CASE REPORT

POSTERIOR INTEROSSEOUS FOREARM FLAP IN RECONSTRUCTION OF FIRST WEB SPACE

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SUMMARY. Use of a fascial flap is often required for reconstruction of a skin defect on the dorsum of the hand. For this purpose, a distally based dorsal forearm fasciosubcutaneous flap based on the perforators of the posterior interosseous artery was developed. The distally based dorsal forearm fasciosubcutaneous flap and especially the posterior interosseous artery flap are a convenient and reliable alternative for reconstructing skin defects of the hand after the release of post-burn adduction contracture of web space I involving vital structure exposure. Although the posterior interosseous artery flap is suitable for covering dorsal skin defects of the hand and avoids interference with the forearm’s two main arteries, the dissection of the vascular pedicle is frequently quite complex and tedious.

Introduction

Post-burn adduction contracture of the thumb predominantly affects the movements at the trapeziometacarpal joint, rendering the thumb ineffective in opposition and in this manner destroying the essential element of snatch and touch.

Adequate release of the contracted first web space followed by a local skin flap cover and dynamic abduction splintage for the subsequent two weeks can give excellent results. Documenting the first web angle at every follow-up can detect early recurrences, and dynamic splintage can be reinstituted to revert it back to normal dimensions. Secondary surgery in the form of flexor pollicis longus tendon lengthening or opponensplasty helps to prevent recurrence of the contracture.

Anatomy of the posterior interosseous forearm artery flap

The forearm fasciosubcutaneous tissue consists of two layers, the subcutaneous tissue and the fascia, enveloped between the dermis and the muscle bellies. The perforating vessels of the posterior interosseous artery penetrate the fascia to run longitudinally with numerous transverse anastomoses in the subcutaneous tissue. The fascia is the deep layer of dense connective tissue that not only envelops the muscle bellies but also thickens to form a septum between them. The distally based dorsal forearm fasciosubcutaneous flap is based on the distal perforators of the posterior interosseous artery and its branches as a perforator-based flap and is supported by anastomotic branches located around the wrist joint. The size of these flaps ranges from 10 to 14 cm in length and from 5 to 7 cm in width.

The flap is pedicled on the distal fascia and the subcutaneous tissue and the fasciosubcutaneous vascular network. Venous drainage is from both the superficial and the deep systems, as there are multiple anastomoses between these venous channels.

Our case

A 22-yr-old male with a deep electrical burn in the right hand. We observed a severe adduction contracture of web space I, as well as severe contractures in the other fingers. We also diagnosed very poor motor and sensitive functioning of the hand due to damage to the median nerve and forearm flexion tendons (Fig. 1).

Fig. 1 - Proposed flap design and incision marks for extensor indicis proprius transfer.
Operative technique

After careful release of the adductive contracture of web space I, the elbow was positioned in full pronation and 90° flexion. The distally based dorsal forearm fascio-subcutaneous flap was pinched as a rectangle along an axis extending from the lateral epicondyle of the humerus to the distal radioulnar joint, which represents the course of the posterior interosseous artery in the dorsal forearm. The operative procedure was performed under a pneumatic tourniquet without exsanguinating the limb, for better identification of the cutaneous vessels.

The secondary helping procedure of opponensplasty was performed first. The tendon of the extensor indicis proprius muscle was passed subcutaneously across the palm and attached by the method of Riordan to the thumb. The radial nerve innervation to the thumb was protected during the attachment. In this way the thumb assumed an excellent position with good abduction and pronation. Such a flap can be designed to be as large as the complete width of the dorsal forearm. It is prudent to avoid the radial border of the forearm whenever possible in order to minimize injury to the radial cutaneous nerve branches.

The skin was incised in curvilinear or zigzag fashion along the central axis of the proposed flap. The skin flaps were carefully elevated to leave some subcutaneous tissue on the underlying fascia investing the musculotendinous layer of the forearm. The fascia was then exposed and sharply incised along the flap outline on the dorsal forearm skin. After a considerable septocutaneous perforator of the posterior interosseous artery had been identified and preserved at the proximal level of the distal radioulnar joint, the dissection was carried out in the plane above the deep fascia from the proximal to the distal side. The pedicle was about 6-8 cm long (Fig. 2).

After release of the tourniquet, excellent blood flow to the fasciosubcutaneous flap was observed. The flap was turned over distally 180° to cover the defect. A suction drain was placed under the flap, and the donor area was closed using a split-thickness skin graft (Figs. 3, 4).

The hand was elevated to minimize post-operative venous congestion, but anticoagulants were not used. The hand was immobilized with a short arm splint for two weeks to ensure graft success, after which time both passive and active mobilization was carefully begun.

Discussion

Soft-tissue reconstruction of the hand remains a challenge for plastic and reconstructive surgeons. Dorsal skin defects of the hands created after the release of post-burn contractures can be covered by fascial pedicled flaps, distant flaps, or free flaps, depending on the patient’s general condition and the conditions of the local wound and donor site.

Free flaps offer flexibility in size, shape, and positioning and do not add donor-site morbidity to the injured hand. Free flap coverage is a time-consuming procedure that requires a more difficult technique and complicated post-operative care. Distant flaps provide enough tissue for reconstruction but require multiple-stage operations involving prolonged immobilization.

Although fascial pedicled flaps have to be widely based and are usually limited in size and mobility by the size and location of the defect, they offer relatively simple and safe wound coverage, spare the distant donor site for further reconstruction, and do not interfere with the patient’s activities and physical therapy.

Conclusions

The posterior interosseous forearm artery flap is a convenient and reliable alternative for reconstructing the first web space after the release of post-burn adduction contracture, involving exposure of vital structures. It obviates the need for more complicated and time-consuming procedures. A secondary procedure, such as opponensplasty, helps to prevent recurrence of the contracture. Early use of this flap allows preservation of vital structures, decreases morbidity, and allows for early rehabilitation.

BIBLIOGRAPHY


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