

Case Report

Pseudoaneurysm of the Perforating Branch of the Deep Femoral Artery Following Anterior Cruciate Ligament Reconstruction

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The present report describes the first known, case of a pseudoaneurysm of the perforating branch of the deep femoral artery following anterior cruciate ligament (ACL) reconstruction. A 19-year-old man underwent ACL reconstruction using the outside-in femoral tunnel-creation method. Seven days after the surgery, he complained of abnormal thigh pain and had swelling with local heat on the distal lateral thigh. Magnetic resonance imaging, computed tomography, and color Doppler ultrasonography showed the pseudoaneurysm in the thigh. Resection surgery was successfully performed by a vascular surgeon 12 days after ACL reconstruction. Careful examination and awareness of postoperative symptoms such as thigh pain and swelling after ACL reconstruction were critical for the early diagnosis of pseudoaneurysm.

Key words: pseudoaneurysm, perforating branch of the deep femoral artery, anterior cruciate ligament

Vascular injury associated with anterior cruciate ligament (ACL) reconstruction is a very rare complication of arthroscopic surgery. A few cases of pseudoaneurysm following ACL reconstruction have been reported [1-3]. To the best of our knowledge, there are no previous reports of pseudoaneurysm associated with the outside-in technique for femoral tunnel creation. Herein, we present the first published report of pseudoaneurysm of the perforating branch of the deep femoral artery (DFA) following ACL reconstruction using the outside-in technique.

Case Report

The patient and his parents gave informed consent

for publication of this case in a medical journal. A 19-year-old man initially presented with ACL rupture of his right knee, resulting from twisting his knee during badminton. Two months after the injury, the patient underwent anatomic double-bundle ACL reconstruction using semitendinosus tendon autograft in our hospital. An air tourniquet was used during the surgery at 280 mmHg for 50 min. An outside-in femoral drill aimer (Smith & Nephew, Andover, MA, USA) was introduced into the anteromedial portal with the knee fixed at 90° of flexion. A 7-mm longitudinal skin incision for anteromedial (AM) tunnel creation was made at the point where the drill sleeve contacted the femoral lateral skin through the iliotibial band, allowing for insertion of the guide wire sleeve into the bone. Then, a 2.4-mm guide wire was inserted to confirm

that the position of the pin was appropriate. A guided pin was then advanced until it reached the tip of the femoral aimer. In the same manner, a guided pin for the posterolateral (PL) tunnel creation was inserted. Then, the guided pins were over-drilled using 5.5 and 6.0-mm-diameter cannulated reamers according to the diameter of the graft consisting of the AM and PL bundles [4]. Tibial tunnels were created using a tibial guide set at 45°. After creating two femoral and 2 tibial tunnels, each graft was passed through each tunnel. Femoral fixation was achieved using an EndoButton system (Smith & Nephew). Graft fixations were performed with 30 N for the AM bundle and 20 N for the PL bundle using double-spike plates (Meira, Aichi, Japan). A concomitant medial meniscal tear was repaired with the FasT-Fix 360 system (Smith & Nephew) at the time of operation. All skin incisions were closed with 3-0 nylon sutures. The tourniquet was released after gauze dressing, with no active bleeding noted.

Seven days after the surgery, knee motion and partial weight-bearing were started. He complained of lateral knee pain during knee range of motion and presented swelling with local heat on the distal lateral thigh just around the small incisions. To exclude the possibility of postoperative infection, magnetic resonance imaging (MRI) was performed 9 days postoperatively. The MRI showed the presence of hematoma-like mass with a diameter of 20 mm on the distal lateral thigh (Fig. 1). The hematoma-like mass was punctured and a large quantity of pulsatile fresh blood was gushing out. Color Doppler showed turbulent flow within the mass and the finding was consistent with the diagnosis of pseudoaneurysm (Fig. 2). Computed tomography angiogram (CTA) confirmed a 20-mm pseudoaneurysm arising from the perforating branch of the DFA (Fig. 3A,B). Twelve days after ACL reconstruction, open surgery was performed by a vascular surgeon. A vertical incision was made parallel to the iliotibial tract and the pseudoaneurysm was exposed between the iliotibial tract and femur (Fig. 4A,B). Both proximal and distal ends of the pseudoaneurysm were ligated and it was resected. The histopathological evaluation showed a pseudoaneurysm.

