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Case report

FEMORAL SHAFT FRACTURE WITH TOTAL SUPERFICIAL FEMORAL ARTERY AND VEIN RUPTURE FOLLOWING TRACTION MECHANISM TYPE OF INJURY – A CASE REPORT

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ABSTRACT

The majority of encountered femoral artery lesions are due to penetrating or stab injuries. In cases of closed femoral fractures, artery damages could be missed due to their rarity, as surgeons might not anticipate them on the first encounter with the injured person.

Damage Control Orthopaedics (DCO) provides a pathway to managing patients with severe orthopaedic injuries, particularly when the trauma is complicated by vascular injuries, such as femoral artery rupture. The DCO approach prioritizes stabilizing the patient before definitive bone fixation. This way, it provides a stable environment to reconstruct damaged arteries, prevent the secondary inflammatory response, provide hemodynamic stability, and prevent other complications associated with prolonged surgeries.

In this case, a 48-year-old man experienced high-energy trauma on his left leg and arrived at the emergency department eight hours after the incident. Upon his arrival, a noticeable deformity was observed in the lower thigh area. X-ray imaging disclosed a distal femoral fracture. Further examination revealed a lack of knee and ankle function, full paraesthesia below the knee region, and absent pedal pulses.

Following a CT angiography, a complete rupture of the superficial femoral artery was confirmed. This case was treated with temporary external fixation, femoral artery reconstruction, and prophylactic fasciotomy. External fixation has been later converted to definitive intramedullary fixation.

Keywords: Vascular injury, intramedullary interlocking nail, closed femur shaft fracture,

INTRODUCTION

Closed femoral diaphysis fractures, along with damage to the femoral artery and vein, are rare in clinical practice. The majority of traumatic femoral artery injuries occur due to penetrating injuries secondary to gunshot or stab wounds [1]. Klueger Y, et al., for instance, report that in a 6-year period, only 10 (1.3%) of 765 patients with closed femoral fractures also had femoral artery lesions [2]. Another study by Cargile JS, et al. 1992, which includes data from 1974 to 1991, found only 13 closed femoral fractures with concurrent femoral artery damage [3]. A 10-year retrospective study by Asensio JA, et al. 2006 provides information on 204 men who suffered femoral vessel injury [4]. 34 of them also suffered femoral fractures, although no exact information is available in the study about whether the fracture was closed, open, or caused by penetrating force. It is only reported that the overall majority of the traumas (86%) in this study were caused by penetrating injury [4]. If arterial trauma is not rapidly diagnosed in closed fracture or is missed, it might lead to prolonged ischemia, which may result in severe complications [1].

CASE REPORT

In this case, a 48-year-old man experienced high-energy trauma on his left leg and arrived eight hours after the incident at the emergency department at Pleven University Hospital.

The patient has complained about a lack of knee and ankle function, full paraesthesia below the knee region, and inability to keep weight on the limb. From anamnesis, he has suffered from traction type of mechanism of trauma.

No pedal pulses or Doppler signals were detected, and capillary refill was absent on the affected limb. The distal thigh region has been visually deformed with a visible hematoma.

Subsequently, he was examined by a multidisciplinary team, which included an orthopedic, trauma, vascular surgeon, and anesthesiologist.

Fig. 1 a) b). Pre-operative x-ray AP and lateral projection.

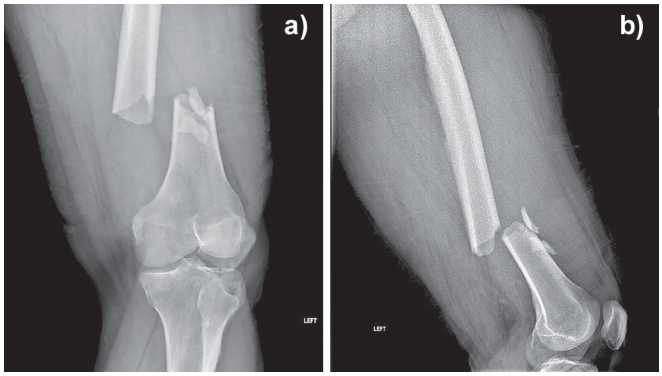
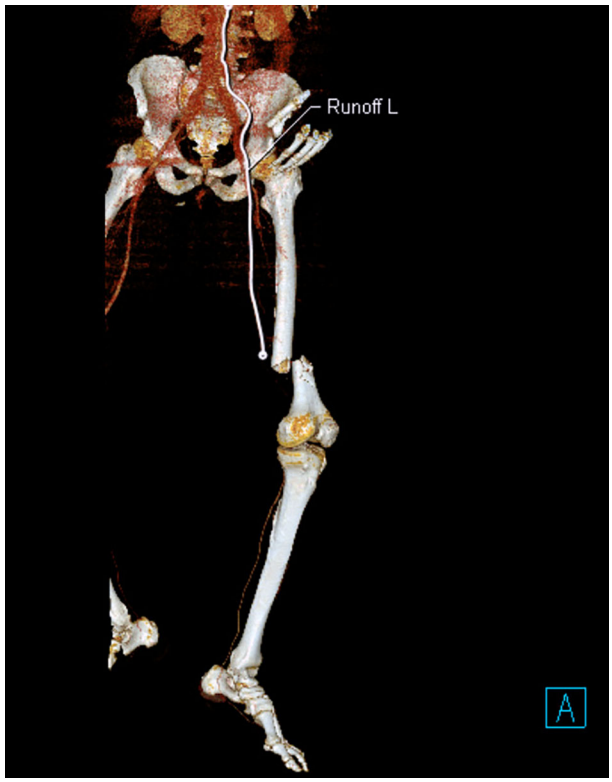


