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One-stage debulking procedure after flap reconstruction for degloving injury of the hand

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KEYWORDS

Degloving injury;
One-stage debulking procedure;
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Summary *Aim:* The aim of this study is to evaluate the use of one-stage debulking procedure to separate the fingers after flap reconstruction for degloving injury of the hand.

Patients and methods: From January 2009 to June 2014, 15 patients with degloving injuries of the hand were treated at the Kaohsiung Chang Gung Memorial Hospital. Among the 15 patients, 11 sustained degloving injury of the fingers; free flap reconstruction was performed in three patients, and a pedicle flap was used in eight. Four patients sustained complete degloving injuries of the hand; reconstruction was performed with an anterolateral thigh pocketing procedure. One-stage debulking procedure was performed for debulking of the flap and interdigitation from the flap envelope.

Results: After the 12-month follow-up and rehabilitation, the fingers could move independently and perform in opposition with the thumb. Protective sensation was also regained. The patients with degloving injury of the fingers could return to daily activity and work after 1-year follow-up, while those with complete degloving injury of the hand could return to daily activities and work after 18-month follow-up.

Conclusion: The use of ALT pocketing procedure is simple for salvage of complete degloving injury of the hand. One-stage debulking procedure provides thin and durable skin coverage for hand after reconstruction. The fingers can also be separated from the envelope of a bulky flap for independent movement to fulfill functional and aesthetic requirements.

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Introduction

Degloving injury of the hand remains one of the most difficult reconstructive problems for the plastic surgeon. Although microsurgical revascularization can be attempted during the primary surgery,^{1–9} the vessels are often severely damaged due to crush injury. Salvage procedures such as reconstruction with free flap or groin flap with or without abdominal flap^{10–15} result in unsatisfactory functional and aesthetic outcomes mostly due to bulky appearance and inability to separate the digits from the flap envelope.

Based on our experience with the one-stage debulking procedure for bulky flaps of extremities,^{16,17} the technique was applied for degloving injury of the hand after flap reconstruction for thinning and separation of fingers from the flap.

Patients and methods

From January 2009 to June 2014, 15 patients with degloving injuries of the hand were treated at the Kaohsiung Chang Gung Memorial Hospital. Among the 15 patients, 12 were men and three were women. The average age was 35.5 years. Eleven patients sustained degloving injury of the fingers including three patients with single digit, two with double digits, two with three digits, three with four digits, and one with five digits. The skin was avulsed from the metacarpophalangeal joint or proximal phalanx to the fingertip. Four patients sustained complete degloving injury of the hand. The skin was avulsed from the wrist to the fingertips. The avulsed skin was examined under a microscope to check the vessels. Microsurgical revascularization was impossible due to severe crush injury of the avulsed skin.

The salvage procedure began with thorough debridement of the wound, amputation of necrotic distal phalanges, and fixation of the remaining phalanges with Kirschner wires in the extension and abduction position. One-digit to four-digit degloving injuries were reconstructed with a free flap for three patients and a groin flap for seven. In the patient with five-digit degloving injury, reconstruction was performed with a groin flap for the thumb and a pedicled anterolateral thigh flap for the second to fifth fingers, respectively. Division of the flap was done 2 weeks after reconstruction.

The four complete degloving injuries of hands were reconstructed with an anterolateral thigh pocketing procedure. The pocket was created above the deep fascial layer of the ipsilateral thigh with a major pocket for the hand and four or five extended smaller pockets for fingers. The average pocketing period was 25 days. After division of the flap from the donor site, the overlying skin of the ALT flap remained on the dorsum of the hand and fingers and the fascial layer of the ALT flap remained on the palmar side of the hand and fingers. A split-thickness skin graft was used for the donor site. A further full-thickness skin graft (FTSG) was used for the palmar skin defect after wound care.

After the wound healed, debulking of the bulky flap and interdigitation of the fingers from the flap envelope were

performed using one-stage debulking procedure. The full-thickness skin of the flap on the dorsal side was removed first, and then all the fatty tissue was excised. Separation of the fingers was performed, and the Kirschner wires were removed. The full-thickness skin was regrafted on the dorsal skin defect after hemostasis and compressed with tie-over dressing that was kept for 7 days. An additional one to two procedures for release of scar contracture combined with FTSG were performed for the patients of Group 2, but no further debulking procedure was needed.

Results

The patient data and results are summarized in [Table 1](#). The average time of follow-up was 18.6 ± 8.2 ($n = 15$) months. All the patients showed comprehensive recovery in hand function except one (Case 14) whose left hand was severely crushed with thenar muscle necrosis and who was lost to follow-up after wound healing. The fingers could move independently and perform in opposition with the thumb. The hand and fingers gained protective sensation with an average 12.3 mm of two-point discrimination (2-PD) after 1-year follow-up. The 11 patients with degloving injury of the fingers could use the injured hand for daily activity and return to work after a 1-year follow-up. The three patients with complete degloving injury of the hand could use the injured hand for daily activity and return to work after an 18-month follow-up.

Case report

Case 9: A 23-year-old male patient sustained degloving injury of the left hand by machine. Avulsion of the skin from the mid-palm on the palmar side and wrist on the dorsal side to the second to fifth fingertips was noted ([Figure 1A](#)). Microsurgical revascularization of avulsed skin was found to be impossible. Debridement was performed, thus achieving hemostasis. The distal phalanges of the second to fifth fingers were amputated. The remaining phalanges were fixed with 0.035-in. Kirschner wires. The avulsed skin was used as salvaged FTSG for the dorsal skin defect and fixed with tie-over dressing ([Figure 1B](#)).

The fingers were reconstructed with a groin flap immediately ([Figure 1C](#)). Division of the left hand from the groin flap was performed 2 weeks later ([Figure 1D](#)). Debulking of the bulky flap and separation of left second to fifth fingers were performed using one-stage debulking procedure 3 months later. The Kirschner wires were removed. Early rehabilitation was performed as soon as the grafted skin healed well. The salvaged finger could move independently and reach protective sensation with 12 mm of static 2-PD after 1-year follow-up. The range of motion of the second to fifth metacarpophalangeal joints reached 60° ([Figure 1E](#) and [F](#)). The patient could return to daily activity and work after 1-year follow-up.

Case 13: A 34-year-old male patient sustained complete degloving injury of the left hand, caused by machinery. Avulsion of the entire skin envelope from the wrist to fingertips was noted ([Figure 2A](#)). The distal phalanges of the thumb and the second to fifth fingers were found severely

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