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CASE REPORT
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Flap Necrosis after Slow Progressing Popliteal Artery Occlusion due to Knee Dislocation of an Adolescent: A Case Report

Diz Çıkığı Nedeniyle Popliteal Arter Oklüzyonu Sonrası Flep Nekrozu: Bir Olgu Sunumu

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Öz

Popliteal arter oklüzyonu künt diz travması sonrası nadir görülen bir vasküler komplikasyondur ve tanıda geç kalındığında uzuv kaybına neden olabilir. Kollateral damarların gelişmesi, cerrahı defect rekonstrüksiyonu planı yapılırken yanıltabilir. Yüksekten düşme sonrası diz çıkığı sonucu popliteal arter tıkanıklığı olan bir hastayı sunuyoruz. Serbest flep ile rekonstrüksiyondan sonra, ayakta iskemi gözlendi ve arteriyografi ile kollateral arterler ve popliteal arterin oklüzyonunu doğruladı. Hastaya femoro-popliteal bypas ameliyatı yapıldı. Granülasyon oluşmasını takiben çapraz bacak serbest flep ile defekt rekonstrükte edildi.

Anahtar Kelimeler: ALT Flep, Flep nekrozu, Popliteal arter oklüzyonu.

Abstract

Popliteal artery occlusion is a rare vascular complication after blunt knee trauma and may lead to limb loss if diagnosis is delayed. Development of collateral pathways may misguide the surgeon in planning surgeries for defect reconstruction. We report a case of a patient with popliteal artery occlusion resulting from dislocation of knee after fall from height, which developed a defect anteromedial to ankle following orthopedic surgery. After reconstruction with a free flap, ischemia was observed in foot and arteriography confirmed the occlusion of popliteal artery with well-developed collateral arteries. The patient underwent femoro-popliteal bypass surgery for limb salvation. At the end of the recovery time, the defect was reconstructed with cross leg free flap.

Keywords: ALT Flap, Flap necrosis, Popliteal artery occlusion.

1. Introduction

Trauma of popliteal artery is a limb-threatening condition associated with both penetrating and blunt injuries[1,2]. Vascular trauma in the pediatric population is less frequent than adults and a significant proportion is owing to penetrating injury[1]. The popliteal artery, by virtue of its ligamentous fixation and anatomical relationships, is susceptible to injury with blunt extremity trauma, which may cause vascular injury in the form of occlusion, laceration, perforation, arteriovenous fistula or false aneurysm[3,4]. Popliteal artery injury is associated mainly with high energy injuries such as athletic activities especially in younger population, including knee dislocation and complex fracture of associated bone structures[5,6]. Failure to diagnose may lead to amputation or even death due to

systemic inflammatory illness especially in the pediatric population[7,8].
In this report, we present a patient who had a soft tissue defect in lower extremity with ipsilateral popliteal artery occlusion with slow progression due to dislocation of knee in which diagnosis was delayed and led to phalanx amputation and reconstructed with cross-leg free anterolateral thigh flap (ALT).

2. Case Report

A 13-years old female was admitted via emergency department after jumping off the 4th floor of a high building for suicide. In the initial physical examination of the patient, the pulses of the foot were palpable, the foot was in normal temperature, and there were pain and limitation in the range of movement of knee and ankle. There was an 8cm oblique skin laceration anteromedial to the left ankle, without any muscle or major vessel damage. Ultrasonography revealed popliteal artery and crural arteries were intact. Plain radiograph showed fracture of distal fibula with dislocation of knee and ankle joint **(Figure 1).**

Figure1. Fracture of distal fibula with dislocation of knee and ankle joint.

The closed reduction of the knee joint, ankle and talocalcaneal joint and external fixation of the knee and ankle were performed in 2 hours after admittance by orthopedics department. An arthroscopic operation was performed to repair the ruptured posterior cruciate, lateral, and medial collateral ligaments on the 5th day. Necrosis was observed anteromedial to the ankle in 2 weeks after the trauma. After a follow up period with wound dressing, a full thickness necrosis with exposing underlying bony structure was seen. The patient underwent free flap transfer operation in postoperative 30th day. The defect was reconstructed with ALT flap using ipsilateral dorsalis pedis artery and concomitant vein for anastomosis without perioperative complication. The patient was given intravenous low molecular weight heparin and oral acetylsalicylic acid in postoperative period. In postoperative day 5, cyanosis in flap and 1, 4 and 5th fingers was observed, and left foot was colder than right foot upon palpation. Motor examination indicated total loss of strength in all ranges of motion and sensory examination showed diminished sensation of left foot.
1. An emergency femora-popliteal arteriography confirmed an occlusion of the left popliteal artery extending proximal to the bifurcation of tibioperoneal trunk. Also, patent collateral circulation was observed in arteriography (Figure 2).

