Distal Finger Replantation

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Reconstruction of the fingertip distal to the flexor tendon insertion by replantation remains controversial and technically challenging, but the anatomy of the fingertip has been well described and provides help in surgical planning. The open-book surgical technique is described with potential complications and is illustrated with clinical cases. *(J Hand Surg 2011;36A:521–528. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Finger replantation, finger revascularization, hand injury.

Historically, reconstruction of the fingertip distal to the flexor tendon insertion by replantation has been controversial. It is technically challenging surgery with a high chance of failure, yet it can avoid painful neuroma formation or unacceptable cosmesis.

In the 1960s, after Kleinert and Kasdan[1] reported the first digital artery repair, Komatsu and Tamai[2] replanted the first thumb, and the work was completed at the Sixth Shanghai People's Hospital,[3] replantation of amputated digits became a reality. Since then, microsurgery has evolved at a rapid pace; however, the need for tip reattachment has remained contentious. Reconstruction can be achieved with myriad small flaps, but no reconstruction is as good as the part itself: guillotine amputation of the fingertip in which there is little tissue damage and where vessels and nerves can be connected without grafts allows restoration of cosmesis and function to the injured hand. Modern perioperative management techniques also mean that this procedure can usually be performed as outpatient surgery, often under local anesthetic block.

INDICATIONS AND CONTRAINDICATIONS

There are no absolute indications for very distal tip replantation, but we believe it should be considered for all digits in children and young women, and those for whom full restoration of length is professionally advantageous, such as musicians.

The procedure is contraindicated in injuries where there is considerable tissue damage by crushing or contamination, peripheral vascular disease, or systemic conditions with associated vascular problems such as diabetes. Manual workers who require an early return to function should also not be considered.

SURGICAL ANATOMY

The vascular anatomy of the digits is well described[4,5] (Fig. 1). The thumb, index, and long fingers have a dominant ulnar digital artery; in the ring and small fingers it is the radial digital artery. The 2 digital arteries anastomose as palmar arches 3 times: at the level of the C1 and C2 cruciate pulleys, and finally just distal to the flexor digitorum profundus tendon insertion as the rounded distal transverse palmar arch (DTPA); 3 or more vessels then radiate longitudinally out from the DTPA to supply the pulp, with the central vessel usually having the largest caliber. These then turn back dorsally, to anastomose with the dorsal proximal matrix arch, which supplies the nail plate germinal matrix; this arch has its arterial origins just before the DTPA. Branches from the distal radiating vessels also pass dorsally to anastomose and supply the nailbed via the middle and distal matrix arches. As the digital arteries divide at the level of the DTPA, they routinely decrease in size from approximately 0.8 mm to as small as 0.3 mm in the radiating branches.

Venous anatomy is unfortunately rather more variable (Fig. 2). At the level of the eponychium, 63% of fingers might have a vein 0.8 mm or larger, but the

