

IATROGENIC ARTERIAL INJURY AND FOOT GANGRENE A CASE REPORT

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SUMMARY

Background: Elective orthopaedic operations on the knee is rarely complicated by arterial injury.

Report: A case report is presented of a 10 year old girl that developed gangrene of the foot following an elective orthopaedic operation on the proximal tibial metaphysis. A transfixion wire that breached the posterior tibial cortex was most probably responsible for popliteal artery injury that resulted in ischaemia and gangrene. The patient had an amputation of all the toes in the affected limb and recovered satisfactory limb function.

Conclusion: In operations on the proximal tibial metaphysis, implants (screws, pins, wires) should not be allowed to perforate the posterior cortex. When this occurs inadvertently, they should be readjusted as soon as radiographs confirm this, to avoid injury to the popliteal artery.

Keywords: ischaemia, arterial injury, gangrene, amputation, orthopaedic operation. (Accepted 8 February 2007)

INTRODUCTION

Arterial injury in elective orthopaedic operations is uncommon¹. The incidence is as low as 0.005% of elective orthopaedic procedures² and 0.3%³ of total joint replacements. When it occurs, the injury may be ischaemic, haemorrhagic, ischaemic/haemorrhagic and pseudoaneurysm formation. Most cases occur during total joint replacement of the hip and knee, especially reoperations. The arteries that are commonly involved are the common iliac and external iliac arteries around the hip as well as the femoral artery around the knee. Haemorrhagic arterial injuries may become obvious intra operatively or shortly thereafter. Non haemorrhagic injuries may not be diagnosed for up to five days⁴.

Limb loss is a complication of this condition that occurs when hypoperfusion is severe, diagnosis is unduly delayed or vascular repair is not accomplished soon enough. The rate of amputation may be as high as 14%^{2,5}. Mortality rate following iatrogenic extremity arterial injury of 5%² to 7%⁶ has been reported.

There is no published report from Nigeria, known to the author, of arterial injuries complicating elective orthopaedic operations. This may be due to the fact that total joint replacement procedures are relatively uncommon and the various series are still

unpublished. This is a report of an injury to the popliteal artery noticed days after operation on the proximal tibial metaphysis and resulting in loss of digits.

CASE REPORT

A 10 year old girl presented with a 7 year old deformity of the left lower limb (LLL) following a fall at home. She was treated at home by a traditional bonesetter using a "bamboo-stick" splint.

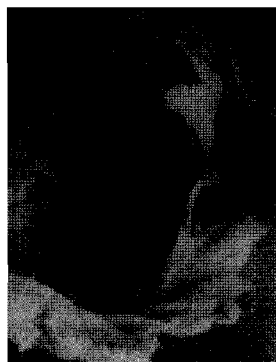
Examination of the LLL revealed anterior bowing of the femur, 90° laterally dislocated patella with the insertion of the patella ligament antero-laterally located. The knee had a fixed flexion deformity of 20° while the quadriceps and calf muscles were atrophied. There were no neurological deficits. She had pain in the left knee on walking, in the 2 years preceding presentation and she walked with a limp. A plain radiograph showed the anterior bowing of the left femur. Blood cells count and chemistry results were all within normal limits. The indication for seeking consultation was her limp, knee pain and deformity. She underwent an operation to reduce the patella and transpose the insertion of the patella ligament with a bone block to a new position just medial to the midline of the knee joint. The patella ligament with its bone block was secured in place with absorbable sutures and a Kirschner wire which was bent to 90° at skin level. The wound was closed in one layer using interrupted silk sutures, without repairing the deep fascia. An above-knee cast was

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then applied. Immediate postoperative circulation in all toes was normal. Postoperative radiograph showed that the transfixing K-wire protruded from the posterior cortex of the tibia by 3mm.

