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Distal revascularisation/replantation using the reversed radial artery

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Summary We describe a technique using the reversed radial artery for distal revascularisation or replantation in the hand. This technique has been used for revascularisation following crush avulsion injuries associated with a large zone of trauma and polydigit replantation. The technique involves dividing the radial artery and venae comitantes proximally and mobilising it distally into the hand for anastomosis. Temporary 'syndactylisation' of adjacent digits is also described. This can be used to convert multiple digits into a single vascular unit and to provide a bed for the transposed radial vessels.

These techniques are an option when there is extensive injury to distal vessels such that end-to-end anastomosis is not possible and interposition venous micrografting may be difficult or prone to failure due to poor quality recipient vessels and the need to place grafts in a traumatised bed.

Amputations and devascularisation injuries caused by avulsion/tearing or crushing mechanisms result in intimal damage to the vessels making them unsuitable for end-to-end anastomosis. In most cases vein grafts are used to overcome this. Two problems with vein grafting are assessing the limits of vessel damage and the need to place the grafts in a traumatised avulsed bed. Successful replantation in these conditions is variable and success rates in the published literature vary considerably between 45 and 80%.[1–3]

We describe a novel technique to secure blood supply to the hand in severe hand injuries. It involves dividing the radial vessels proximally and relocating them distally on their pedicle for microvascular reconstruction. The use of the reverse radial artery with its venae comitantes is an alternative to using multiple interpositioned microvenous grafts. Temporary 'syndactylisation' of adjacent digits is also described. This can be used to convert multiple digits into a single vascular unit and to provide a bed for the transposed radial vessels.

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Patients and methods

This technique has been used successfully in two cases of digital devascularisation from crush degloving injuries and in one case of polydigit replantation. The technique will be illustrated with two case reports.

Case report 1 (Figure 1.0)

A 33-year-old engineer sustained a crush degloving injury to the right hand in an industrial roller. He sustained fractures to all 12 digital phalanges and devascularisation of the middle and the little fingers. The digital vessels were avulsed in the little finger and middle finger at the level of the base of the proximal phalanges. The ulnar digital vessels to the ring and index finger were also divided.

All tendons and nerves were intact. The common digital arteries of the palm were contused but intact proximally. There was a degloved wound on the dorsum of the hand, but sufficient veins were intact in all digits.

Due to the crushing avulsion mechanism, the proximal and distal ends of the digital vessels were severely damaged and not suitable for end-to-end repair. Vein grafting was considered to be unreliable due to the poor quality of the proximal and distal vessels and the need to place the grafts in a traumatised bed. Therefore, we elected to use the radial artery as a vascular pedicle to enable revascularisation beyond the zone of trauma. After confirmation of adequate cross circulation in the palm by using the Allen test, the radial artery with its venae comitantes was divided proximally. It was turned distally on its pedicle and channelled through a palmar incision extending to the base of the little finger (Figures 1.1 and 1.2). We 'syndactylised' the 3rd and 4th webs by suturing dorsally-based flaps to create a bed for the transposed radial artery, thus allowing the artery to reach the level of the proximal interphalangeal joints of these digits. End-to-side anastomosis was performed of the radial digital vessels of the little and middle finger to the reversed radial artery at the level of the middle of the proximal phalanx (Figure 1.2). Successful revascularisation was achieved and a skin graft was used to cover the radial digital artery as it crossed the proximal phalanges. The fractures were reduced using a distal ligamentotaxis traction system.

Three months later the webs were released. An adequate collateral circulation was confirmed to the middle finger by clamping the reversed radial artery before division of the web. It was possible to divide the 4th web and preserve the radial artery supply to the little finger (Figure 1.3). Given the severity of the injury, the patient made a satisfactory functional recovery (Figure 1.4).

Case report 2 (Figure 2.0)

A 36-year-old male factory worker amputated the five digits of the left dominant hand while using a circular saw. The index, middle and ring fingers were amputated just distal to the metacarpal phalangeal joints in a volar oblique direction resulting in a zone of trauma extending from the distal palmar crease to the digital webs. There was a residual attachment by thin skin strips in the web spaces but without arteries or veins. (Figure 2.1). The thumb was amputated transversely through the proximal phalanx just distal to the metacarpal phalangeal joint. The little finger was amputated through the proximal interphalangeal joint (PIPJ). The neurovascular bundles of the index, middle and ring fingers were damaged for 1—2 cm at the amputation site such that end-to-end anastomosis was not possible.

Faced with the prospect of poor quality vessels and the need for multiple vein grafts, it was decided to use the

Figure 1 (1.0) Crush degloving injury to the right hand with devascularisation of little and middle fingers. (1.1) Forearm incision to harvest the radial artery, 'syndactylisation' of the middle and ring fingers and skin graft covering the transposed radial artery as it crosses the proximal phalanges. (1.2) Three months post injury. Line drawing demonstrating the path of the transposed, reversed radial artery and the location of anastomoses with the digital arteries. (1.3) Six months post injury and 3 months post division of the 'syndactylised' middle and ring fingers. (1.4) Six months post injury.