

## LATE THROMBOSIS OF THE FEMORAL ARTERY COMPLICATING FRACTURE OF THE FEMUR

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Damage to the femoral artery as an immediate complication of fracture of the femoral shaft is well recognised, and the need for early surgical intervention has been stressed repeatedly (Griffiths 1948, Hardy and Tibbs 1960). In the case to be described, patchy skin necrosis caused by thrombosis of the femoral artery occurred several days after delayed internal fixation. Restoration of the blood flow seventeen days after nailing promoted recovery of the limb.

### CASE REPORT

A man of fifty-five was admitted to University College Hospital having been found unconscious in the street. On examination he was deeply unconscious and shocked, but there were no other abnormal signs in the central nervous system. There was an obvious fracture

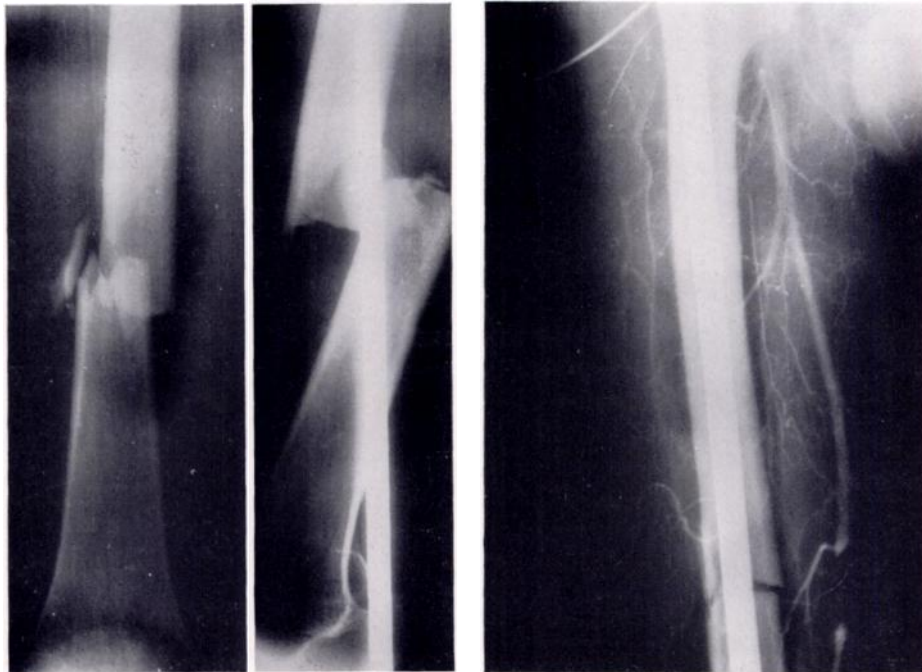


FIG. 1

FIG. 2

Figure 1—Antero-posterior and lateral radiographs on admission, showing the fracture of the right femur. Figure 2—Femoral arteriograph, showing complete occlusion at the level of the fracture.

of the right femur with extensive swelling, and lacerations of the face, occiput and left shin. The right foot was warm and the posterior tibial pulse was palpable. The dorsalis pedis pulse was not palpable in either foot. Radiographs showed a linear fracture of the skull, fracture of the nasal bones and a transverse fracture of the right femur at the junction of the middle and lowest thirds (Fig. 1.)

The patient was resuscitated with plasma and blood; the lacerations were sutured and the femoral fracture was treated by skeletal traction with a Steinmann pin through the tibia. He recovered consciousness the same day. Angulation and overlap of the bone fragments persisted in spite of increasing the traction. The circulation of the foot remained satisfactory. Ten days after injury internal fixation of the fracture with a medullary nail was done without difficulty after exposing the fracture, although it was necessary to adduct the distal fragment widely at operation.

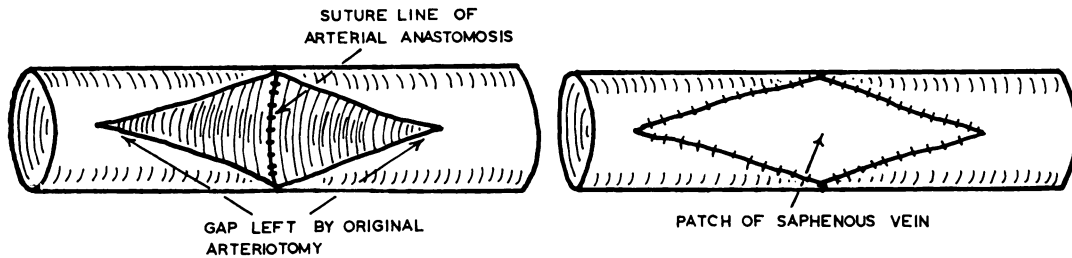


FIG. 3  
FIG. 4  
Figures 3 and 4—The method of arterial reconstruction after endarterectomy and resection of damaged segment.

Two days later the patient developed an area of skin necrosis over the right calcaneal tendon. In the succeeding days patches of gangrene appeared on the sole of the foot, over the head of the fifth metatarsal, the lateral aspect of the fifth toe and the heel. Later it was noted that the right foot was cold and that the posterior tibial and popliteal pulses were absent. The superficial femoral artery pulsated to the level of the fracture site. There was hypoaesthesia of stocking distribution from just above the ankle with complete loss of sensation in the forefoot. Arteriography showed complete occlusion of the femoral artery for about three centimetres at the fracture site with medial displacement of the artery (Fig. 2).

