Arterialized venous flap for covering and revascularizing finger injury

O. M. Fasika and J. H. Stilwell
Whiston Hospital, Prescot, Merseyside, UK

Introduction

This report presents the use of an arterialized venous flap in the resurfacing and revascularization of devitalized digits.

Two types of venous flap have been described. The first has an established nutrient flow by retrograde venous perfusion, while the second relies on arterialization of the vein by anastomosis.

Flap survival is not significantly different when comparing those flaps which have undergone a conventional reanastomosis with those in which the venous system has been arterialized (Farrior and Baker, 1988).

Case report

A 32-year-old butcher presented to the Accident and Emergency Department at Whiston Hospital. About 1 h previously he had sustained crush injuries as well as full thickness burns to his non-dominant right index, middle, and ring fingers when he was using a hot iron press to seal meat packaging. The index and middle fingers were ischaemic distally. Finger movements were present at all joints. A radiograph of the right hand revealed undisplaced comminuted fractures of the middle phalanges of the index, middle, and ring fingers.

At exploration, the digital vessels on both sides of the index and middle fingers were seen to be thrombosed at the level of the proximal interphalangeal joints. After thorough surgical toilet, it was apparent there were areas of skin loss over both middle and distal phalanges of the three fingers with flexor tendon exposure at the proximal interphalangeal joints of the index and middle fingers.

The thrombosed segments of the radial artery of the index finger and middle finger ulnar artery were resected. Two venous flaps, each 3 × 2 cm, were raised from the volar aspect of the ipsilateral wrist (*Figure 1*). The flaps were reversed to avoid potential problems with valves of veins, and interposed between the gaps in the arteries. End-to-end anastomosis was carried out using 10 0 nylon interrupted stitches and good arterial inflow and outflow was established. The flap was then used to cover the flexor tendons (*Figure 2*). Split-skin grafts, taken from the volar surface of the proximal forearm were used to cover the remaining raw area in the fingers and the flap donor sites.

Postoperatively, the flaps looked rather engorged. On the 5th day postoperatively, complete graft take was noted. Active movements were started 2 days later and the patient was discharged home 2 weeks postoperatively.

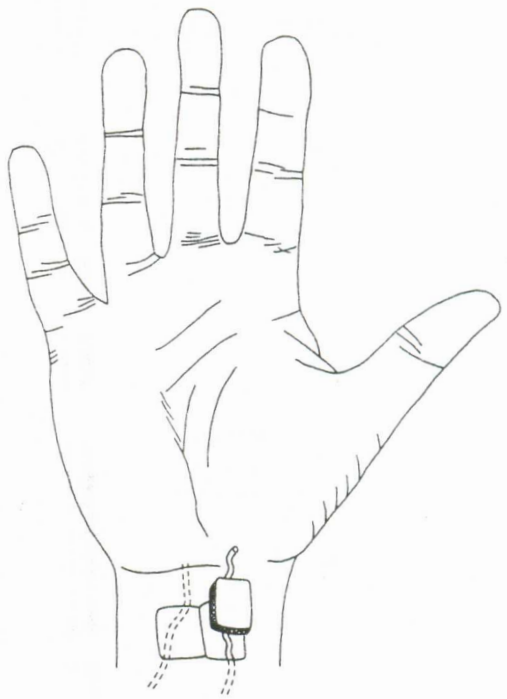

Figure 1. Diagram shows a venous flap with the proximal subcutaneous pedicle still attached. The venous flap on the ulna side is outlined.

Discussion

The management of finger injuries should aim at recovery of a good range of movement. The retention of digital length in this case was necessary because of the preservation of sensation at the distal aspect of the fingers. The two problems of reconstruction posed were, therefore, the revascularization of devitalized parts and the provision of skin cover over exposed flexor tendons. In order to combine both tissue cover and revascularization, flaps can be used which incorporate recognized blood vessels, which could either be arterial or venous.

Venous flaps have the advantage of not compromising donor arteries. The flexor aspect of the wrist was chosen because of the availability of vessels with diameter identical

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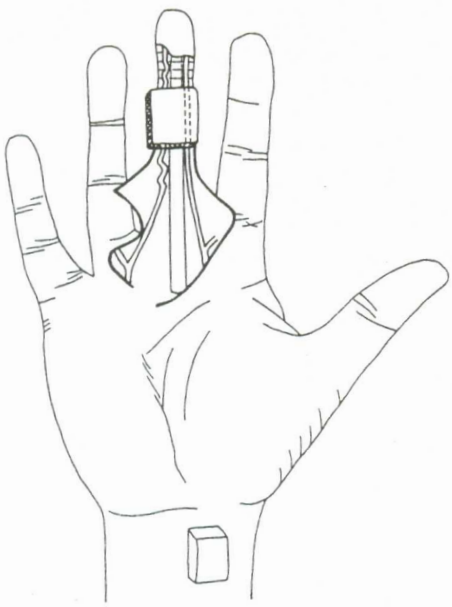

Figure 2. Venous flap from the volar aspect of the wrist applied to cover the flexor tendons in the middle finger.

to those of digital vessels. The skin is non-hair-bearing and the thickness is similar to that of the recipient site skin.

A reappraisal of the mechanism of fluid exchange in the microcirculation is essential to explain survival of venous flaps. The function of capillaries is to exchange fluid between the blood and the interstitial spaces. They have very little wall rigidity and must be kept open by means other than arterial pressure to maintain the survival of the venous flap. In this respect, they are kept open by suction forces. These suction forces act because the interstitial pressure is less than atmospheric pressure (Baek et al., 1985). They may therefore provide a mechanism for keeping the capillaries open, even when the arteries are shut off completely, a situation that exists in venous flaps.

Exchange of materials occurs when the flow is arrested for a few seconds, while the capillary is flushed through, when flow resumes. Fluid exchange occurs irrespective of the direction of flow within the capillary. Since only 25–30 per cent of the content in arterial blood is used under normal circumstances, adequate nutrients must be available for the survival of a venous flap.

It will be noted that the venous flaps presented here appeared engorged during the immediate postoperative period. This might be explained by the high hydrostatic pressure at the venous end of the capillaries, giving rise to a higher filtration pressure and a 'waterlogging' of the extravascular tissue.

References

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Requests for reprints should be addressed to: Dr O. M. Fasika, Plastic Surgery Unit, Manor Hospital, Nuneaton, Warwickshire CV11 5HX, UK.