Case Report

Direct Thermal Injury to the Popliteal Artery after Total Knee Arthroplasty

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Abstract

Vascular damage after total knee arthroplasty is rare. However, delayed diagnosis and management may cause adverse outcomes for patients. In particular, direct thermal injury to the popliteal artery after total knee arthroplasty is extremely rare. A 74-year-old woman presented to another institution with a left popliteal artery injury after left total knee arthroplasty. Arteriography revealed total occlusion of the popliteal artery, and emergency surgery was performed. Because of the total occlusion of the popliteal artery due to severe direct thermal injury, anastomosis was performed in an end-to-end fashion with a right great saphenous vein graft. At the time of discharge, she had no specific symptoms other than pain at the surgical site, with a palpable left dorsalis pedis pulse. While performing total knee arthroplasty, the anatomical position of the popliteal artery should be carefully considered to prevent injury.

Keywords: *Arthroplasty, knee, popliteal artery*

Introduction

The popliteal artery is the second most commonly damaged vessel of the lower extremity.

Ischemia caused by this damage is one of the factors associated with adverse outcomes for limb salvage.[1] Although vascular damage during total knee arthroplasty (TKA) is rare, delayed diagnosis and management may cause adverse outcomes in patients.[2] In particular, cases of direct thermal injuries of the popliteal artery due to TKA are extremely rare. Here, we report a case of successful treatment of direct thermal injury of the popliteal artery caused during TKA.

Case Report

A 74-year-old woman who underwent left TKA due to osteoarthritis at another medical center was transferred to our institution. The patient had undergone gastrectomy for gastric cancer 10 years before. There was no other specific medical history. TKA was done using a posterior-stabilized cemented knee system. The surgery was completed through a standard medial parapatellar approach under tourniquet control.

The patient complained of left leg pain 7 h after TKA. On examination, there was cyanosis of the left foot; however, the sensory function was intact. Transthoracic echocardiography revealed normal left ventricular

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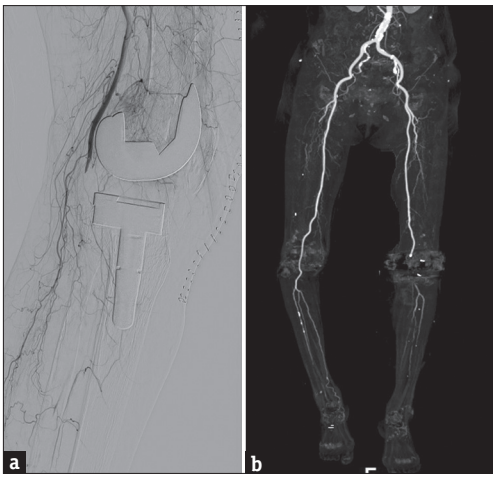

Figure 1: (a) Preoperative arteriography showing complete occlusion of the popliteal artery; (b) preoperative three-dimensional computed tomographic angiography showing segmental occlusion of the left popliteal artery

function and no thrombi in the heart chambers. Electrocardiography represented a normal sinus rhythm. A Doppler study demonstrated a decrease in blood flow to the dorsalis pedis artery and the posterior tibial artery. Due to the beam-hardening artifact on three-dimensional computed tomographic (3D CT) angiography, arteriography [Figure 1a] was performed. The arteriography showed total occlusion of the left popliteal artery, and an emergency operation was performed 2 h after symptom onset.

The popliteal artery was exposed via a posterior approach. The popliteal artery was found to have a direct focal thermal injury, and there was no blood flow downstream from the damaged vessel [Figure 2a]. After removing the damaged vessel, it was confirmed that there was good distal backflow; thus, distal thrombectomy was avoided and anastomosis in an end-to-end fashion was performed with a right great saphenous vein (GSV) graft [Figure 2b].

After surgery, restoration of blood flow in the popliteal artery was confirmed by an intraoperative Doppler ultrasound assessment. The patient was discharged without complications after 2 weeks. A computed tomographic (CT) scan was not performed before discharge due to a mild elevation of creatinine (1.9 mg/dl). An ultrasound scan before discharge confirmed patency of the popliteal artery; however, it was not officially reported.

