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Replantation of a leg in an adult with 6-years' follow-up

After traumatic amputation of the distal half of the leg, a replantation was carried out using microsurgical technique in a 24-year-old lumber mill worker. He returned to his job after 1 year, and 6 years after the accident he had good function and satisfactory sensibility in the sole of his foot. The case shows that even a lower limb replantation may give useful results under favourable conditions.

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Most cases of successful lower limb replantations have been reported from China (Table 1). Chen (1983) reported 14 cases of complete amputations with success in 10. He pointed out that warm ischemia greater then 10 hours is the practical limit for survival. However, some complications including infection and renal failure did occur in their series.

Case report

On April 20, 1979, a 24-year-old man who was working with a circular saw cutting boards from a log got his leg between the moving log and the sheltering table and the leg was severed through the middle of the tibial shaft. He was taken to Kuopio University Hospital with the amputated leg, which was cooled down, and the bleeding in the stump was controlled with small hemostats (Figure 1).

The patient arrived at Tampere University Hospital by helicopter 5 hours after the accident. He was in good condition and was immediately anesthetized with continuous epidural anesthesia.

The injury went obliquely in an anterior-posterior direction so that the calf muscles were severed distally. An 11-mm-thick and 28-cm-long Küntcher nail was inserted in the proximal tibia after making the oblique surface of both bone ends even and shortening the tibia by 4 cm to facilitate the soft-tissue repair. Then the severed leg was attached to the nail.

Two veins (saphena magna and tibialis posterior) were anastomosed with 8–0 nylon sutures. Thereafter, the posterior tibial artery (diameter 3 mm) was repaired using a telescoping sleeve-anastomosis with six interrupted sutures. After about 10 hours' ischemia, the circulation was reestablished. The severed leg was kept cold with ice bags during the initial procedure.

The anterior tibial artery (diameter 4 mm) was also repaired, but it required a 8-cm-long vein graft,

Table 1. The level of amputation injury in successful lower extremity replantations according to previous authors; subtotal and failed cases are excluded.

Authors and year		Number of cases	Leg						Age
			Foot	Ankle	Lower	Mid	Upper	Thigh	
Magee & Parker	1972	1		1					42
Morrison et al.	1977	1		1					2
Usui et al.	1979	1			1				4
Le Savoy	1979	1			1				17
Van Beek et al.	1979	1	1						6
Luo et al.	1979	4			<	4	>		
Mamakos	1982	1						1	11
Chen & Zeng	1983	10		4	<	5	>	1	10–52
Bajeć & Godina	1983	1			2[a]				2
Kutz et al.	1983	3	1		2				4–22
Kusunoki et al.	1984	1			1				31

[a] both legs

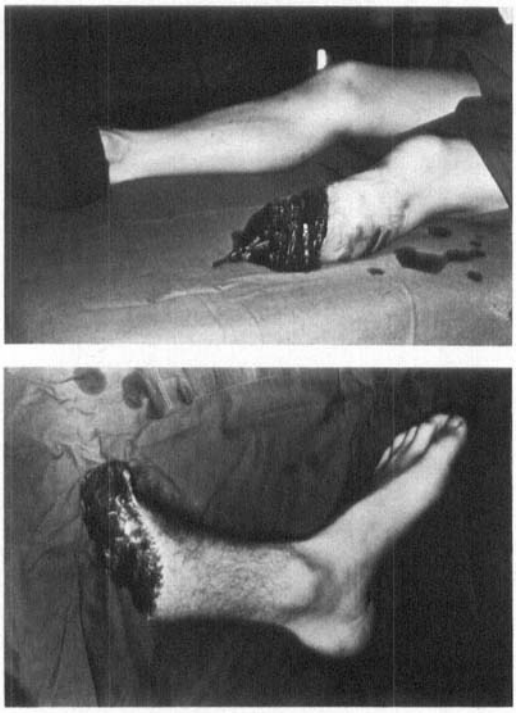

Figure 1. The midshaft amputation of the left leg in a 24-year-old male. The hemostats still in place for bleeding control as placed during primary care.

mainly because of tissue edema. The ends were telescoped to each other in both anastomoses (Vilkki 1982). Two more veins (tibialis anterior and saphena parva) were repaired, and a lot of time was spent achieving an acceptable anastomosis between the ends of the tibial nerve using 10–0 nylon. Two superficial minor nerves (suralis and peroneus superficialis) were repaired as well.

The muscles were sutured as anatomically as possible, although there was some defect in the muscles of the anterior compartment. Bone coverage was possible using the tibialis anterior fascia. Some split-thickness skin grafting was necessary both anteriorly and posteriorly. The leg was suspended with two transverse metal pins, and this position was maintained during the first 3 weeks.

