A Thin Anterolateral Thigh Free Flap for Severe Hand Burn Deformity

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Background: Hand is one of the most commonly involved areas in burn injury, resulting in contracture.[1] Reconstruction of severe postburn hand deformity is very challenging. Because there is no adjacent skin laxity to allow for local flaps in the burned hand, distant or free flaps should be considered.[2] Application of the thin anterolateral thigh flap in hand reconstruction has become one of the most preferred options for resurfacing of soft-tissue defects after contracture release.[3] Other than closing the defect after contracture release, restoration of hand function is also essential.
Patient and Methods: In 2010, a man, 37 years old presented with severe contracture on the right hand due to an explosive flame burn 1,5 years ago. On the right hand, there was hyperextension at the metacarpophalangeal (MCP) joint with flexion on the wrist and thumb abduction with hyperextension at the interphalangeal joint. Our goal is to reconstruct this severe hand burn deformity using thin ALT free flap with flap thickness 4 mm to achieved good hand contour.
Results: The thin ALT free flap was vital, and 1-year follow-up gives good hand contours. Patient under rehabilitation therapy from 2 weeks postoperative to attain good functional hand.
Summary: A thin anterolateral thigh free flap gives good alternative for resurfacing defect in reconstruction of burn hand than other fasciocutaneous flaps. The advantage are it provides the same color and texture, thin and pliable flap to form good hand contour.[8]
Keywords: *burn hand, thin alt free flap*

Latar belakang: Manajemen luka yang tidak tepat pada pasien luka bakar akan memperberat morbiditas pasien. Tangan merupakan salah satu area yang sering terkena cedera luka bakar dan dapat mengalami kontraktur dikemudian hari. Rekonstruksi pasien dengan luka bakar tangan, merupakan suatu tantangan bagi ahli bedah plastik. Selain bisa menutup defek pasca release kontraktur, kembalinya fungsi tangan penting diperhatikan.
Pasien dan Metode: Tahun 2010 dilaporkan laki-laki 37 tahun dengan kontraktur difus pada tangan kanan karena luka bakar 1,5 tahun yang lalu. Deformitas pada tangan kanan berupa fleksi 90 derajat pada wrist joint, hiperekstensi pada MCP joint dan abduksi pada ibu jari serta hiperekstensi pada interphalangeal joint. Tujuan kami melakukan rekonstruksi pada deformitas tangan akibat luka bakar menggunakan ALT free flap yang tipis dengan ketebalan flap 4 mm untuk mendapatkan kontur tangan yang baik.
Hasil: ALT free flap yang tipis ini hasilnya vital, dan dalam 1 tahun follow-up memberikan kontur tangan yang bagus. Sejak 2 minggu pasca operasi, pasien sudah dilatih oleh fisioterapis untuk mencapai fungsi tangan yang baik.
Ringkasan: Pada pasien ini, penutupan defek pasca release kontraktur tangan akibat luka bakar, thin anterolateral thigh free flap memberikan pilihan yang baik dibandingkan flap fasiocutan lainnya. Keuntungan dari alt free flap yang tipis dapat memberikan jaringan dengan warna dan tekstur yang sama, sehingga dapat membentuk kontur tangan yang baik.

Inappropriate burn wound management, could increase morbidity in burn patients . The occurrence of contracture is a frequent sequelae of third-degree or fourth-degree burn wounds at the joint.[1] However hand reports for only 2,5- 3% of TBSA, and its one of the most commonly included areas in thermal injury and up to 80% of treated burn injuries.[2,3] The hand is most threatened to burn injury because it is the body part closest to the damaging agent and may be used by patients to defend their own self.[4] Several hand burns occur at the

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workplace, for instance flame burns or electrical burns. The final consequence is dependent on the initial severity of the injury, including surface area involved and depth of burn injury. 3 Reconstruction of severe postburn hand deformity is very challenging for plastic surgeon. Because there is no adjacent skin laxity to allow local flaps in the burned hand, distant or free flaps could be alternative modality.[5] Perforator flaps have been introduced for reconstruction and resurfacing; in particular free anterolateral thigh (ALT) to be one of choice in the resurfacing of defect after release contractures. It was first reported for post-burn reconstruction by Song et al, 1984 as a septocutaneous perforator-based flap, has obtained great popularity, especially in China, Japan, and Taiwan and developed for clinical applications by Koshima et al.[6,7,8] The indications for free flap transfer is complex soft tissue defects with exposed tendons, joints, and bones, whereas base of the defect inappropriate for split or full thickness skin grafting.[6] One of advantages of this flap is it has moderate thickness and can be thinned, be converted into pliable flap.

In this study, we reported one case of severe hand burn deformity that reconstruct and resurface the defect after contracture release with thin anterolateral thigh free flap.