Approximately 10 months after surgery, 3D CT angiography [Figure 1b] was performed, and although there were limitations due to metal artifacts, the patency of the popliteal artery could be confirmed by a radiologist.

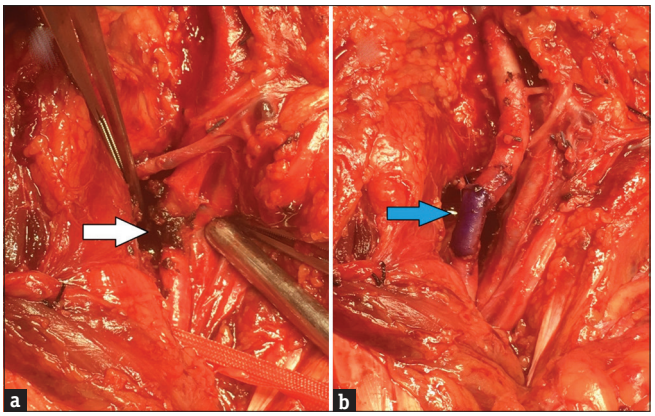

Figure 2: (a) Operative field showing direct thermal injury of the popliteal artery (white arrow); (b) postoperative field showing the great saphenous vein graft (blue arrow) anastomosed in an end-to-end fashion

Discussion

Vascular injury due to TKA is very rare, with an incidence of approximately 0.003%–0.23%.[2] However, it may increase the fatality risk. Although the incidence is low, the most commonly damaged blood vessel due to TKA is the popliteal artery. The proximity of the popliteal artery to the posterior tibial surface makes it susceptible to damage during knee surgery. During 0–90° of right knee flexion, the distance from the posterior tibial surface to the popliteal artery has been measured to be 0.96–3.15 mm, which should be carefully considered by vascular surgeons.[3]

Vascular injuries include occlusion, transection, arteriovenous fistula, and pseudoaneurysm formation.[4] While some postoperative vascular injuries are caused by damage to calcified vessels causing thrombosis or embolization,[5] blunt trauma due to excessive tissue manipulation is a more common cause.[6] In our patient, there was no calcification of the popliteal artery, and the orthopedist confirmed that no situation arose during surgery requiring different procedures during TKA and that no injury, transection, or other acute arterial complication of TKA was detected intraoperatively.

We assumed that the damage was due to blunt trauma by an oscillating saw. We opted for open surgery rather than an interventional approach due to the high possibility of dissection due to intimal damage. However, on reopening, we found a direct thermal injury causing complete occlusion of the popliteal artery. We postulated that this injury could have occurred due to the high temperature of the oscillating saw during proximal tibial resection.

The reported mechanisms of injury are due to direct trauma to the vessel, a posterior retractor, an oscillating saw, pins used to hold the tibial jig, or during posterior

capsular release. According to a previous study on temperature elevation during knee arthroplasty, the median maximum temperature of the oscillating saw blade was 68°C (45°C–100°C).[7] This case did not involve transection of the popliteal artery, but involved direct thermal injury by the oscillating saw. To prevent injury to the popliteal artery, Ninomiya *et al*.[8] advised against positioning the posterior retractor lateral to the posterior cruciate ligament or >10 mm into the soft tissue and instead recommended placing the retractor medial to the middle of the tibial plateau. They also recommended avoidance of extreme flexion and extension.

In such cases of postoperative vascular injury, early diagnosis and treatment are thought to be the most important factors in determining the patient's prognosis. Our patient underwent repair of the popliteal artery approximately 7 h after TKA.

Symptoms of vascular injury include pain, pallor, and paresthesia. Because a splint is generally applied to the patient's leg after TKA, the leg and/or foot are not exposed, and therefore, any vascular injury is overlooked. Moreover, patients may not be able to differentiate between surgical and ischemic pain, leading to confusion.

In conclusion, during TKA, all operative procedures should be performed with careful consideration of the anatomical position of the popliteal artery. In particular, the clinical symptoms of the patients should be closely monitored after surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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