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Consecutive flap transfer for repairing massive soft tissue defects in the opisthenar with improved donor site closure

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【**Abstract**】**Objective:** To explore a surgical model of utilizing consecutive free scapular flap and adjacent pedicled flap transfer for repairing massive soft tissue defects on the dorsum of the hand while minimizing the donor site morbidity.

Methods: Six patients with massive soft tissue injuries on the opisthenar and forearm were treated with free scapular flaps. Afterwards, a pedicled flap adjacent to the donor site was transferred to cover the donor site defect by direct closure.

Results: All six free scapular flaps survived without signs of infection. Three adjacent pedicled flaps presented minor signs of insufficient blood flow on the distal apex, which resolved after six weeks with only conservative therapy. All the incisions healed without other complications. At six-month follow-up, the patients regained full shoulder function.

Conclusion: With the assistance of an adjacent pedicled flap, the scapular flap is a highly applicable approach in repairing massive soft tissue defects in the opisthenar. It can achieve positive outcomes in both reconstructive and aesthetic aspects.

Key words: ***Soft tissue defect; Free scapular flap; Perforator flap***

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Trauma-related massive soft tissue defects of the forearm and hand present a big challenge for surgeons.[1] The flap coverage contributes actively to the vascularity of the hand and may assist the revascularization of the structures.[2] However, when it comes to treating massive soft tissue defects, there are limited options that could yield sufficient area: thoracodorsal flap, anterolateral thigh (ALT) flap, scapular and parascapular flap, etc. Since Gilbert et al[3] successfully deployed a free scapular flap in 1982, this type of flap has become one of the classic "workhorse" flaps, with multiple merits including inconspicuous location, consistent anatomy of the pedicle, being easy to design and incorporate, and more importantly, having a reliable blood supply.[4]

Nonetheless, how to close the donor site with minimal morbidity remains a concern. Conventional measures like skin grafting has many disadvantages including pigmentation, early and late phase contracture, depressed outlook, potential functional limitations, and so on. Besides those, tissue expansion requires careful planning and a long time, which therefore makes it not practical in the cases of emergency wound repair.

Wei et al[5] recently reported that any perforator flap with a vessel that has Doppler signals can be reliably harvested and utilized. In addition, adequate pedicle length can be achieved by retrograde dissection. Following this principle, some researchers proposed a series of "buddy flaps" that aim to assist the primary donor site closure.[6,7]

The purpose of this study is to investigate a modality of repairing the massive soft tissue defect

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in the opisthenar and forearm by using a large free scapular flap transfer, followed by adjacent axial flap for the donor site closure, so as to achieve safe and aesthetically acceptable defect coverage with minimal invasion.

METHODS

This study was conducted from October 2009 to January 2013 at the Trauma Center of Beijing Jishuitan Hospital. Six patients (four males and two females with the mean age of 30.2 years, range 22 to 37 years) who admitted to the emergency room for trauma-related extensive soft tissue injuries combined with extensor tendon defect of the opisthenar and forearm were included.

Defect coverage

All the patients first received thorough debridement and then were equipped with vacuum-assisted suction drainage (VSD) system for five days along with systemic prophylactic antibiotic regimen. Before the second surgery, the skin surface projection of the circumflex scapular artery was identified with the aid of Doppler sonography, and the flap was designed accordingly. The patient was laid in lateral decubitus position. The VSD system was first removed, followed by another thorough debridement and cleaning of the wound. Treatment of the comorbidities including tendon repair and phalangeal fracture reduction were performed at the same time.

Thereafter, the scapular flap was dissected and elevated from medial to lateral, and then to the area where triangular space was located. The pedicle was dissected proximally in the triangular space up to the bifurcation of the subscapular artery and subsequently ligated. The flap was placed on the opisthenar defect. The circumflex scapular artery was anastomosed end-to-end to the radial artery, and one concomitant vein was connected to the cephalic vein. After good perfusion of the flap was observed following the anastomosis, closure of the donor site was performed.

Donor site closure with adjacent pedicled flap

Perforators of the thoracodorsal or intercostal artery below the scapular flap were also identified by the Doppler sonography and then a pedicled flap was designed to incorporate one of the positioned perforators. The perforator flap below the scapular flap was incised and raised superficially to the latissimus dorsi muscle. Branches of the thoracodorsal or intercostal artery were carefully identified and labeled as pedicle. Other perforating vessels were either ligated or cauterized. A thin latissimus dorsi muscle containing the perforator vessels was dissected and freed, so as to protect the vessels. Then retrograde dissection of this muscle-vessel strip was carried on until the whole flap could be easily harvested and transferred to the scapular site. The flap was rotated clockwise, adjusted and sutured on the defect margins of the first donor site. There was no excessive tension upon the incision and the secondary donor site was directly closed (Figure 1).

Patients were cared for by experienced staff for the first 48 hours. The flap color, capillary refill, and turgor were closely monitored. Meanwhile, antibiotics, Dextran 40 and analgesic were administered. The postoperative care was uneventful.

RESULTS

Applications of VSD

No patients complained of any discomfort caused by the device. At the time of device removal, all the wounds were clean with minimal secretions, and granulations started to grow.

Combined free flap and adjacent perforator flap

The size of the free scapular flaps varied from 10.5 cm×18 cm to 15 cm×24 cm. The details are summarized in Table 1. There were no cases of flap loss. One patient had an arterial emergency three hours after surgery. As a result, re-exploration was performed immediately, which removed a thrombus at the vessel joint, and the anastomosis was redone. No further complications were noticed afterwards.

As for the adjacent island flaps, three patients presented with the signs of insufficient blood flow on the distal apex of the flap, like delayed capillary refill, blisters. One of the patients developed subcutaneous liquefaction in a small area (approximately 2 cm^2 in