



Free Sensate Anteromedial Thigh Fasciocutaneous Flap for Reconstruction of Complete Circumferential Degloving Injury of the Digits: Case Report and Literature Review

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Complete circumferential degloving injury of the digits usually results in a large cutaneous defect with tendinous structure and bone and joint exposure. When revascularization is not possible, a thin and adequately sized flap is required to resurface the defect, restore finger function, and prevent amputation. In this report, we present our experience with reconstruction of the entire circumferential degloving injury of the digit using a free sensate anteromedial thigh (AMT) fasciocutaneous flap. The donor site was closed primarily and healed without complications. The postoperative course was uneventful and the patient could achieve good key pinch, grasping function, acceptable static 2-point discrimination, and adequate protective sensation. Patient satisfaction with the resurfaced digit was 9 on a 10-point visual analogic scale (VAS). This method may be a valuable alternative for reconstruction of the entire circumferential avulsion injury of the digit.

Key words: degloving injury, free anteromedial thigh flap, digit

INTRODUCTION

Complete degloving injury of the finger, which is a class III injury according to the Urbaniak classification¹, can be difficult to manage due to the lack of appropriate tissues that can be used to cover denuded tendons, pulleys, phalangeal bones, and structurally intact joint capsules. Smaller sized defects can be treated by simpler procedures, such as secondary intention healing, delayed closure, or skin grafting.^{2,3} Larger soft tissue defects are treated with a pedicle or free flap, especially when poorly vascularized structures are exposed.⁴ Due to developments in microsurgical procedures, free flaps have been introduced for large defect reconstruction of complete circumferential degloving injury of the digits. Although several methods are used to manage this type of injury to preserve function and prevent deformities⁵⁻¹⁸, none provide an ideal solution to the problem due to the unique

prehensile finger skin, which has loops and whorls on the fingerprint. However, there is no simple application of the free AMT fasciocutaneous flap that has been used in this field. The purpose of this paper is to present our experience with reconstruction of entire circumferential degloving injuries of the digit using a free sensate AMT fasciocutaneous flap.

CASE REPORTS

A 38-year-old man presented with a degloving injury of his left index finger caused by an accident with a roller machine; the finger showed complete loss of the skin envelope at the level of the proximal interphalangeal joint (Figure 1A). The degloved skin envelope could not be replanted, and the patient did not want to use the cutaneous part of the second toe fashioned as a wrap-around flap. Therefore, following debridement, an AMT flap, 11 × 7 cm in size was raised from his right thigh to cover the exposed bones and tendons of the index finger (Figure 1B, C, D).

The operative technique of the AMT flap was first outlined based on the perforator patterns described by the "ABC system".¹⁹ Briefly, a line was drawn connecting the anterior superior iliac spine and the superolateral corner of the patella, which we refer to as the AP line. A straight anterior incision was made about 2 cm medial to the AP line and subfascial dissection was performed me-

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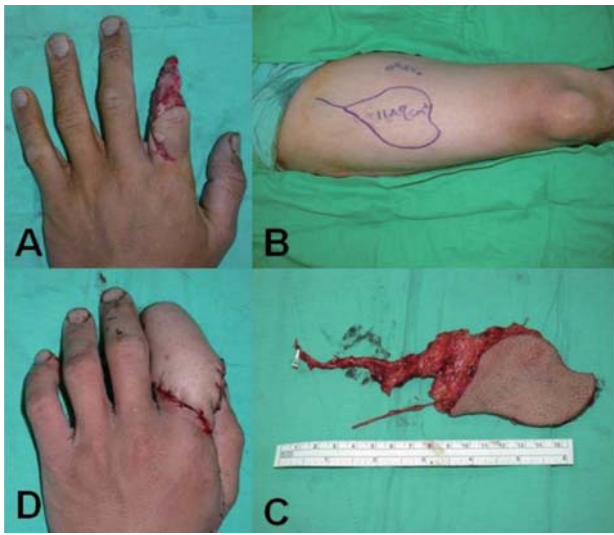


Fig. 1 Preoperative view of complete circumferential skin loss of the left index finger with intact tendon and bone (A). The anteromedial thigh flap was outlined over the medial thigh (B, C). Intraoperative view of the resurfaced index finger (D).

dially over the rectus femoris muscle and sartorius-vastus medialis muscles to explore the cutaneous perforators in the anteromedial thigh flap territory. The intermuscular space between the rectus femoris and vastus medialis/sartorius muscles can be easily entered to explore the origin of the perforators. Exploration of the anteromedial thigh perforators was straightforward, requiring minimal dissection, and took only a few minutes.

The arterial pedicle was anastomosed end-to-side to the radial artery at the anatomical snuffbox, and the venous pedicle was end-to-end anastomosed to the venae comitantes of the radial artery. The medial cutaneous femoral nerve was included in the flap and was sutured to a branch of the radial nerve. The donor site was closed primarily. The postoperative course was uneventful, and the patient was discharged on Day 10. Six months after the operation, the range of active motion of the proximal interphalangeal joint of the index finger was 0° to 70°, whereas that of the distal interphalangeal joint was 0° to 50° (Figure 2). In comparison with the normal side, the recovery of key pinch function was 96.4% and that of grasping was 93.8%. The static 2-point discrimination value was 12 mm in this patient.

