TREATMENT OF TRANSFER AND REPLANTATION COMBINED WITH DORSAL INTEROSSEOUS FLAP FOR DESTRUCTIVE INJURY OF HAND WITH ROTATION, AVULSION AND AMPUTATION: A CASE REPORT

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ABSTRACT

Avulsion and amputation are common surgical traumas in clinical emergency treatment. The patient had the left hand twisted by agricultural machinery, resulting avulsion or amputation of limbs to varying degrees. The episode was urgent and the injury was greatly traumatic with hemorrhagic shock, and emergency surgical treatment was needed. The treatment methods vary. In our study, we used transfer and replantation combined with dorsal interosseous flap for destructive injury along with the postoperative functional recovery and exercise. The long-term postoperative follow-up of the functions of affected limb during daily life and work provided more confirmed evidence for the feasibility of this surgical mode in the application to the avulsion and amputation.

Keywords: Destructive injury, Ectopic replantation of residual finger, Reverse island flap of forearm dorsal interosseous artery perforator.

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Medical Records

The patient, a 42-year-old male, was admitted to the hospital with left hand twisted by agricultural machinery for 2.5h and normal vital signs. Physical examination revealed that hand skin, muscles, tendons, nerves, blood vessels and metacarpal bones were all damaged by machinery, the thumb and the middle finger disconnected completely, the second and the fourth finger phalanxes were connected to the skin, but their tendons, blood vessels and bones were damaged severely, the little finger was deleted (Fig. 1, 2).

After examining the general condition of the patient, we performed operation including thumb replantation, ectopic replantation of residual finger, the third residual finger transfer in the fifth metacarpal bone and soft tissue defect repair with reverse island flap of forearm dorsal interosseous artery.

The operation methods are as follows:

After successful general anesthesia with intubation, the patients should be supine and keep left upper limb abduction, then the routine disinfection and draping the operation area were completed. The operation was performed under the control of upper arm tourniquet¹º debridement: brushing the injured limb, cleaning the wound, removal of foreign bodies and free, devitalized tissues, wound irrigation, we performed debridement using system equipment in a certain direction, assessed and designed the operation program.
Intraoperative findings showed that 5 fingers were all disconnected by rotation, avulsion and amputation in the metacarpal level, the index, the ring and the little finger were all damaged severely, unable to replantation. The thumb at the distal MP level as well as the middle and distal phalanx of the middle finger are relatively complete, which were only connected to partial flexor and extensor tendon. The amputated fingers could try replantation although their blood flow were disappeared. Along the relatively complete skin edge incision of the thumb, the middle finger and the proximal end of the residual hand, we performed thorough debridement from outside to inside and from the far end to the proximal end. Two subcutaneous veins were found respectively in the dorsal side of the thumb and the middle finger, the bilateral nerve vascular bundles of the thumb and the middle finger were found in the palmar side. The phalanxes were shortened according to the residual finger skin and the length of neurovascular bundle. Meanwhile, the flexor and extensor tendons to be repaired were revealed. After debridement, the wound was washed again, resterilized and draped with a sterile sheet (see Figure 3).

Thumb shortening replantation, middle finger transfer and replantation in the little finger position: in order to maximize the function of replantation finger, the middle finger was transferred and replanted in the fifth metacarpal bone. The little finger was fixed in the slightly palm position using 1.0 mm Kirschner pin shaft, periosteum and extensor tendon were repaired using 5/0 absorbable suture, the flexor pollicis longus muscle tendon and the flexor profundus tendon of the middle finger were repaired with 4/0 absorbable suture by applying Kessler method. The two dorsal veins of middle finger, the two superficial veins of dorsal skin, and the two dorsal subcutaneous veins of thumb were anastomosed end to end using 11/0 nondestructive suture. The principle artery and the ulnar digital proper artery of the thumb were also anastomosed using 11/0 nondestructive suture. The proximal end of residual common palmar digital nerve of the index finger was anastomosed with the little finger radial digital artery using 9/0 absorbable suture, then the proximal end of residual thumb nerve was anastomosed with the radial digital proper nerve of the thumb. Similarly, the digital proper nerve of the middle finger was anastomosed applying the above method.