The femoral artery was explored seventeen days after internal fixation (J. L. P.). The superficial femoral artery was found to be tethered to the femoral vein by dense fibrous tissue, and was adherent to the callus at the fracture site over a distance of ten centimetres. There were no spikes or loose flakes of bone in the vicinity. The artery was occluded over a length of five centimetres, with no pulsation below the block. The rest of the artery felt normal, with no evidence of atheroma. The artery was mobilised and after systemic heparinisation it was opened by a longitudinal incision two centimetres long where the thrombus was most dense. A limited endarterectomy was carried out: grey-brown organised thrombus firmly adherent to the wall of the artery and recent clot were removed. The arterial wall at this site was discoloured and uneven and was considered too unhealthy to leave. It was resected, leaving a two-centimetre gap with healthy arterial wall on either side which was confirmed by extension of the arterial incision. Continuity of the artery was restored by direct suture with 4/0 silk, leaving a linear opening anteriorly above and below the suture line where the original arterial incision had been extended (Fig. 3). This opening was closed with a patch of saphenous vein in order to prevent narrowing (Fig. 4). There was good pulsation below the anastomosis on release of the clamps and the posterior tibial pulse was palpable at the end of the operation.



FIG. 5  
Femoral arteriograph thirteen weeks after femoral artery reconstruction, showing good flow with slight dilation at the level of the graft.

Subsequently all the gangrenous areas healed except those on the heel and over the head of the fifth metatarsal, which were later grafted with split skin. The area of sensory loss which was present over the foot and ankle before operation had not diminished appreciably when the patient was discharged on crutches. Femoral arteriographs thirteen weeks after operation showed an excellent flow through the graft (Fig. 5).

#### DISCUSSION

This case is unusual in that occlusion of an otherwise normal femoral artery occurred some days after medullary nailing. Such occlusions usually occur at the time of injury. Surgical intervention as an emergency measure is usually required to save the limb and internal fixation of fractures may be carried out as a complementary procedure (Kirkup 1963). It has been said that a delay of more than eight to twelve hours before restoration of the circulation after sudden complete occlusion leads to thrombosis of the distal arterial tree and ischaemic necrosis of the muscles. Attempts to restore the circulation after this time are "doomed to failure" (Griffiths 1948).

Damage to limb arteries may occur in three ways: 1) direct laceration or contusion by bone fragments at the fracture site; 2) contusion or laceration from direct injury of the artery; and 3) incomplete rupture of the artery or fracture of the intima, usually produced by overstretching the artery as a result of a fracture or dislocation adjacent to it.

The present case does not fit clearly into this classification because it is not known precisely when injury to the vessel occurred. Damage to the arterial wall may have taken place when the fracture was sustained, predisposing to complete thrombosis after the manipulations required to introduce the medullary nail. Alternatively the primary injury may have occurred at the time of internal fixation, because there was no evidence of circulatory insufficiency in the limb before this. The progressive appearance and the scattered distribution of the patches of gangrene may have been caused by emboli arising from the contused vessel wall before the complete thrombosis occurred.

Occlusion of a normal superficial femoral artery does not lead inevitably to irreversible gangrene because of the ample collateral circulation through the profunda femoris. In cases requiring emergency arterial surgery there is, presumably, associated interference with collateral channels and ischaemia is at once apparent.

Closed medullary nailing is known to have led to occlusion or division of the femoral artery resulting sometimes in the loss of the limb (Watson-Jones *et al.* 1950). Such complications do not seem to have been reported with the open method of intramedullary nailing. In the case under discussion a notable feature was the degree of tethering of the artery by the callus. In spite of the fact that care was taken during the manipulations to introduce the nail the relatively fixed artery was probably kinked during adduction, with damage to the vessel wall and subsequent thrombosis.

In this patient several methods of arterial repair were considered. Hughes (1958) said that the best results in arterial surgery were obtained with resection and direct anastomosis. This method was not used here because of the amount of tension which would have been required, particularly as the knee could not be flexed and adequate mobilisation would have meant the sacrifice of collateral channels. It was also felt that an anastomosis under tension would increase the risk of narrowing which invariably occurs at such anastomoses.

Autogenous vein graft, the next most satisfactory form of reconstruction, was impracticable because the saphenous vein was double and of small calibre in its entire length.

Bonney (1963) described a case in which endarterectomy was used eight hours after injury. Endarterectomy was carried out in this patient in the first instance, but removal of the thrombus revealed a wall so damaged that further thrombosis or aneurysm formation seemed likely to occur.

The method of reconstruction used, using a saphenous vein patch, gave the advantage of a direct anastomosis with the avoidance of narrowing. The patch also served to reduce the amount of tension on the suture line.

#### SUMMARY

1. A case of femoral artery occlusion after fracture of the femur occurring several days after internal fixation with a medullary nail is described.
2. Arterial reconstruction was undertaken seventeen days after the internal fixation, twenty-seven days after the injury, with restoration of flow and recovery of the limb.

We are grateful to Mr C. W. Flemming and Mr Donal Brooks for allowing us to report their case.

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