



Microsurgical Replantation and Reconstruction

George H. Landis, MD

The ability to microsurgically reattach a body part that has been amputated represents one of the pinnacles of reconstructive surgery. Replantation of such parts offers a result that is usually superior to any other type of reconstruction. Microsurgical reconstruction significantly improves limb salvage which often provides significant advantages to limb amputation.

Today, replantation surgery is rather common, and the success rates are up to 90%. The goal of surgery is the restoration or reconstruction of a functional limb. Proper prehospital treatment of the patient and the amputated part is essential for good results.

With some exceptions, all amputated parts should be considered for replantation. All indications for replantation must take into account the status of the amputated part (sharp amputation versus crush) and the patient (healthy versus systemic illnesses.) The indications are not based solely on potential viability but are predicated on the potential for long-term function. The final decision to perform a replantation attempt is made by the microvascular surgeon.

QUESTION #1: WHICH OF THE FOLLOWING ARE LEAST SUITABLE FOR SURGICAL REPLANTATION?

- A. Thumb
- B. Multiple level amputation
- C. Multiple fingers
- D. Hand
- E. Amputations in children

Although the indications for replantation have not changed significantly over the years, experience with the techniques and results has refined these indications (Table I). The status of the amputated part (sharp amputation versus crush) and the patient's pre-injury health status must be taken into account. Replantation indications are based not solely on potential viability but on the potential for long term function. Overall, thumb replantation probably offers the best functional return. Even with poor motion and sensation, the thumb

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Trauma patients who have sustained amputation of a body part present as a challenge to all health care providers. In this edition of *North Memorial Trauma Update* we are pleased to have Dr. George H. Landis, Microvascular Reconstructive Plastic Surgeon, as our guest author. Dr. Landis will be discussing initial patient stabilization, appropriate handling of the amputated body part, microsurgical replantation and reconstruction options.

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is useful to the patient as a post for opposition. Multiple finger amputations present reconstructive difficulties that may be difficult to correct without replantation of one or all of the amputated digits (Fig. 1). Any hand amputation offers the chance of reasonable function after replantation, usually superior to available prostheses. The risk of complications goes up and the chance of functional return

Figure 1



Table I

Indications for replantation
Thumb
Multiple digits
Hand or Arm
Any part in a child
Contraindications for replantation
Severely crushed or mangled parts
Multiple-level amputations
Patients with multiple trauma or severe medical problems

When the part is partially amputated, you may apply gentle pressure if there is bleeding, but you do not want to cut off the blood flow to the partially amputated part, so pressure needs to be light—just enough to slow blood loss. Gently splint the injured area to prevent movement or further damage. Care of the amputated part is summarized in Figure 2. The goal is to keep the amputated part cool but not to cause more damage from the cold ice. In addition to rapid transport, it is important to

Table II

The appropriate history and clinical findings to be recorded in amputation injuries:
Mechanism of trauma (sharp cut, dull cut, crush, avulsion)
Time and place of amputation
Condition of the amputated part and the stump
Degree of contamination
General condition of the patient
Other injuries

effectively communicate the situation to the microsurgical center (Table II).

QUESTION #3:
In what way is limb salvage clearly superior to amputation?

- A. Functional outcomes
- B. Initial cost
- C. Lifetime cost
- D. Disability

Leg threatening injuries present patients and clinicians with a difficult decision: whether to pursue primary amputation or limb salvage? The same microsurgical techniques used in replantation are deployed in limb

salvage. While the functional outcomes, initial costs, and disability of limb amputation and salvage are similar, the lifetime health-care costs are three times higher for patients with amputations compared to those treated with reconstruction. Not only is reconstruction a reasonable

Figure 2

PROPER CARE OF THE AMPUTATED PART



Answers: 1. b, 2. b, 3. c

goal at an experienced Level-I Trauma Center, it results in lower lifetime healthcare costs.¹

The outcomes of upper limb replantation are best compared to the alternative: prosthesis. Most reattached upper limbs will function better than prostheses. In addition, the estimated cost of upper limb prostheses is \$30,000 – 60,000 in the first year and \$10,000 a year thereafter.

CONCLUSION

One of the highlights of reconstructive surgery is the ability to microsurgically reattach a body part that has been amputated. Optimal results are dependent upon the proper initial care of the part and patient as well as microsurgical expertise. In addition, limb salvage using microsurgical techniques results in substantially reduced lifetime healthcare costs. Optimal results are dependent upon the proper initial care of the part and patient as well as microsurgical expertise. In addition, limb salvage using microsurgical techniques results in substantially reduced lifetime healthcare costs.

1. Health-care costs associated with amputation or reconstruction of a limb-threatening injury. MacKenzie EJ, et al., *J Bone Joint Surg Am.* 2007 Aug; 89(8):1685-92.



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goes down with amputations above the elbow. It is generally believed that replantation should be attempted with almost any part in a child. Although there have been several reports of successful lower limb replantation, this area remains controversial. The available lower extremity prostheses make amputation less of a functional problem in the leg than in the upper extremity. Replantation and revascularization of the foot, lower leg, or both, in children may give gratifying results, however.

QUESTION #2:
Which of the following should not be done when preparing a severed body part for transportation?

- A. Gently cleanse the part
- B. Submerge the part in ice water
- C. Place the part in a sealed bag
- D. Wrap the part in saline-soaked gauze

Both the patient and the amputated part must be cared for appropriately to ensure optimal outcome. First and foremost, the patient must be medically stabilized. It is easy to overlook other serious injuries or illnesses in the setting of an amputation. The care for the part of the body includes stopping the bleeding, elevating the injured area, and wrapping or covering the injured area with a sterile

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