TRAUMATIC ARTERIOVENOUS FISTULA OF THE
POSTERIOR TIBIAL VESSELS

Report of a Case

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In October 1964 a youth of seventeen was struck by a car, sustaining closed fractures of
the upper half of the left tibia and fibula. The calf was enormously swollen. The dorsalis
pedis pulse was palpable and the colour of the foot was normal. The fractures were reduced
and immobilised in a padded plaster from the groin to the toes.

The next day the toes were blue, cold, insensitive and immobile. The plaster was split
widely with prompt restoration of colour. Five days after the injury the plaster was removed:
neither the dorsalis pedis nor the posterior tibial pulse was palpable, but the foot was pink and warm, although
insensitive and immobile. A Steinmann’s pin was
introduced through the calcaneus and a new plaster
was applied with skeletal traction. Two days later
active extension of the toes returned but flexion of the
toes was absent. A week later the plaster was again
changed. The dorsalis pedis pulse was easily palpable
and the colour of the leg and its temperature were
normal. Hypoalgesia was found over the outer aspect
of the lower calf and the whole of the foot; the calf
was a little swollen, and a large blister was present
over the site of the tibial fracture. Traction was
discontinued after five weeks, the Steinmann’s pin was
removed and the patient was allowed to walk, non-
weight-bearing, with crutches. He was discharged home
two months after the injury. At each of three out-patient
attendances for changes of the plaster the calf was found
to be hard and swollen.

Seven months after the injury the plaster was finally
removed, the fractures being united. He was readmitted
to hospital that day because of considerable swelling
below the knee. Ankle movement was restricted to
5 degrees and there was no movement in the long toe
flexors or in the tibialis posterior. After elevation for a few days the swelling of the foot and
ankle diminished, leaving a localised swelling of the calf (Fig. 1). This partly emptied on
compression and refilled in a few seconds. A continuous bruit was heard over the calf, and a
systolic bruit in the popliteal fossa. A diagnosis of posterior tibial aneurysm with arteriovenous
connection was made. Percutaneous femoral arteriography showed occlusion of the posterior
fibular artery 6-5 centimetres (2-5 inches) from its origin, there being a narrow communication
with a large aneurysmal sac. Early filling of an enlarged vein draining the sac was seen
(Figs. 2 and 3).

Operation—At operation six weeks later with a pneumatic thigh tourniquet the gastrocnemius
muscle was split vertically and the soleus appeared brown, avascular and thinned. A large

FIG. 1
The clinical appearance of the leg after the fractures had united.
aneurysmal sac was entered immediately deep to it and about 800 millilitres of blood and clot removed. The anterior wall of this cavity was grey, smooth and shiny, with two vascular openings at its upper end. On release of the tourniquet, arterial blood escaped from one opening and venous from the other (Fig. 4). These two vessels were dissected and found to be of comparable size with walls of almost equal thickness; only at the upper end of the wound was the artery readily identifiable. The posterior tibial artery and a vena comitans were identified above and below the openings, and quadruple ligation was performed, the damaged segments being removed. The posterior tibial nerve was found compressed and flattened. The necrotic soleus muscle was excised but no deeper exploration was made, and the wound was closed in layers with suction drainage. Histology of the soleus muscle showed changes of necrosis.

Progress—After operation the circulation to the foot and toes seemed to be improved. When last seen six months after operation he still had some calf swelling. The ankle moved from 5 to 20 degrees of plantar-flexion, and inversion and eversion were about one-third normal. The dorsalis pedis pulse was present. He had small sores on the outer side of the left heel, on the dorsum of the left fourth toe and on the medial side of the left second toe. The whole of the sole of the foot was insensitive to pinprick whereas the dorsum of the foot and the outer side of the left calf were hypersensitive. The inner side of the calf had normal sensation. The long toe flexors were not working. The calf muscle worked to a power of 4 (Medical Research Council grading).

DISCUSSION

Rufus of Ephesus in the first century A.D. described arteriovenous connections (Hughes and Bowers 1961), but their pathology and physiological significance were not appreciated until William Hunter (1762) published his observations and reflections on two cases.
A search of the literature has revealed only one case (Harris 1963) of an arteriovenous fistula complicating a closed fracture of the tibia and fibula. In this case the peroneal vessels were affected at the level of the fibular fracture. The fractures remained ununited at six months, when a thrill was felt conducted through the plaster. Union occurred in this case after the fistula was excised. In our case union of the tibia occurred at seven months, but before operative treatment of the vascular lesion.

Many arterial injuries have been described after the recent wars. DeBakey and Simeone (1946) analysed 2,471 cases of arterial injuries in the second world war, but none occurred in closed fractures (Simeone 1966). The same cases were reviewed by Elkin and Shumacker (1955). In 265 injuries the posterior tibial artery was involved, but without fistula formation. In reviewing 593 arteriovenous fistulae at other sites they pointed out that these could be missed unless every wound was examined for a vascular injury, the examination to include auscultation. Further, an arteriovenous fistula that is present from the onset of injury could be overlooked unless examination was repeated after swelling had subsided.

In our case the leak into the vein must have been small, allowing the formation of a large sac with considerable tension within it. In most cases the false sac is smaller because the venous drainage acts as a safety valve to reduce tension (Kimmonth, Rob and Simeone 1962).

Ligation is the accepted method of treatment for lesions of relatively minor vessels such as the posterior tibial artery. There is widespread agreement that some months should elapse whenever possible before surgical intervention. Kimmonth et al (1962) advised that in the acute stage the conservative approach is safer, unless the surgeon is an expert in this field, because an arteriovenous fistula stimulates the formation of a collateral circulation. Premature surgery may lead to amputation, but after three months the limb is safe. The only indications for early surgery are: 1) continuing expansion of the haematoma; 2) a large fistula embarrassing cardiac function; and 3) threatening gangrene.

Increasing understanding of ischaemic changes in lower limb injuries might make one add a fourth indication for early surgery—Volkmann's ischaemia—but we would stress that in the rare vascular injury described the effects of Volkmann's ischaemia must be balanced against the effects of operating on a limb before the development of an adequate collateral circulation. We would stress again the importance of auscultation at all stages in the examination of fractures with much swelling.

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REFERENCES


