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Popliteal Pseudoaneurysm after Arthroscopic Posterior Cruciate Ligament Reconstruction

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This report presents the case of a 30-year-old motocross (BMX) cyclist with a third-degree posterior cruciate ligament rupture. The technique used for reconstruction was the transtibial single-bundle autologous hamstring technique. Unfortunately, the procedure was complicated by a popliteal pseudoaneurysm, which was located in line with the tibial canal. The pseudoaneurysm was treated with an end-to-end anastomosis and the patient recovered without further complaints. In this case, the popliteal artery was damaged most probably by the edge of the reamer or the guide wire during removal. Vascular complications can be limb- and life-threatening. This case report aims to increase the awareness of this serious complication with a review of the literature.

Keywords: **Posterior cruciate ligament, Arthroscopic reconstruction, Popliteal pseudoaneurysm**

Posterior cruciate ligament (PCL) reconstruction is a challenging surgical procedure due to the rarity of symptomatic isolated PCL ruptures and the proximity of the PCL insertion to the neurovascular bundle. To our knowledge, four cases of vascular complications that occurred in PCL reconstruction have been reported in literature[1-4]. Vascular complications can be limb- and life-threatening. This case report aims to increase the awareness of this serious complication with a review of the literature.

Case Report

We present the case of a 30-year-old male with a symptomatic isolated third-degree PCL rupture caused by a bicycle motocross (BMX) accident 21 months prior to presentation. The patient had no medical history and a body mass index of 23 kg/cm^3. Physical examination showed full range of motion (ROM), mild hydrops, tender medial joint line, an obvious posterior sag and a positive posterior drawer test (grade III), with no sign of other ligamental injuries. An arthroscopy was performed because of persistent complaints, which showed a total rupture of the PCL and a second-degree chondral defect of the medial femur condyle. The initial nine months of physical therapy was not successful. The patient consented to an arthroscopic transtibial PCL reconstruction using a hamstring graft after being comprehensively informed about the benefits and risks of the procedure.

The surgery was performed by the senior author (MD), an experienced orthopedic surgeon in (arthroscopic) knee surgery. The single-bundle transtibial technique was performed using Arthrex Inc. (Naples, FL, USA) instruments. The patient was positioned in the supine position with the affected leg hanging free in a leg holder. A tourniquet was placed around the upper thigh and inflated to approximately 250 mmHg pressure. An autologous semitendinosus hamstring graft was harvested and prepared. The standard infrapatellar anteromedial and anterolateral portals were created, plus an extra posteromedial portal. The PCL residue was removed with a shaver and a minor capsular release was done to obtain full visualization of the tibial insertion of the PCL. The tibial tunnel position was determined with the knee in approximately 90° flexion and with the PCL Tibial Adapteur Guide Marking Hook (Arthrex Inc.) positioned from anteromedial towards posterolateral one cm below the joint line. Fluoroscopy

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was used to register guide wire and reamer progression. The guide wire was drilled through the PCL Tibial Adapteur Guide Marking Hook and repositioned once under visual control. The Popliteal Protector Cap (Arthrex Inc.) was placed over the tip to avoid guide wire progression when reaming the tibial canal with an eight millimeter cannulated reamer. A drill stop was used to avoid reaming excessively deep.

With the PCL Femoral Adapteur Guide Marking Hook, the femoral canal was positioned and reamed. The hamstring graft was prepared and guided through the tibial and femoral tunnel. The graft was fixated in the femoral canal first and then, after correction of posterior tibial sag, brought up to tension by hand. After repeated flexion and extension of the knee, the graft was fixed distally with a cannulated delta tapered interference screw and an additional staple, with the knee in approximately 80° to 90° flexion.

Immediately after surgery, the knee was stable and peripheral pulsations were intact. On the first postoperative day, the patient was allowed to flex the knee up to 90° and weight bearing was limited to approximately 10 kg. During walking with a physical therapist, the patient felt a snap followed by intense pain in the calf. Physical examination showed a painful tense swollen calf with weak pulsations. Neurological examination was unremarkable. Ultrasound revealed a lesion of approximately six millimeter on the ventral side of the popliteal artery directly in line with the tibial canal and a lobed pseudoaneurysm. This caused pressure on the surrounding tissue in the back of the knee and lateral deviation of the neurovacular bundle. These findings were confirmed by contrast computed tomography and angiography (Fig. 1).