Fig 2. CT angiography.

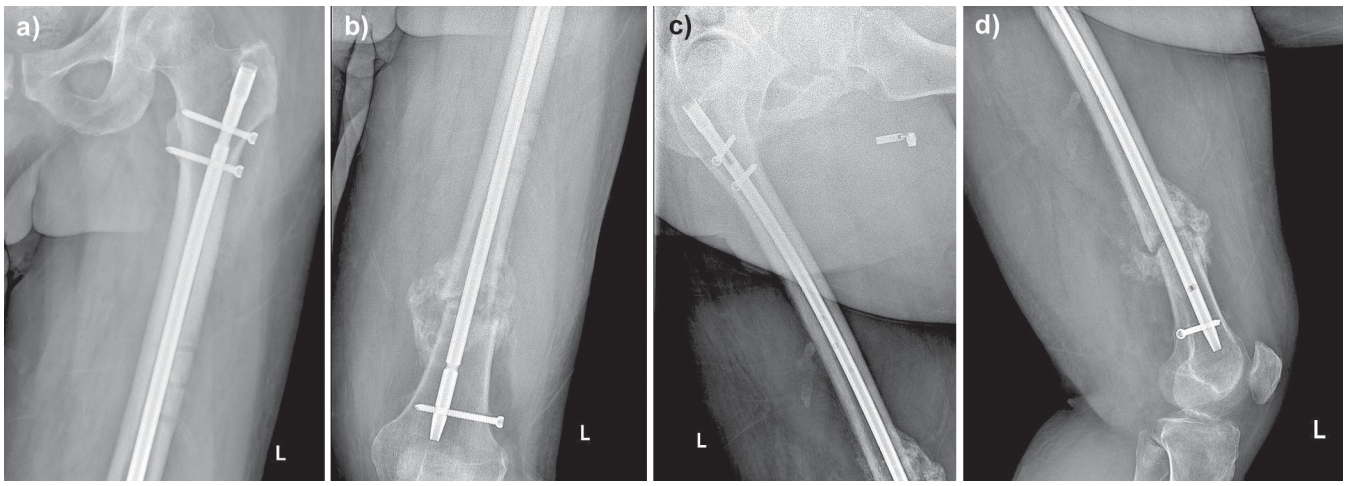


X-ray image confirmed distal femoral diaphyseal fracture (Fig 1. a) and b) [AO classification 32-A3]. Due to clinical signs of potential vascular injury, further investigation by CT Angiography was ordered. Thus, a rupture of the superficial femoral artery was revealed at the level of the fracture (Fig. 2.). Full body CT and abdominal ultrasound did not reveal any other trauma.

After an interdisciplinary discussion, he was admitted for emergency surgery. First, an external fixator was implanted in the distal femur proximal to the fracture site and the proximal tibia, distal to the fracture, thus stabilizing the knee joint and the fracture site. After fracture site stabilization, superficial femoral artery reconstruction has been done by vascular surgeons. The femoral vein was deemed to be non-reconstructable and thus was ligated. Prophylactic fasciotomy was performed. After surgery, the patient was transferred to the intensive care unit for stabilization. Definitive fixation with IMNL was done on the 10th day, according to standard surgical technique. The vascular surgery team was present in the operative theater during definitive fixation with IMNL in case of re-rupture of the artery. Post-operatively, pedal pulses were checked using a Doppler ultrasound.