Reverse interosseous dorsal flap transposition, free skin grafting: the shape and area of the flap were designed according to the skin defect area of the back and stump of the hand. Using the connecting line of radial margin of ulnar head and external epicondyle of humerus as axis and 2.5 cm above the ulnar styloid process as key point, we cut reversely retrograde island flap of forearm dorsal interosseous artery (13.5cmX7.5cm) under the deep fascia of forearm and put it in the skin defect area of the back of the hand through the open skin tunnel. Then we stopped the bleeding using tourniquet and sutured the full-thickness skin. We also cut free skin flap on the same side of the ilioinguinal region and performed free skin grafting, including package and pressurized fixation after the skin suture. The operation was successful and the blood supply of the skin flap and replantation finger was good.
After 2 months, physical examination of the patient showed that the replantation finger opposition function made a recovery, the skin flap survived, the skin shape did not need to be repaired again (see Figure 4, 5).

Discussion

The anatomy and function of the hand are extremely complex, destructive injury can cause not only loss of the hand shape but also lack of the hand function. Because of varying degrees of damages, or even deletion of skin, muscles, tendons, nerves, vessels and bones due to destructive injury, it is very difficult to reconstruct the tissue and function of the hand. Therefore, early recovery of the hand function is very important to treat hand injury.

Reason of transfer and replantation of middle finger in the little finger position: the replantation position should be selected according to the length of the finger, after replantation finger survival, the finger should have the thumb opposition function, the digital opposition function and the pinching function. However, if the hand is damaged severely, especially missing metacarpophalangeal joint, the replantation finger will lose the finger flexion and extension function, the thumb opposition function and other fine motor skills, and can only perform some grasping gross actions.

In order to maintain the function of the replantation finger and the thumb, the span between them should be pulled as far as possible. In this case, the replantation finger can not only perform grasping action but also maintain the digital opposition function, which will improve the life quality of the patient.

Since the 2nd, the 4th and the 5th fingers were damaged seriously including the skin and soft tissue defect of the stump and the back of the hand, exposure of large area of bones and tendons, the above fingers cannot be replanted. Skin flap replantation must be performed so as to solve the skin defect problem. In order to perform the operation by one-stage operation, reverse island flap of forearm dorsal Interosseous artery should be selected firstly, which is thin, elastic, flexible, and also has the advantage of nerve sensory existing. The flap has gradually replaced the groin flap and radial forearm flap, as It is not only beautiful but also provide the main artery blood supply. The survival rate of this flap is increased and postoperative patients do not need to be repaired by second-stage operation. The skin flap replantation by one-stage operation could cover the wound as soon as possible, reduce the chance of infection, protect the replantation finger and meet the needs of independent braking and care of the replantation finger. Moreover, the patient should carry out functional exercises as soon as possible in order to promote edema regression and functional recovery.

There are different treatment methods for varying degrees of hand injuries. Since the thumb function accounts for 40-50% of all the functions of the hand, the thumb replantation should be performed for the injury that only the thumb is completely disconnected combined with degloving damage. The operation can not only maintain the beautiful appearance of the thumb but also ensure the thumb opposition function. In most cases, the debridement, tissue repair and island flap of forearm dorsal artery repair will be performed for multi-finger amputation with destructive injury, in which most soft tissues have defect and finger replantation or ectopic replantation cannot be performed. In this case, since the thumb and middle finger were the residual fingers, thumb replantation and middle finger ectopic replantation by one-stage operation could be performed, by which the survival rate of replantation was increased, the thumb opposition function and the appropriate angle of purlicue were maintained, and pinching function could also be recovered early. Therefore, in this case, the treatment methods for the destructive
injury of the hand including residual thumb replantation, reconstruction of the little finger and the island flap of forearm dorsal artery repair provide reference for the future clinical therapy.

References


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