CASE REPORT

Fixation of femoral attachment: anterior cruciate ligament avulsion fracture with arthroscopy suture loop technique

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SUMMARY

Anterior cruciate ligament (ACL) avulsion fracture is rare and mostly occur in tibial attachment. Avulsion fracture of femoral attachment of ACL was uncommon and mostly reported in skeletally immature patient. This article aims to report an interesting case of femoral attachment–ACL avulsion fracture in skeletally mature patient with arthroscopic suture loop fixation. A 32-year-old man, with no significant medical-surgical history, sustained a right non-contact pivoting knee injury during soccer competition. Plain radiographs of knee joint demonstrated intra-articular bone fragment in the intercondylar notch space. The MRI confirmed femoral attachment–ACL avulsion fracture. Then, we planned to perform fixation of femoral attachment–ACL avulsion fracture with arthroscopy suture loop technique. At 5 months after surgery, patient had no pain and swelling knee. The physical examination demonstrated negative Lachman test, anterior drawer test, pivot shift test and patient can return to preinjury daily activity and sport activities.

BACKGROUND

Anterior cruciate ligament (ACL) injury is the most common knee ligament injury. Yet, ACL avulsion fracture is rare and mostly occur in tibial attachment. Avulsion fracture of femoral attachment of ACL was uncommon and mostly reported in skeletally immature patient.^{1–11} From previous studies, there were only five reported literatures in skeletally mature patient.^{12–16} Two patients were treated by removal of avulsion fragment and subsequently ACL reconstruction by bone–patellar tendon–bone graft.^{12–13} One patient underwent arthroscopic repair by suture anchor and two patients underwent arthroscopic fixation by screw.^{14–16}

This article aims to report an interesting case of fixation of femoral attachment–ACL avulsion fracture with arthroscopy suture loop technique.

CASE PRESENTATION

A 32-year-old man, with no significant medical-surgical history, sustained a right non-contact pivoting knee injury during soccer competition. The patient went to the hospital 2 days after injury and complained of pain, swelling, instability of knee and inability to bear weight on the affected limb. Physical examination revealed marked swelling knee and limited range of motion. The

Lachman test was positive. The anterior drawer, pivot shift and McMurray tests were unable to evaluate because of severe pain and limited motion of the knee. Knee aspiration was performed and the content was 80 mL of fresh blood.

INVESTIGATIONS

Plain radiographs of knee joint demonstrated intra-articular bone fragment in the intercondylar notch space (figure 1). The MRI demonstrated a large amount of knee effusion, bone contusion at mid weight-bearing lateral femoral condyle and femoral attachment–ACL avulsion fracture with 1.2×0.5×0.5 mm fragment size (figure 2).

DIFFERENTIAL DIAGNOSIS

We diagnosed this patient with femoral attachment–ACL avulsion fracture on the right knee.

TREATMENT

Diagnostic arthroscopy and treatment were performed. The patient was positioned supine on the operative table. An affected leg was positioned in 90° knee flexion with leg holder and non-affected leg was placed on a leg holder in a lithotomy position. Arthroscopic examination demonstrated femoral attachment–ACL avulsion fracture with no meniscal injury (figure 3). The suture passer was passed around ACL and advanced by the

Figure 1 Preoperative radiographs (anterior-posterior and lateral view of the knee) demonstrated intra-articular bone fragment in the intercondylar notch space.

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Figure 2 Preoperative MRI (T1 and T2 weighted) sagittal section of knee demonstrated a large amount of knee effusion, bone contusion at mid weight-bearing lateral femoral condyle and avulsion fracture at femoral attachment of anterior cruciate ligament.

Figure 3 Arthroscopic examination of the right knee demonstrated. (A) Displaced femoral avulsion fragment of the anterior cruciate ligament. (B) Empty notch of medial aspect of lateral femoral condyle. (C) Intact lateral meniscus. (D) Intact medial meniscus.

monofilament thread into the joint space. Monofilament thread was retrieved from the joint to the outside from anteromedial portal. Strong heavy strained non-absorbable sutures (Ultra-braid No. 5) were passed from outside and retrieved into joint to loop around the ACL via monofilament thread as a shuttle relay ([figure 4](#)). The small incision was made at the lateral side of the distal thigh. The 4.0 mm femoral tunnel was made at the femoral attachment of ACL by outside-in technique. Suture was retrieved from joint to lateral cortex of distal femur via femoral tunnel. Fracture was reduced to anatomical position and suture was pulled and tied around the screw with the washer in full extension of the knee ([figure 4](#)).