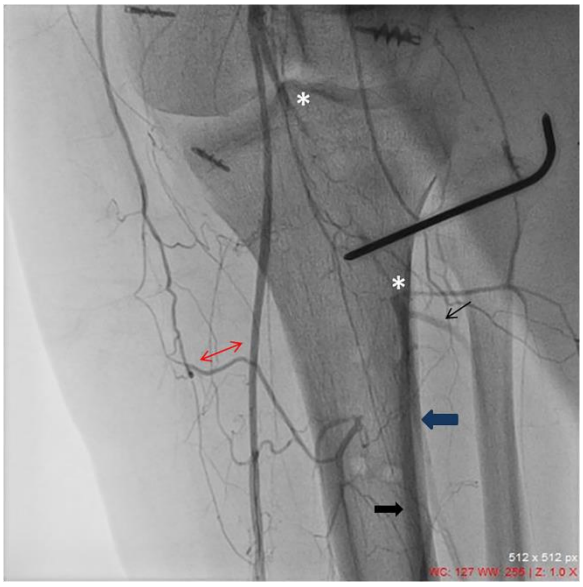

Figure 2. Patent collateral circulation was observed in arteriography

Vascular surgery department performed an emergency surgical intervention for limb salvation. The exploration of popliteal artery showed contusion and subadventital hematoma. An embolectomy was first attempted with a 3F Fogarty catheter. Upon failure, a bypass from the superficial femoral artery to the tibioperoneal trunk with the saphenous vein was performed. Intraoperative palpable pedal pulses distal to the anastomosis confirmed patent circulation. The ALT flap was totally lost, cyanosis of fingers was not regressed and superficial necrosis on dorsum of the foot was observed. The patient was referred for postoperative hyperbaric oxygen (HBO) therapy for 2 weeks.
After recovery period and stabilizing the patient, the three fingers (1st finger, at metatarsal joint; 4 and 5th fingers partially) were amputated, debridement of superficial necrosis on dorsum of the foot was done (Figure 3) and a cross-leg free latissimus dorsi musculocutaneous flap was performed to reconstruct the bone exposed defect of ankle with preserving the blood flow of donor site[9]. After 3 weeks from surgery, the flap was divided and recovered without complication (Figure 4).

Figure 3.

Figure 4.

The patient was discharged on day 45 an d referred to start physical therapy and rehabilitation. One year after the last surgery, patient is able to walk without help (Figure 5).

3. Discussion

Popliteal artery can be injured after severe traumas; including transection of artery and blunt trauma associated with dislocation of the knee, proximal tibial physeal fracture, crush injury and floating joint [6,10–12]. Knee dislocation can be caused by low velocity forces

Figure 5.

caused by such as sports accidents, or high velocity forces like traffic accidents and falls[10]. Also, occult knee dislocation should be considered if there is a ligamentous instability of the knee[8]. To our knowledge, patients with normal neurovascular examination results of lower extremities can be safely observed with serial examinations[4,13]. In physical examination, major signs including absence of pulse, pain, paresthesia and low temperature of extremity are assessed[11,14]. It is also considered that a vascular pathology requiring major surgery is excluded if there is no symptom displaying arterial damage in serial examinations during the first 48 hours[4,8]. If needed, Doppler ultrasonography is a rapid and noninvasive imaging method[2,6,11]. Angiography is not necessary in the routine evaluation after blunt knee trauma unless there is a pathological neurovascular finding[4]. CT angiography is a highly sensitive and specific diagnostic technique for arterial injury[2,11,14].

Initial assessment involves palpation of pedal pulses, however in a patient with popliteal artery injury, palpable pulses in distal region may be present in early period[6,11,12]. In this case, foot pulses were palpated initially and there was no sign of ischemia in early period, the patient only described pain in the traumatic zones, knee, and ankle. Doppler ultrasonography confirmed the blood flow of crural arteries were intact, which misled us not to perform preoperative CT angiography.

The diagnosis of an acute occlusion in popliteal artery after knee dislocation may have more obvious symptoms[3,7,14]. However, chronic occlusion may present solely as a progressive claudication in the

extremity[5]. Arterial occlusion, especially a stenosis slowly and gradually progressing toward complete occlusion, results in ischemia and development of collateral vessels[15]. The existence of multiple collateral pathways of popliteal artery was reported in radiological and cadaver studies[16,17]. In our patient, we think that the reason of late onset of arterial insufficiency was well-developed collateral circulation, which was visualized in femora-popliteal arteriography. Collateral circulation contributed to the circulation of the foot and calf in a retrograde aspect, as shown in the arteriography and therefore resulted in absence of ischemia symptoms. We consider that the cyanosis might have been triggered due to hypoperfusion perioperatively or in postoperative period which disrupted collateral circulation and resulted in inadequacy of tissue perfusion in limb.

There are similar cases in the literature that mentions delayed diagnosis of popliteal artery occlusion after blunt trauma, without any obvious ischemia symptom. Kim et al reported a case of a patient with acute pain in the knee, who had a history of blunt knee trauma one week ago. Popliteal artery occlusion with well-developed collateral arteries was seen in CT angiography, and physical examination showed no evidence of acute ischemia[6]. In our case, the time between dislocation of knee and free flap operation was one month, which may have caused better developing collateral vessels that contributed to the circulation of the foot, and the initial symptoms of ischemia were not seen until the 5t h day of flap transfer.

High-energy multitrauma injuries such as fall from height or traffic accidents may result in knee dislocation and concurrent tissue defects in the lower extremities. If a free tissue transfer is to be preferred for defect reconstruction in lower extremity in patients with a history of joint dislocation or cruciate ligament injury in the knee region, even if there is no symptom suggesting disruption in circulation and the pedal and crural pulses are palpable, it is necessary to visualize the patency of popliteal artery with CT angiography before surgery. If occlusion is detected, we believe that it would be appropriate to perform the reconstruction with a cross-leg free flap using a flow-through design.

4. Conclusion

The diagnosis of popliteal artery occlusion after blunt trauma can be delayed in the absence of the initial symptoms of acute ischemia. In multitrauma patients with needs of free tissue transfer, the possibility of a popliteal artery injury should be kept in mind when there is a trauma near the knee joint. We think that preoperative CT angiography initial to free tissue transfer and considering the option of cross-leg free flap procedure is important to avoid unexpected complications and limb loss.

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