PATIENT AND METHODS

In 2010 reported 37 years old man with severe contracture on the right hand. The wrist joint was flexed by about 90 degrees, the metacarpophalangeal joint was hyperextended by about 45 degrees and thumb was abducted with interphalangeal joint was hyperextended (Figure 1) due to an explosive flame burn 1,5 years ago. We performed contracture released and resurface the defect with thin anterolateral thigh free flap.

Surgical Procedure

One surgical team did contracture release on the right hand and prepared the recipient vessel, tourniquet was applied during this procedure, while another team harvested the flap. Size of defect at the wrist joint was 12x10 cm, with base was tendon and vessel. It

Figure 1. Preoperative view of the patient, volar view (*upper*), radial view (*lower*)

was covered with thin anterolateral thigh (ALT) free flap, harvesting ALT with size 17x10 cm. Flap elevation start at its medial edge where skin and deep fascia were incised. This flap based on perforator of descending branch lateral circumflex femoral artery. Prior to surgery, the location of the perforators are detected with a Doppler probe. The length of perforator was 7 cm and two venous commitantes, each 7 cm in length. The recipient vessel was radial artery and distal and proximal cephalic vein. Ischemic time was 2 hours. Arterial anastomoses was end-to-side and vein anastomoses was end to end. We performed thinning of the ALT free flap before we divided the pedicle by removing deep fat tissue over the entire flap, maintaining superficial fat in all parts except for 2 to 3 cm around main perforator flap. The thickness of the flap is approximately 4 to 5 mm after thinning, therefore could be achieved good contour hand with the same color and texture. Whereas defect in the MCP joint was covered with full thickness skin graft, harvesting from the right inguinal. Applied K-wire for 2 weeks for graft fixation. The donor site was closed with split thickness skin graft (Figure 2).

Figure 2. Defect after contracture released, showing exposed tendons vessel (*upper*), anastomoses donor recipient vessel and insetting of ALT free flap (*center and lower*)

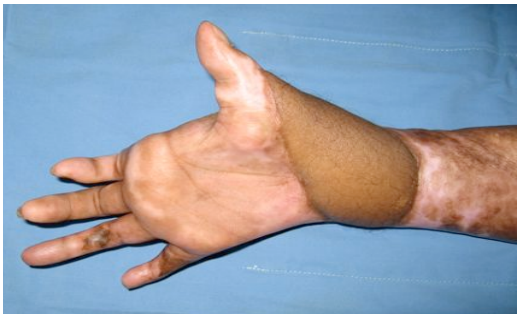

Figure 3. At 1-year follow-up

RESULTS

This thin ALT free flap was vital, and 1 year follow up gives good contoured hand. Patient under rehabilitation therapy since 2 weeks postoperative to attain good functional hand.

DISCUSSION

Severe postburn hand deformities is classified into three major patterns. The first is hyperextension deformity of the metacarpophalangeal joint associated with wrist flexion and proximal interphalangeal joint contractures. The second is a thumb adduction contracture with hyperextension deformity of the interphalangeal joint of the thumb, with flexion contracture of the metacarpophalangeal joint. The third is a flexion contracture of finger into the palm.[5]

For reconstruction of the hand, the ideal flap should have the following features: "Replace Like Tissue with Like Tissue", has large skin territory, moderate thickness but reliability for defatting procedures, and versatility, thus pliable flap to form good contours hand, be an aesthetic zone and provide smooth gliding surfaces, minimal donor site morbidity and can be easily hidden, and sizable pedicle for microsurgical anastomosis, and no required major artery or muscle sacrifice.[5,6,8,9]

ALT flap, especially after thinning procedures,has all of these features and represents a good alternative for defect resurfacing in hand reconstruction rather than other fasciocutaneous flap.

Flap thinning technique has been reported by Kimura and Satoh (1996) and Koshima et al (1993) to avoid bulky anterolateral thigh flaps. Thinning may be performed to about 3–4 mm thickness almost consistently except in the area of the vascular pedicle, but the small veins just beneath the dermis should be preserved.[6] Otherwise flap necrosis can occur if excessive thinning was done and this condition should be avoided by leaving the fat tissue around the main perforator to ensure good vascularization.[8]

SUMMARY

In resurfacing defect for reconstruction of burn hand, a thin anterolateral thigh free flap represents a good alternative rather than other fasciocutaneous flaps. The advantage of the thin alt free flap can provide the same color and texture, thin and pliable flap to form good contours hand, minimal donor site morbidity

and give rehabilitation therapy earlier than the other alternative choice to promote functional result. Skin grafts can be an alternative choice, but required appropriate postoperative immobilization, and use of splinting for some time to prevent recontracture.

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