The patient needed 11 units of blood before and during the 15-hour operation.

During the first postoperative day the serum potassium rose to 6.5 mEq/l and blood hematocrit varied from 0.27 to 0.32. Also creatin phosphokinase (CK) enzyme rose to 9200 U/l (Presta & Ragnotti 1981). After 2 days, the serum potassium was 4.2 MEq/l and CK was 6200 U/l. Skin temperature monitoring (Vilkki 1982) showed values over 36°C from the beginning, and the circulation in the leg and foot was good with palpable distal pulses. The body temperature varied between 37.5 and 39.8°C during the first week, with the highest values between the fourth and seventh postoperative days. However, the patient received four more units of blood during this period, which might have contributed to his fever. He received 8 million units of penicillin G and 4 g of cloxacillin daily during the first week; no signs of infection developed. A small superficial skin necrosis developed in the anterior wound margin, and a split-thickness skin graft was needed after revision at 3 weeks. The patient remained in the hospital for 7 weeks. Some difficulty was noticed when raising the patient to an erect position; the leg became blue if it became dependent, and it began to bleed easily from under the thin epithelium after the skin grafting. For that reason, the leg and foot were kept in a firm bandage when he was mobilized after 1 month.

Crutches were used for 3 months without weight-bearing and thereafter partial weight-bearing was allowed. After 6 months he began to walk without crutches; he had 4 cm of his shoe raised. Angiography showed filling of the arteries (Vilkki 1982) at 6 months and bone healing progressed slowly. There was some sensibility in the heel after 7 months, and the mobility of the ankle joint was moderately good.

The Küntcher nail was removed after 20 months. Two minor secondary operations were also necessary to release contractures in the first, second, and third toes.

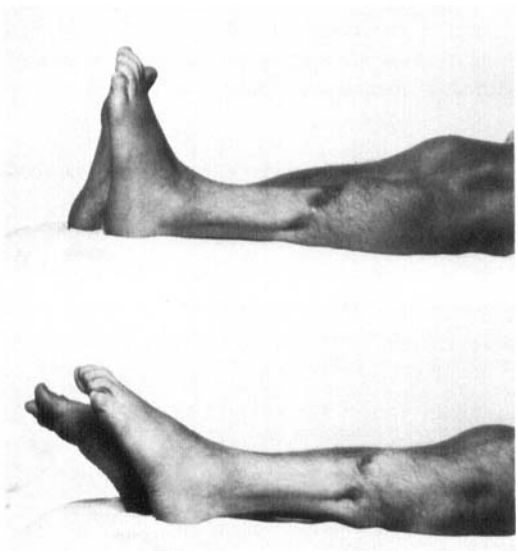

Figure 2. Ankle mobility after 6 years.

The patient went back to his previous occupation 11 months after the injury. During the second year after the injury, there was a period of hypersensibility of the sole. This totally disappeared after 3 years. At 4.5 years the motor conducting velocity in the posterior tibial nerve through the anastomosis was 34.9 m/s and the distal latency was 6.6 ms. The sensory conducting velocity in the sural nerve was 22.2 m/s.

The function after 6 years is presented in Figure 2. There is strong plantar flexion in the ankle joint, but weaker and limited dorsiflexion. The range of movement is from 10° dorsiflexion to 40° plantar flexion. The subtalar movement is restricted, but the foot is in good shape and position. The arterial supply is normal via the dorsalis pedis as well as tibialis posterior arteries. There are no pains or problems from the joints, and there is no limitation of walking distance. The patient experienced cold sensitivity only during the first 2–3 years. There is an adequate protective sensibility of the foot and the Ninhydrin test shows a normal foot print.

Discussion

Prerequisites for successful leg replantation are as follows:

1. An experienced replantation team.
2. A moderately sharp-cut injury.
3. Soft tissues must be reasonably intact and the possibility of using emergency free-flap coverage must be kept in mind.
4. The tibial nerve must be adequately repaired using microsurgical technique.
5. Shortening of the bone should not exceed 8 cm.
6. Cold-ischemia time should not exceed 12 hours.

After an ideal amputation injury in the middle leg, replantation may be useful provided that satisfactory sensory recovery has been obtained. It might also be useful to replant a part of the amputated extremity, for example, the sole of the foot as a free-tissue transplant for coverage of the stump in cases where replantation is not possible. This would lengthen the stump and facilitate prosthetic rehabilitation in proximal amputations. Major replantation requires centralization to permit the development of sufficient experience.

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