DISCUSSION

In 1981, Urbaniak *et al.*¹ classified ring avulsion injuries into three categories depending on the magnitude of

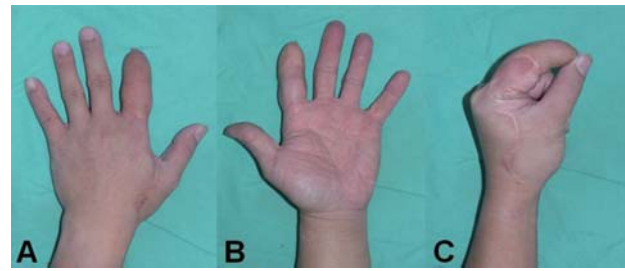


Fig. 2 At 6-month follow-up, the index finger had recovered an acceptable appearance (A, B) and range of active motion (C).

structural involvement. Although the avulsed skin should be used for wound coverage wherever possible²⁰, the tissues and vascular structures are usually so traumatized that replantation is not feasible. Class III injury, with complete loss of the skin and exposed intact functional bone and tendon, is the most difficult injury to manage because of the scarcity of muscle and skin in this region. The general consensus among hand surgeons is prompt coverage of raw areas and early motion exercise are the key factors in successfully treating avulsed fingers.

Therapeutic options include skin grafting, local flaps, and free tissue transfer. Circumferentially stripped fingers with circulatory disturbance constitute an unfavorable bed for skin grafts. In addition, skin grafting is not usually considered because of problems associated with wound contraction, non-gliding of tendons directly under skin grafts, and avascular necrosis of the distal bones. Although local flaps, such as palmar advancement flaps, homo- or hetero-digital flaps, cross finger flaps, or distally-based dorsal hand flaps offer the main advantage of “replacing like with like,” their use is limited by the size and location of the defect.²¹⁻²³

Reconstruction of digital defects can be performed using distant pedicled flaps from the groin, trunk, or contralateral arm.²⁴⁻²⁶ This method requires the hand be attached to the distant body part for at least 2 weeks, which usually causes joint stiffness after prolonged immobilization. The other disadvantage of this technique is the flaps are very thick and bulky and require multiple, staged defatting procedures. Free flaps offer flexibility in size, shape, and positioning and do not add donor site morbidity to the injured hand. Although free flaps are technically more demanding, they offer a favorable cosmetic result and are arguably superior to local options.

The flap used for reconstruction of totally degloved digits should be thin, pliable, broad enough to wrap around the degloved digits easily, and readily harvestable.

Therefore, use of free fasciocutaneous flaps is a valuable surgical option when only a thin layer of vascularized tissue, including the fascia for tendon-gliding, is required. A wraparound flap from the big toe is thought to be the optimal option for the degloved thumb and has achieved satisfactory results²⁷, but no preferred alternatives have been accepted for the reconstruction of degloved digits when microsurgical replantation of the avulsed skin is impossible.

The dorsalis pedis flap, first reported by O'Brien and Shanmugan in 1973²⁸, is broad and long enough to cover vulnerable parts easily. However, this flap causes high donor site morbidity, such as pain in the donor site when wearing open toed sandals, and yields unacceptable cosmetic results. The AMT flap, first described by Song *et al.* in 1984, is a perforator skin flap that leaves the muscle essentially intact, thereby minimizing donor site morbidity. In addition, we choose an AMT flap for the patient, rather than an ALT flap, because the AMT flap is thinner and hairless in this case.

The advantages are severalfold, including: First, in contrast to fasciocutaneous flaps from other regions, it provides a very large skin territory. Second, the flap donor site is in a concealed area, and the loss of the lateral circumflex femoral system does not harm the blood circulation of the lower limb. Third, in addition to the skin defect, damaged vessels can be reconstructed by a flow through flap design. The main disadvantage of the flap is it is technically demanding: pedicle dissection is relatively difficult due to several muscle branches.

In conclusion, the AMT flap is a flap that offers a good option for aesthetically challenging reconstructions. The free AMT fasciocutaneous flap was the first used to treat degloving injury of the finger in this paper, which is a class III injury according to the Urbaniak classification. Although some authors insist ray amputation is sometimes a better alternative, especially when the proximal interphalangeal joint is involved^{29,30}, most of the investigations contain enough evidence to support attempts to reconstruct these injuries. Our experience showed the free AMT fasciocutaneous flap can be used for resurfacing defects, restoring acceptable finger function, and preventing amputation in treating complete circumferential degloving injury of the digits.

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FINANCIAL DISCLOSURE

None of the contributing authors have any conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript.

CONFLICT OF INTEREST

None.

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