CASE REPORT

Femoral Artery Thrombosis after Closed Femoral Nailing: an Unusual Complication

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Introduction

Interlocked nailing is a common surgical procedure for internal fixation of femoral shaft fractures. Early complications associated with this procedure are infection, fat embolism syndrome, acute compartment syndrome, pudendal nerve palsy and occasional vascular injury¹⁻¹⁰. We report here a case in which femoral artery thrombosis developed after closed interlocked nailing of the femur. Prompt diagnosis and treatment helped in salvaging this patient's limb. This report is intended to increase awareness of this limb threatening complication.

Case Report

A 25-year-old man sustained a femoral shaft fracture following a fall from a motorbike 6 hours prior to presentation. On examination, he was hemodynamically stable and other organ systems were normal. There were no distal neurovascular deficits. Antero-posterior and lateral radiographs showed a transverse fracture of the distal third of the shaft of the femur with a small butterfly fragment (Fig. 1). The patient was subjected to skeletal traction through a proximal tibial pin pending operative fixation.

A closed intramedullary interlocked nailing procedure was performed under spinal anaesthesia on a fracture table with the patient in supine position. Several attempts involving closed manipulation of the fracture fragments with successive increases in magnitude of traction over about half an hour were required to reduce the fracture. Fracture fixation was satisfactory (Fig. 2). On postoperative monitoring, distal pulses (dorsalis pedis and posterior tibial arteries) were absent in the affected leg and it was cooler than the normal one. Ankle and toe dorsiflexors were observed to be weak. Diminished sensation associated with paresthesiae was present in the foot of the affected leg. In view of these clinical findings, a vascular

injury was suspected. Doppler examination of the lower limb revealed no flow in the femoral artery beyond the fracture site. An angiographic study confirmed absence of blood flow beyond the distal limit of the butterfly fragment (Fig. 3). Based on the sequence of events and the fact that fracture fixation had been achieved by closed intramedullary nailing, an intimal tear with thrombosis of the femoral artery was considered likely. Femoral artery thrombectomy was planned in consultation with the attending vascular surgeon. The femoral artery was exposed in Scarpa's triangle. A transverse arteriotomy was performed and a no. 5 Fogarty catheter inserted through it beyond the level of the knee (Fig. 4). The balloon was inflated and the catheter withdrawn, resulting in extraction of a 2 cm soft thrombus (Fig. 5). The artery was then irrigated with a 1:500,000 dilution of heparin saline solution. The arteriotomy was closed with 6-0 nylon. Following removal of bull-dog clamps, immediate return of distal pulsations was confirmed. Because the injury-revascularization time had been around 8 hours, pan-compartmental decompression of the leg was performed using a double incision technique. The patient was started on anticoagulation therapy with intravenous heparin (5000 IU/day). There was appreciable recovery in motor power and sensation following the procedure. A follow-up CT angiogram performed 4 weeks postoperatively revealed restoration of good cross-sectional blood flow across the site of the femoral artery injury (Fig. 6). The fasciotomy wound over the lateral aspect of the leg was secondarily sutured on day three, whereas, the wound over the medial aspect of the leg required split skin grafting on day seven. The wounds healed well and the patient had a good functional recovery (Fig. 7a,b). He was asymptomatic when last followed up at 18 months. Written, informed consent was obtained from the patient authorizing the treatment, photographic documentation and radiographic examination.

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Fig. 1 Lateral radiograph showing a fracture of the distal third of shaft of the femur.

Discussion

Closed interlocked nailing of the femur is recognized to be a reasonably safe surgical procedure. A few complications, such as infection, nonunion, angular and rotational malalignment, pudendal nerve palsy, heterotopic ossification, acute

Fig. 2 Postoperative radiographs showing femoral interlocking nail *in situ*.

Fig. 3 Angiograph showing absence of flow in the femoral artery beyond the fracture site signifying thrombosis of the femoral artery.

compartment syndrome and fat embolism syndrome, have been reported¹⁻¹⁰. The infection rate after this procedure is reportedly less than 1%¹⁻³. There are few reports concerning vascular injury following such a procedure. Roper and Provan reported a case of late thrombosis of the femoral artery which

Fig. 4 Fogarty catheter being inserted through an arteriotomy in the femoral artery to remove the thrombus.

Fig. 5 Photograph of soft thrombus extracted by the Fogarty catheter.

required surgical exploration 17 days after nailing¹¹. However, they did not document whether distal pulses were present immediately after nailing. Thus, it is possible that the injury was missed initially, at the most opportune time to diagnose this complication, leading to a possibly erroneous diagnosis of delayed occlusion several days later, when pre-gangrenous changes had already developed. The authors and their patient were extremely lucky to achieve good functional recovery following revascularization at such a late stage; this is not the usual outcome.

The femoral artery is the chief arterial supply to the lower limb¹². It passes inferiorly and medially, first in the femoral triangle and then in the adductor canal. At the inferior end of the adductor canal, it passes through an opening in the adductor magnus to become the popliteal artery. Being relatively fixed at the junction of the middle and distal thirds of the thigh, this artery is vulnerable to injury.

In the present case, the anatomical fact that, while passing through the adductor hiatus, the femoral artery is rendered relatively immobile¹³, could have contributed to its vulnerability to injury. Femoral artery thrombosis following closed fracture fixation can be caused either by external compression by a displaced comminuted fracture fragment or by an intimal tear resulting from excessive intraoperative traction. The latter seems more plausible in our case. The femoral artery would have become taut because of prolonged excessive traction on the fracture table. In this setting, repeated manipulations of fracture fragments could have resulted in an intimal tear, leading to thrombotic occlusion of the blood vessel.

The management of such injuries ideally involves surgical exploration of the site of injury after its delineation by various imaging modalities. The pattern of injury (complete transection/partial transection/lesion in continuity) should dictate the treatment technique. Complete transection would definitely require end-to-end repair or a reversed interposition vein graft. Partial transection could be addressed by a lateral suture or vein patch graft. Lesions in continuity, in which intraluminal thrombosis has resulted from an intimal tear, may

require resection of the injured segment followed by repair. However, some of these lesions are amenable to thrombectomy using a Fogarty balloon catheter inserted through a proximal femoral arteriotomy. In the present case, we considered that a lesion in continuity with intimal thrombosis was likely because the patient had undergone the essentially closed technique of intramedullary nailing. Based on this clinical suspicion and the absence of any displaced bone fragments in the postoperative check radiographs, we decided to attempt thrombectomy using a Fogarty balloon catheter because it is a minimally invasive procedure. The possibility of exploration was kept in mind, but this was not needed because there was immediate return of distal pulses following the procedure. Pan-compartmental fasciotomy should be considered in such situations¹⁴.

A high index of suspicion led to prompt diagnosis of an occult vascular injury in our case. Early revascularization of the limb along with necessary compartmental decompression resulted in an excellent functional outcome. This report reconfirms the importance of thorough postoperative clinical examination and circulatory monitoring of limbs that have been operated on to ensure timely detection and management

Fig. 6 CT angiography film showing patent femoral artery postoperatively.

Fig. 7 Clinical photograph at 18 months follow-up showing full range of dorsi and plantar flexion (note the healed fasciotomy scar over the medial aspect).

of limb threatening vascular complications. It is possible to prevent such complications by refraining from overzealous attempts to reduce difficult femoral shaft fractures and instead

switching to a formal open reduction during which the surgeon can quickly and safely restore bony alignment by direct purchase on fragments.

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