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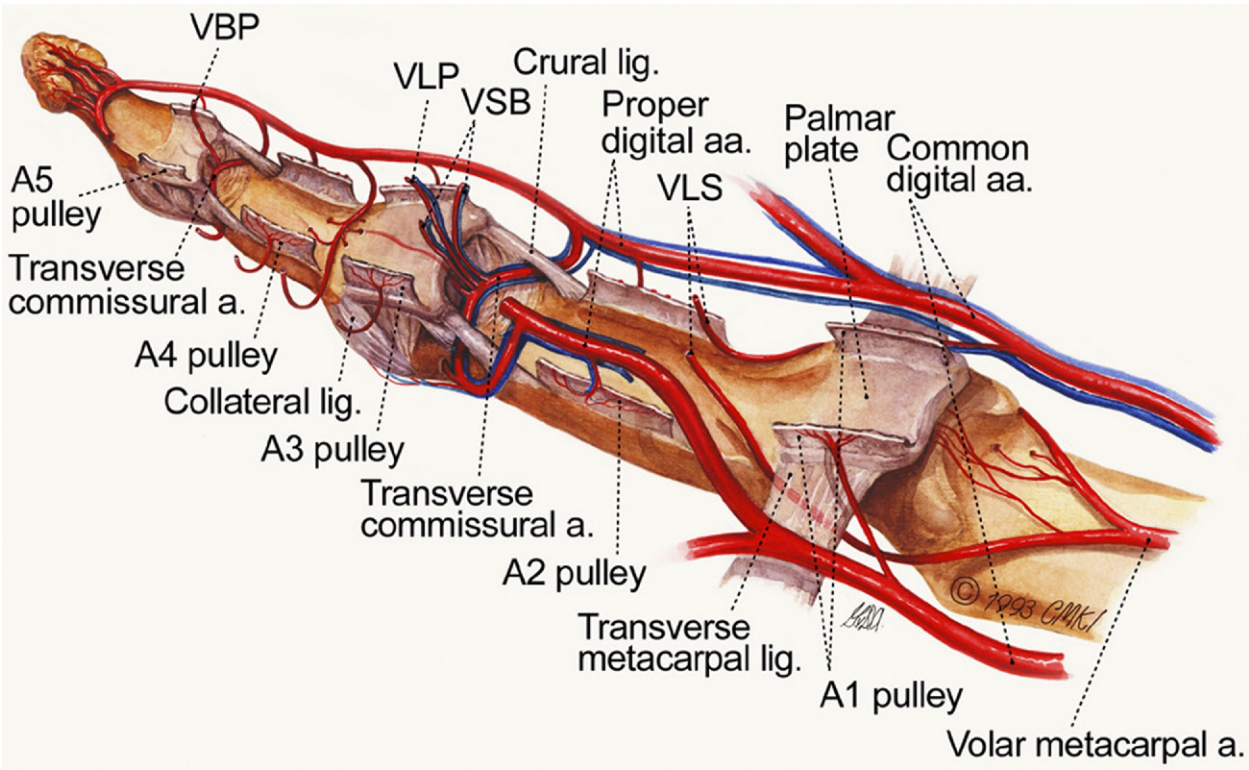

FIGURE 1: Arterial supply to the finger. Used with permission of the Christine M. Kleinert Institute.

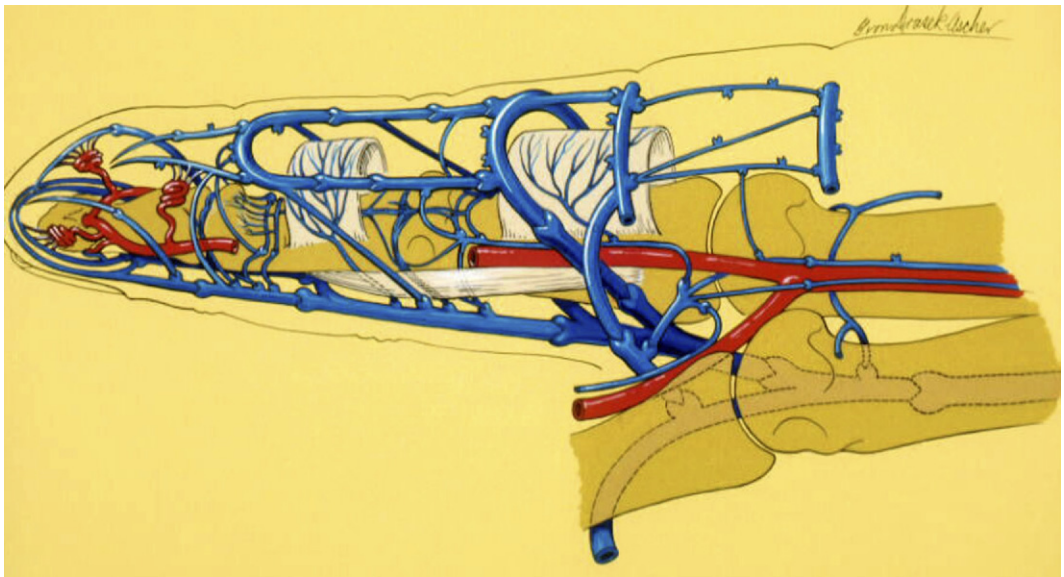

FIGURE 2: Venous drainage of the finger. Used with permission of the Christine M. Kleinert Institute.

location of these veins is unpredictable. Searching laterally for the commissural veins provides the greatest likelihood of success, at all levels of distal tip amputation, with an equal mix of vessels 0.5 mm or larger and 0.4 mm or smaller. Restoration of arterial flow can help highlight the position of suitable veins. These may be volar or dorsal.

The finger pulp has a true vascular plexus with a large network of capillaries joining the dorsal venous system, permitting rapid shunting of blood flow to control digital temperature; despite the digital blanching and hypoperfusion caused by active hyperextension of the fingers, 97% of the blood flow through the pulp persists. If the tip is not replanted after injury, loss of