pain due to gross degenerative changes (Fig. 1). Mr W. Alexander Law at the London Hospital performed a vitallium mould arthroplasty in October 1949 (Fig. 2). She returned to work after eight months and enjoyed an active lifestyle until her retirement in 1984.

When seen in January 1995 she walked with a limp but did not require a walking aid and was free from pain. There was true shortening of 6 cm on the left side and a positive Trendelenburg sign. There was no fixed-flexion deformity and she had an excellent range of movement. A radiograph showed settling of the prosthesis with considerable resorption of the neck (Fig. 3).

Discussion. The first mould arthroplasty was made in 1923 from glass and inserted in an ankylosed hip by Smith-Petersen at Massachusetts General Hospital. Over the next two decades, a number of different materials were used until vitallium was introduced in 1938. The Smith-Petersen cup arthroplasty was a standard method of hip reconstruction until the advent of total hip replacement (Charnley 1961).

There have been other reports of prostheses with long survival times, but we could find no other record of a satisfactory result at 45 years.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References

THE VASCULAR SUPPLY TO BONE IN DISTRACTION OSTEONEOGESIS:
AN EXPERIMENTAL STUDY

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A fundamental requirement of bone healing and reconstitution is an adequate blood supply to the soft-tissue bed surrounding the bone defect. There have been many studies on the effect of the regional blood supply on fracture healing and on the development of delayed union (Brookes 1960; Trueta 1963, 1974; Rhinelander 1968), but in distraction osteoneogenesis the vascular supply to the new bone has not been defined.

We aimed to describe the anatomy of the regional blood supply to the new bone created by distraction.

Materials and methods. We used two adult female Swiss Mountain sheep, aged five and seven years and weighing 59 and 62 kg, respectively. Under general anaesthesia with endotracheal intubation and controlled respiration, a modified circular four-ring fixation frame was mounted on to the left tibia using stainless-steel Kirschner wires 1.6 mm in diameter. A 2.5 cm segment of bone was then resected through two parallel osteotomies with an oscillating saw. The bone ends were brought into contact and the wound closed in layers. After 72 hours mechanical distraction of the bone gap was begun at 0.35 mm every eight hours, for 28 days. The external fixation frame was left in place for consolidation for seven days.

On day 35, under general anaesthesia and heparinisation, we infused by hand through the femoral artery a 15% suspension of Micropaque (Laboratoires Nicholas, Gaillard, France) barium sulphate in water containing 1.5% gelatin (maintained at 37˚C in a water-bath). The animals were then killed and the blood vessels of the tibia ligated and the left tibia excised. The specimens were fixed in 4% buffered formalin and cleared by the Spalteholz technique (Spalteholz 1911). The intact transilluminated bones were observed through a stereomicroscope so that the gross external and internal vasculature could be seen.

Results. Around the edges of the bone gap we observed masses of callus composed of rather dense connective tissue with areas of calcification due to membranous ossification. On the posterior surface the callus was in close contact with the muscle bed in which a longitudinal vessel ran in a cranio-caudal direction. From it, a major bifurcating branch entered the new bone in the translucent middle plane (‘equatorial line’) and reached the anterior periosteal border (Fig. 1). Within the gap a plexus of vessels developed (Fig. 2). There were no new independent vessels in the anterior part of the new bone.

Medullary vessels did not cross the osteotomy site. A small number sprouted from the medullary cavity of the distal bone fragment and ran in a cranial direction to supply the distal medullary part of the callus (Fig. 3).
Discussion. The main blood supply to the new bone formed in distraction osteoneogenesis is centripetal and appears to originate from the posterior muscular bed and the surrounding soft tissues.

External fixation is a minimally invasive method for stabilising a fracture and does not disturb the vascular anatomy of the fracture site. Brueton, Brookes and Heatley (1990) showed that after an osteotomy in which the gap was maintained, intense ischaemia of both the cortex and medulla of the distal fragment had occurred two weeks after surgery. In this circumstance, the medullary circulation was the main source of revascularisation.

Our observations have identified a large longitudinal artery situated in the muscle bed at the posterior aspect of the tibia, from which important new vessels sprout and penetrate the new bone. These newly-formed vessels extend through the gap, giving off proximal and distal branches at the anterior margin. They are the main vascular source and may explain the proliferation of new bone which is always apparent first at the posterior aspect of the distraction gap. Our findings underline the importance of an intact posterior soft-tissue bed in distraction osteogenesis of the tibia.

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References