On the 15th day, all sutures were removed, and the patient was discharged home.

Fig. 3 a) b) c) d). Post-operative x-ray AP and lateral projection.



DISCUSSION

Of all vascular injuries, around 70% constitute femoral artery injuries, and of them, 90% are due to open penetrating trauma [5].

The following case reminds us about the rarity of superficial femoral artery injury with femoral fracture due to blunt trauma. A recent retrospective study by Coleman et al. 2016, analyzed data from 25,516 patients from the tertiary care center and found only 3 patients who had suffered femoral fractures with concomitant superficial femoral artery injury [6]. Another 10 patients in the study were found to have popliteal artery lesions with femoral fractures. In our practice, we have not found data on patients who have suffered previous superficial femoral artery damage with ipsilateral femoral fracture.

In this case, the pedal pulses were absent on the initial examination. Still, we should remember that the presence of a pulse in the affected extremity should not definitely exclude arterial damage, as was shown by studies by Jones RE, et al. 1979, Smith RF, et al. 1969, and Rowe VL, et al. 2002 [7, 8, 9]. For instance, a lesion as an intimal flap tear could be present, with full normal pulses palpable distally to the site of injury, as described in a case report by Perron AD, et al. 2001 or in a retrospective study by Kluger Y, et al. 1994 [2, 10]. Report of false aneurysm of superficial femoral artery with concurrent femoral fracture, with normal pedal pulses, also been published by Fallon and Thomford, 1970 [11].

As Lewis and Pickering's experiment showed, surgeons should not consider the presence of capillary refills proof of normal limb circulation [12]. The experiment showed that even in limbs rendered completely ischemic experimentally, normal capillary refill could exist due to blood return from adjacent veins. A case study published by Bellemans J et al. 1999, provides evidence of capillary refill as an unreliable sign of circulation. He described the presence of a warm foot and normal capillary refill in the patient who developed total occlusion of the popliteal artery proximal to trifurcation [13].

Arterial injury can vary from traumatic laceration, complete rupture, and intimal flap tear to thrombosis [5]. Therefore, the appearance of the whole extremity should be examined. If the color, temperature, sensation, or mechanism of injury provides suspicion of possible vessel damage, CT angiography should be immediately performed [5].

According to the golden rule and widely accepted consensus, arterial reconstruction should occur within 6 hours of trauma [15]. Hence, minimizing the time to transfer to a tertiary care hospital is essential. In our instance, he arrived at the emergency department 8 hours after the initial incident. Another 2 hours were taken to admit and prepare the patient for the operation and gather the surgical team.

According to DiChristina DG, et al., definitive bone stabilization provides mechanical protection to the reconstructed artery [15]. However, such intervention may be done only in cases where the patient suffered an injury <6 hours ago, and an orthopedic team can stabilize the bone in less than 30 minutes [17]. In such a way, the patient will be within the 6-hour golden rule to allow vascular repair and avert ischemic injury to the limb. In our case, however, more than 10 hours have already passed since the initial trauma, and the orthopedics clinic is located at another hospital site, which would require additional transportation.

Thus, we agree with the statements of Zlodowski M, et al. 2007 and Jin L, et al. 2022 that in cases where fixation with IMLN is unsuitable, as in our case, the use of external fixation will allow vascular reconstruction to be done in a controlled environment and protect the vessel from re-rupture [16, 17]. The advantage of external fixation is that intra-operative fluoroscopy is not required during this intervention and is relatively quick to perform, which was important in this case [18, 19].

Unfortunately, the patient has suffered several complications. First, the patient has suffered pressure ulcers in the calf region, which we attribute to prolonged immobilization and loss of sensitivity. Second, no ankle function is still present two months later. However, knee function was returned, which was absent during the first month after de-hospitalization.

CONCLUSION

The rarity of this case study reminds us of the possibility of femoral vessel damage in closed femoral fractures.

The injured individual's late presentation to the hospital and logistical constraints have contributed to the patient's complications in this case.

A staged approach, guided by the DCO concept, has been used successfully, with provisional external fixation, artery reconstruction, compartment syndrome prophylaxis, and later conversion to definitive IMLN fixation.

From this case report, surgeons are reminded to use the safest approach when the patient's condition is doubtful and to keep attention to the clinical signs of vascular injury in closed fractures.

Informed consent

The patient has provided written informed consent.

Abbreviations

DCO - Damage control orthopaedics
IMLN - Intramedullary locking nail
ICU - Intensive care unit

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