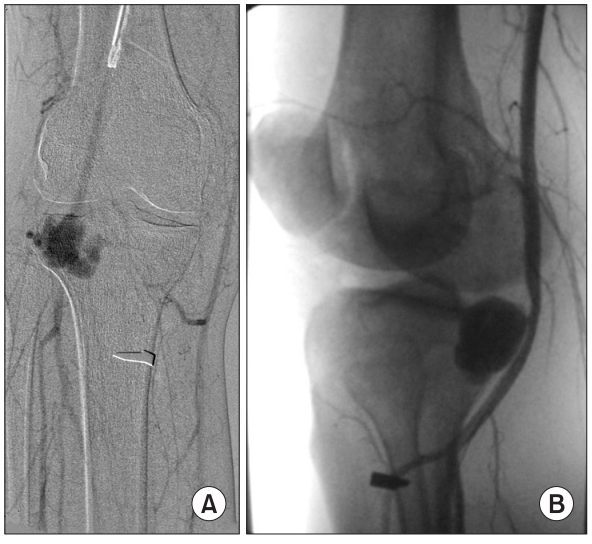

Fig. 1. (A) Popliteal pseudoaneurysm was in line with the tibial canal. The popliteal artery was laterally deviated by the mass of the pseudoaneurysm. (B) Popliteal pseudoaneurysm was located in line with the tibial canal.

A vascular surgeon was consulted and she decided to perform an open procedure. Exploration showed a lesion of approximately six millimeter wide with rough edges on the ventral side of the popliteal artery. An end-to-end anastomosis of the popliteal artery was determined the best treatment option in this case.

After 10 days of hospital stay, the patient was discharged and started on a rehabilitation program. Progression to full weight-bearing and full ROM was allowed after six weeks. Duplex ultrasonographic imaging showed a normal blood flow 10 months after vascular surgery. At one-year follow-up, the patient is satisfied with the results. The Lysholm score increased from 11 preoperatively to 84 postoperatively and the Tegner activity score increased from one to four.

Discussion

Reconstruction of the PCL involves surgery close to the posterior neurovascular bundle. Thus, the risk of vascular complications is significantly high. However, vascular complications in PCL reconstructive surgery seem to be underreported: only a few cases have been published as case reports[1-4]. With this case report, we aim to increase the awareness of these limb- and life-threatening complications.

The approximate distance between the posterior capsule and the popliteal artery is measured to be only 7.6 mm (standard deviation [SD], 2.4) at joint line when the knee is in 90° flexion[5]. On the axial plane, the popliteal artery is located lateral to the lateral border of the PCL in 77% of the cases[5]. The distance between the posterior cortex and the popliteal artery at one cm and two cm below the joint line is 7.2 mm (SD, 2.6) and 9.7 mm, respectively (SD, 3.3)[5].

During PCL reconstructive surgery, there are several moments in which the neurovascular bundle can be damaged: during transtibial guide wire drilling, during reaming of the tibial canal by progression of the guide wire or by the edge of the reamer lacerating the vascular wall, and winding of the neurovascular structures around the drill bit. Another pitfall is when you remove or reposition the guide wire with the automatic drill in forward, the screw-thread will progress the guide wire at first, which can also result in a puncture hole or winding of the vascular wall around the tip. In addition, the surgeon should be aware that popliteal artery injuries can co-exist with PCL ruptures in acute cases[6].

There are several options to reduce the risk of neurovascular complications described in the literature, such as the use of a posteromedial incision or portal[7] and the use of fluoroscopy to visualize the progression of the guide wire and reamer. Instruments such as a spade tip guide wire, a tapered drill bit, or an oscillating reamer[8] are less likely to damage surrounding tissues. Knee flexion, as well as a limited capsule release, is also proven to increase the distance between the posterior capsule and the popliteal artery[5,9,10].

In our case, most of these safety measures were used, such as flexion of the knee during preparation of the tibial canal and the use of a posteromedial portal and fluoroscopy for extra visual control, a popliteal protector cap when drilling the guide wire, and a drill stop during reaming. Regarding the size and roughness of the lesion, we believe the most probable cause of the pseudoaneurysm in this case was the edge of the reamer traumatizing the popliteal vessel wall or progression of the guide wire during removal leading to winding up of the popliteal artery wall.

The lesson we have learned from this case is that you cannot be too cautious. Vascular complications can be limb- and life-threatening if not recognized and treated in a timely manner. In this case, the time between the occurrence of symptoms and the treatment of the complication was adequate and the patient was rehabilitated without further disabilities. Currently, at one year after surgery, the patient is satisfied with the treatment results and knee function is still improving.

In order to minimize the risk of vascular complications in PCL reconstructive surgery, we advise to look for less traumatizing instruments and to limit the amount of riskful actions. Besides the standard precaution measurements mentioned above, the use of an all-in-one guide pin and retrograde reamer would most likely lower the risk of vascular complications. Currently, we use the Flipcutter (Arthrex Inc.) all-in-one guide pin and reamer in arthroscopic reconstructive knee ligament surgery.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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