TRAUTOMATIC ISCHAEMIA OF THE CALF

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Volkmann in 1881 described the changes in skeletal muscle which follow impairment of its blood supply. Since that time there have been many reports of muscle ischaemia of which most were associated with arterial damage or spasm, proximal to the muscle concerned.

This paper draws attention to swelling and oedema of muscle in a confined space as another cause of ischaemia. In the case presented it is believed that the rise in pressure was not sufficient to occlude the main artery but that it was sufficient to occlude the intramuscular vessels. This hypothesis would explain why, although there was complete necrosis of the calf muscle, the posterior tibial pulse was always present.

CASE REPORT

A youth aged seventeen was admitted to the Royal Salop Infirmary after a road accident in which his motor cycle collided with a car. He had sustained many injuries including a compound fracture of the lower right radius and ulna, fractures of the sixth cervical vertebra, of both left pubic rami, and the right body of the pubis and right inferior pubic ramus. The right calf was painful and there were two discrete areas of bruising and abrasion, one anteriorly and one posteriorly. The calf muscle was tense and the foot was held in equinus which could not be corrected because of pain. There was loss of sensation to pinprick and touch over the outer side of the shin and dorsum of the foot. There was a small laceration on the dorsum of the foot.

The possibility of arterial damage was considered but rejected because the posterior tibial pulse at the ankle was easily felt. The blood pressure was 95/70 millimetres of mercury and radiographs of the right tibia and fibula showed no fracture. The dorsalis pedis pulse was not palpable.

Treatment and progress—After appropriate treatment for the various injuries the patient was nursed in a pelvic sling with the legs elevated on Böhler-Braun splints with skin traction.

On the third day after the injury two areas of skin necrosis, about one by two inches in size, developed on the right leg in the areas previously noted as bruised. These areas were not associated with the adhesive extension strapping. Nevertheless the splints and pelvic sling were removed and the patient was nursed with the legs supported on pillows. There was no pain in the calf at that time. The area of anaesthesia was unchanged, the posterior tibial pulse was easily palpable, and the foot was still held in equinus.

For the following three weeks the patient’s condition remained unchanged. He was anorexic, and his temperature varied between 99 and 101.6 degrees Fahrenheit. No other cause of pyrexia having been found, it was thought that there might be some infection present deep to the necrotic skin of the calf, and that the leg should be explored.

Operation—After removal of the necrotic areas of skin the whole calf and anterior compartment of the leg was found to be devitalised, but not infected, with easily identifiable muscle planes. The muscles were normal in shape, pale pink in colour, they did not bleed or contract when cut, and were easily removed down to the layer of fascia covering the deep flexors of the calf. Here the posterior tibial artery was pulsating strongly. Because of the danger of damage to this vessel, further excision was not attempted. The wound was lightly packed with gauze.

Bacteriological culture yielded only bacillus subtilis.

Outcome—During the next ten days three further excisions of devitalised muscle were done, with special care to preserve the posterior tibial artery. The wound was allowed to granulate.
Secondary infection of the granulating area was controlled by local applications of hydrogen peroxide and antibiotic treatment. Two months later the wound had granulated sufficiently to allow split-skin grafting and one month later the patient was allowed up on crutches. A small sequestrum developed on the anterior border of the tibia—probably due to exposure osteitis. This was removed without complication.

The patient is now fit and walks well without aid, and he can drive a tractor. The right ankle is virtually stiff, with the foot held at a right angle. There is sensibility over the sole of the foot; the skin is healed over the whole leg with the exception of a small area in the region of the skin graft. The posterior tibial pulse is easily palpable.

The patient, therefore, is walking on a "living prosthesis"—the only structures present between his knee and ankle being the tibia, the fibula, the posterior tibial vessels and nerves, the skin and subcutaneous tissues (Fig. 1).

**DISCUSSION**

It is suggested that at the time of the accident a contusion of the calf took place and that this led to swelling and oedema of the calf muscles. Since the muscles were enclosed in a tight envelope of deep fascia they were unable to expand and the consequent rise of pressure within the "envelope" interfered with the venous, capillary and probably arteriolar blood flow with consequent muscle necrosis. The areas of bruising and abrasion of the calf were consistent with being run over by the wheel of a vehicle.

In 1959 Parkes described a crush injury to the forearm, without bone injury, which resulted in early spastic contracture of the finger flexors and partial ischaemic lesions of the superficial radial, median and ulnar nerves. Assuming that the venous return through the muscles was impeded by the increase in tension in the muscle compartment and thence shunted
to the superficial veins, he obstructed the superficial veins by means of a sphygmomanometer cuff inflated to just below arterial diastolic pressure. Immediate relief of pain and spasm with return of sensation followed. The symptoms and signs returned if the cuff was deflated. The condition was successfully treated by maintaining this obstruction to the superficial venous return for long periods until the signs and symptoms abated.

Owen and Tsimboukis (1965) drew attention to the localised areas of muscle necrosis found in the calves of patients who had sustained fractures of the tibia and fibula. This was suggested as a cause of the relatively common loss of dorsiflexion of the ankle following these fractures.

Hughes (1954), in discussing vascular injuries in the Korean campaign, described a case in which damage to the popliteal vein and greater and lesser saphenous veins caused necrosis of the calf muscles which necessitated amputation.

Some support for the hypothesis mentioned above has been found in a somewhat similar case.

CASE REPORT

A child of eight years was admitted after a garden roller had crushed his calf against a low wall. He had a transverse fracture of the mid-shaft of the tibia, as well as the fibula, compounded from within by a spike on the tibia. The foot was in full equinus, and dorsiflexion caused great pain in the calf, which was tense. The dorsalis pedis and posterior tibial pulses were both palpable.

At operation to decompress the calf the deep fascia was tense and distended, and it was then split from the popliteal space to the calcaneal tendon. Immediately the muscles bulged into the wound; they bled when cut and contracted when stimulated. After precautionary decompression of the deep flexors the fractures were reduced.

It was not possible to close the skin at once, but after ten days in plaster the calf muscle swelling had subsided greatly and it was possible to close the skin. The fracture united without complication, and at the twelfth week the patient had a full range of movement in the knee and ankle.

SUMMARY AND CONCLUSIONS

1. A patient with complete ischaemia of the muscles of the calf and anterior compartment of the leg is described.
2. In diagnosis, tenseness of the calf, equinus and pain on attempted dorsiflexion of the ankle are most important.
3. Peripheral pulses may be present and do not contra-indicate decompression by operation to prevent ischaemia.

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REFERENCES