Swelling and pain around the distal lateral thigh immediately disappeared after resection of the pseudoaneurysm. Then, the patient re-started rehabilitation, achieving full knee range of motion 3 months after

ACL reconstruction. Nine months after the operation, the patient returned to sports activities without any complaints about his knee.

Discussion

Knee arthroscopy has been developed as a safe and minimally invasive surgery. The incidence of iatrogenic vascular injury following knee arthroscopic surgery ranges from 0.56 to 0.80% [5,6]. There have been several reports of pseudoaneurysms after ACL reconstruction [1,7,11]. Most of them arose from the popliteal artery and inferior genicular artery. To the best of our knowledge, this is the first case of a pseudoaneurysm arising from the perforating branch of the deep femoral artery (DFA) following outside-in ACL reconstruction. The outside-in technique is one of the most commonly used methods for the femoral tunnel creation in ACL reconstruction. It creates a femoral tunnel of adequate length and obliquity through the ACL femoral footprint with minimal incidence of posterior wall blow out [12]. However, the disadvantage of this technique is the additional incision on the distal lateral thigh. The DFA lies deep in the thigh and it gives off 3 of 4 perforating branches. The perforating branch of the DFA can run near the distal



Fig. 1 T2-weighted magnetic resonance image showing a hematoma (arrow) around the distal lateral thigh.

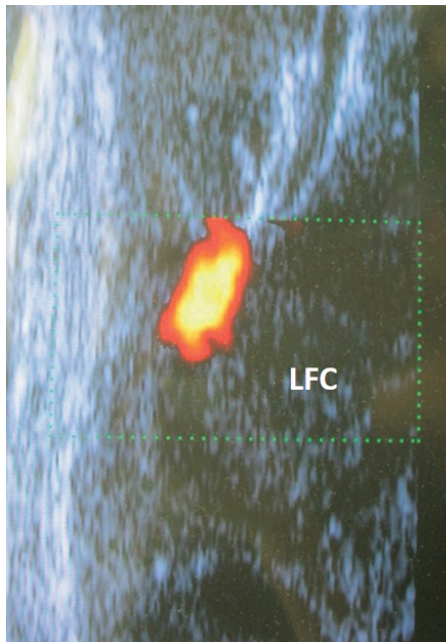


Fig. 2 Color Doppler showing turbulent flow within the sacular structure around the lateral femoral condyle (LFC).

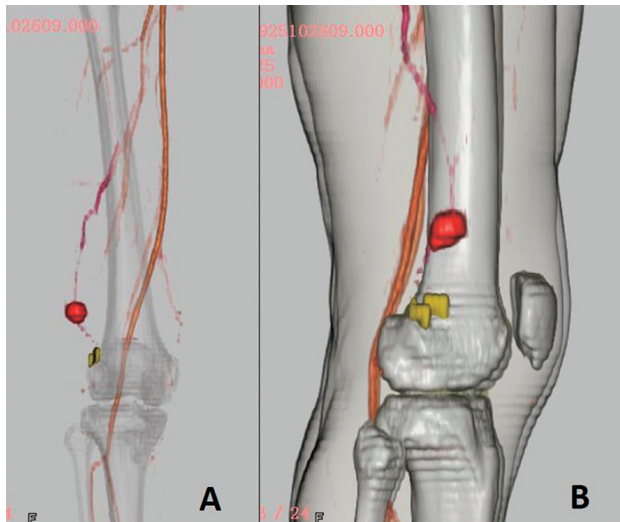


Fig. 3 Contrast-enhanced computed tomography angiogram of the right lower limb showing a pseudoaneurysm of the perforating branch of the deep femoral artery. (Left) anteroposterior view; (right) lateral view from lateral side.