On the sixth postoperative day, she suddenly developed severe pain in the left leg but this promptly resolved with analgesic. Circulation, movement and sensation in the toes were normal. On the 9th day PO, she was noticed to have anaesthesia of the left toes and very sluggish capillary refill. The transfixion pin was removed and the cast bivalved along its whole length. Examination revealed tenderness in the leg and foot with reduced warmth in the forefoot. Although leg compartment pressures were not directly measured, she did not have clinical features suggestive of compartmental syndrome. Due to a consideration of foot ischaemia secondary to popliteal artery spasm, Doppler ultrasonography of the LLL was requested. This was delayed for seven days by lack of finances. By this time, the toes and skin of the sole of the forefoot became gangrenous, as shown in

Figure 1. Left foot of the 10 year old girl with ischaemic gangrene



Ultrasonography revealed good blood flow with normal waveforms in the femoral and popliteal arteries. The tibioperoneal trunk, anterior tibial, posterior tibial and peroneal arteries were also normal. As shown in

Figure 2A: Doppler USS of the left anterior tibial artery

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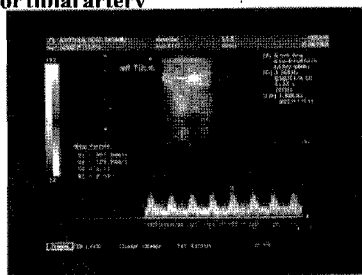


Figure: 2B Left posterior tibial Artery on Doppler USS

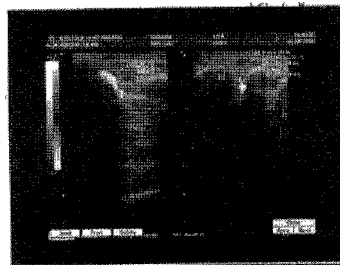
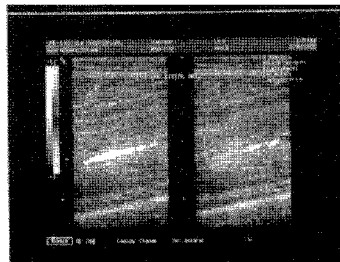


Figure: 2C Left dorsalis pedis artery on Doppler USS



Good blood flow was also demonstrated in the dorsalis pedis and dorsal metatarsal arteries but the digital arteries were not demonstrated.

The patient required amputation of all toes and debridement of the sole of the forefoot to conserve the foot. The wound healed satisfactorily, as shown in

Figure 3: Healing stump of the left foot after amputation and debridement



And without delay. She is now ambulant, without knee pain or deformity, and is being followed up.

DISCUSSION

The popliteal artery lies in the floor of the popliteal fossa, a posterior relation of the proximal metaphysis of the tibia. The artery terminates at the lower border of the popliteus muscle by dividing into the anterior and posterior tibial arteries. The popliteal artery is at risk during orthopaedic operations on the knee joint (especially total joint replacement). A procedure on the proximal tibial metaphysis where the posterior cortex is breached (as in osteotomy) also endangers the artery although injuries occur only rarely. In the

reported case, the posterior cortex of the proximal tibial metaphysis was perforated by a transfixing wire. It is probable that the artery was not injured at operation. However, additional posterior migration of the wire may have occurred making it come in contact with the popliteal artery on the sixth post operative day. Spasm of this artery may have caused the sudden pain in the leg and foot from resultant ischaemia. Thrombosis in the digital arteries, the most distal part of the arterial circulation in the lower limb could have resulted in gangrene of the toes despite wire removal. Microthrombosis in the skin circulation of the sole, as a result of ischaemia, can explain the latter's involvement. It is estimated that the duration of ischaemia was less than 36 hours. Ischaemia time of 30 days has been reported^{7,8} in the lower limb. Popliteal artery injury is associated with a high rate of limb loss^{2,5,9,10}, but this was limited to the toes in the reported patient. The patient is a child who is not expected to have atheromatous plaques in the femoro-tibial arterial system.

This could have limited the extent of gangrene to the fore foot through effective collateral circulation.

Risk factors for amputation following arterial trauma include preoperative ischaemic neurologic deficit, compartmental hypertension, concomitant fracture popliteal vein injury, severe soft tissue injury and postoperative wound sepsis¹¹. None of these was present in this patient. Assessment of arterial injury is by routine clinical examination of the extremity as well as Doppler ultrasonographic examination⁷ which is non-invasive. Arteriography is important for localization of an arterial injury and for planning reperfusion procedure which could not be performed in the reported patient. Amputation in the foot is emotionally distressing. However, it must be seen as a life saving reconstructive procedure which improves the quality of life. This patient required amputation of all toes in the affected foot. Her wound healed satisfactorily. The only functional impairment expected is a limp during rapid-pace walking and running. The clinical point of note is that in operations on the proximal tibial metaphysis, implants (screws, pins, wires) should not be allowed to perforate the posterior cortex. When this occurs inadvertently, they should be readjusted as soon as x-rays confirm this so as to avoid injury to the popliteal artery.

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