Postoperative rehabilitation

Postoperatively, the knee was immobilised in a long knee brace. At the end of 2 weeks, the extension knee brace was

Figure 4 Arthroscopic suture fixation of anterior cruciate ligament (ACL) right knee demonstrated. (A,B) Suture shuttle was passed around the ACL posteriorly and advances the monofilament thread into the joint space. Monofilament thread was retrieved from the joint to the outside. (C,D) Heavy strained non-absorbable suture (No.5 Ultrabraid) was inserted from anteromedial portal. (E) Fracture was reduced to anatomical position and suture was pulled and tied around the screw with the washer in full extension of the knee.

converted to a hinged knee brace and partial weight bearing was begun. During the period of immobilisation, static quadriceps, hamstring flexion exercises and straight leg raising exercises were performed. By the end of 4 weeks, full weight bearing was begun. Open chain quadriceps exercises were not initiated until 6 weeks postoperatively. Return to previous full activities was achieved at the end of 4 months.

OUTCOME AND FOLLOW-UP

When he presented to us at 6 weeks after surgery, patient gained full range of motion. The radiographs showed bony union at 3 months after surgery ([figure 5](#)). At 5 months after surgery, patient's knee had no pain and swelling ([figure 6](#)). The physical examination demonstrated negative Lachman test, anterior drawer and pivot shift test. Patient can return to preinjury daily activity and sport activities.

DISCUSSION

Avulsion fracture of femoral attachment of ACL in skeletally mature patient is rare. From previous studies, there was limited evidence for treatment. Literature about non-operative treatment was not found. There were only five reported literatures about operative treatment that were reviewed.¹²⁻¹⁶

Uhorchak *et al* and Nagraj *et al* reported a 25-year-old and a 20-year-old man with femoral attachment-ACL avulsion fracture at the right knee. Both patients were treated by arthroscopic removal of avulsion fragment and subsequently ACL reconstruction by bone-patellar tendon-bone graft.^{12 13} Prasathaporn *et al* presented a 25-year-old man with lateral tibial plateau fracture with femoral attachment-ACL avulsion fracture. Fracture was fixed by plate and screws. ACL repair with suture anchor fixation was performed. Six months after surgery, physical examination showed negative Lachman test, anterior drawer and pivot shift test.¹⁴ Shah *et al* presented a 47-year-old woman with femoral avulsion fracture of ACL with multiple fractures of the clavicle, tibial plateau and proximal fibula. Arthroscopic debridement and bony fixation were performed by screw fixation.¹⁵ Zabi-erek *et al* presented a 50-year-old man, amateur scuba diver, with negative radiographic finding. Arthroscopic finding

Figure 5 Postoperative radiographs (anterior-posterior and lateral view of right knee) demonstrated healing of avulsion fracture 3 months after operation.

Figure 6 Five months postoperative range of motion evaluation. (A) Full extension of the right knee joint. (B) Flexion right knee joint.

confirmed an avulsion fracture of the ACL femoral attachment with one large bony fragment. The anatomical reduction was achieved at 90° of knee flexion and two K wires were used to temporarily fix displaced femoral attachment. Two 2.4 mm cannulated, fully threaded screws were used to stabilise the femoral bony insertion of the ligament.¹⁶

In our reported patient, fixation of femoral attachment of ACL avulsion fracture with arthroscopy suture loop technique showed excellent clinical outcome. The patient could obtain full range of motion on the knee at 6 weeks and bone union at 3 months. Four months after surgery, patient can return to full sport activity with full range of movement. Several benefits of this technique were minimally invasive procedure to promote

anatomical reduction, stable fixation and early mobilisation. This procedure can prevent the reported incidence of fragment fracture in arthroscopy cannulated screw fixation and be performed in small or comminuted fragment in femoral attachment ACL avulsion fracture. The possible limitation in this reported procedure is longer lever of arm fixation; therefore, the windshield or bungee effect that can jeopardise fixation can be occurred.

Learning points

- ▶ Anterior cruciate ligament (ACL) avulsion fracture at femoral attachment is uncommon case.
- ▶ Arthroscopy assisted ACL avulsion fracture fixation with suture loop technique can be a treatment option.

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