the most important one with highest strength, which is twice stronger than ACL, comprising the anterolateral bundle (ALB) and the posteromedial bundle (PMB) (12). The ruptured bundles can lead to posterior and rotatory instability of the knee joint (13). Ruptures of the PCL are rare in

comparison with other ligament injuries. The avulsion fracture of the PCL from the femoral attachment seldom occurs (14), given its inherently robust fibers. However, the avulsion from the tibial insertion arises more frequently than the femoral attachment. There are a few reported cases of the avulsed PCL from the femoral insertion, but it often arises among children as the ligament tissues, compared with bony structures, are relatively higher in flexibility and strength (5,15,16). Nevertheless, these injuries are often undervalued and ignored, inducing some complications (17).

In 2005, Park *et al.* (2) reported a case of a 42-year-old patient with a PCL avulsion from the femoral insertion, with arthroscopic repair technique using four transfemoral tunnels. In 2012, Xu *et al.* (3) reported a case of 22-year-old patient with an avulsion of the PCL with a femoral origin. There were two parts in the partial osteochondral avulsion fracture of the PCL PMB. One part was fixed with polydioxanone suture through drill holes and the other was removed.

Our case presents a 52-year-old man who is the oldest person on record to have an avulsed PCL from femoral attachment recovered by employing arthroscopy repair. The mechanism of injury was a direct blow to the lateral aspect of the knee while in a standing position, which resulted in a tension force from medial to lateral across the knee causing femoral avulsion of the MCL, and subsequently, posterior and ACL avulsion from femur and tibia, respectively. PCL was secured at the footprint of femoral medial epicondyle through a minimally invasive surgical procedure, arthroscopy for the knee joint. A femoral tunnel was made to tighten the PCL that had once been loose.

In conclusion, we reported a rare case, completely presenting the associated radiographs and arthroscopic photos. As for the repair of avulsed PCL from the femoral attachment, this report provides a valuable option of arthroscopic fixation using rivets and a single tunnel.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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