lateral thigh where the incision is made and the guided pin is inserted in the outside-in technique. In the present case, CTA showed that the pseudoaneurysm had developed near the stab incision for AM femoral tunnel creation. Because it was located between the skin

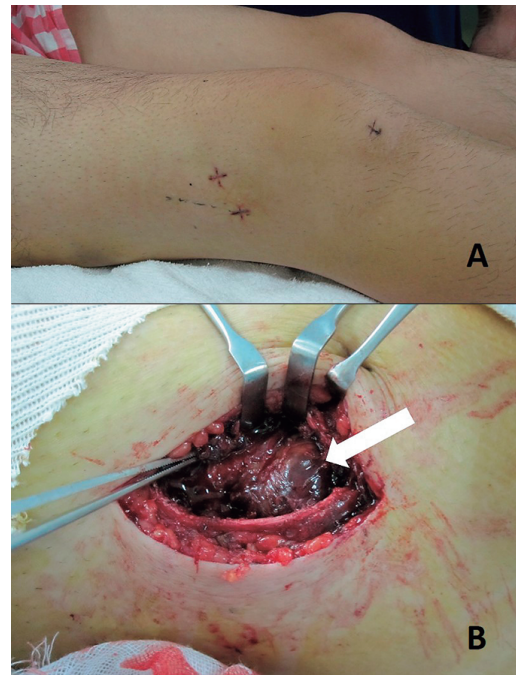


Fig. 4 Intraoperative photographs. (A) Operative incision was performed as marked directly over the pseudoaneurysm. (B) Intraoperative photograph showing the pseudoaneurysm (arrow).

incision and the EndoButton, we hypothesized that a sharp-pointed knife for making stab incision or guided pin insertion might injure the artery. To avoid this complication, the surgeon should make a minimum incision for femoral tunnel creation and dissect the iliotibial band carefully. If the surgeon uses an air tourniquet, its temporary release during femoral tunnel creation could possibly detect any vascular injury.

Vascular injury following arthroscopic surgery may often be overlooked due to delayed presentation because of indeterminate symptoms such as knee pain and swelling. In this case report, the patient complained of lateral knee pain and presented with swelling with local heat on the distal lateral thigh seven days postoperatively. First, we suspected postoperative infection of the knee. MRI, CTA, and color Doppler helped us recognize the occurrence of pseudoaneurysm. Pseudoaneurysms typically present late with clinical signs such as pain and swelling, and the development of a pulsatile mass may suggest the diagnosis [13]. Careful examination around the knee is essential for early diagnosis of pseudoaneurysm after knee arthroscopic surgery.

Current therapeutic approaches to pseudoaneu-

rysm include open surgical resection [9], ultrasonography-guided compression [14], ultrasonography-guided thrombin injection [15], and coil embolization [16]. A recent review article reported that resection was the treatment most frequently described in the literature, accounting for 75% of the pseudoaneurysms resulting from knee arthroscopy [17]. In the present case, surgical resection was successfully performed by a vascular surgeon. Seven months after operation, the patient regained full range of motion and muscle strength.

Conclusion

In conclusion, even if the arthroscopic ACL reconstruction is minimally invasive and very low incidence of vascular injury, surgeons should understand the detailed anatomy of artery around the knee. The present case report suggests that it is especially important to be aware of the presence of the perforating branch of the DFA, which can run very near the additional incisions in the outside-in technique. Although it is very difficult to prevent vascular injury, careful follow-up after surgery may help surgeons recognize that complication as early as possible.

Acknowledgments. We thank Mr. Ei-ichi Ishikawa and Ms. Yoko Yamakawa for their technical cooperation.

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