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ORIGINAL ARTICLE

Level of difficulty: Expert

Posterior interosseous reverse flap

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Abstract: Losses of skin substance of the dorsal face of the hand occasionally justify resorting to cover flaps when the noble elements (bones, tendons) are whether damaged or exposed. Few flaps allow filling in these losses of substance. Among those, which do, posterior interosseous reverse flap is indicated in some cases. We will present the technique and the main indications for the posterior interosseous flap. It is an island flap receiving reverse-flow vascularisation by the posterior interosseous artery. This flap is harvested from the second proximal quarter of a line extending from the lateral epicondyle of humerus to the ulnar head. The antebrachial fascia is incised longitudinally on the ulnar extensor of wrist and *digiti minimi*. The cutaneous flap is raised from radial to ulnar while sectioning the different intermuscular septa. Only the septum dividing the *digiti minimi* and ulnar extensor of wrist is preserved because it contains the pedicle. Once the main pedicle is identified, the skin paddle can be raised from proximal to distal. Then the septum holding the pedicle is detached from the ulna through to the distal radio-ulnar articulation, level with the bone surface. This flap is appropriate for losses of skin substance of the dorsal face of the hand extending to the first phalanxes and the first commissure. It can also be used to cover the anterior face of the wrist and is perfectly suited for retraction of the first commissure. Contrarily to the Chinese and ulnar flaps, it does not cause any damage to any significant arterial axis. Its main drawback is the scar on the donor site, which is often unsightly, while in the child; direct closure is possible in most cases.

Keywords: Posterior interosseous flap – First commissure – Dorsal face – Hand

Introduction

Losses of hand skin substance of the dorsal and ulnar face of the hand often justify creating a cover flaps because the tendons are generally exposed or damaged

Fig. 1. Fifth ray amputation following ballistic injury with loss of skin substance requiring a cover flap. The posterior interosseous flap is in this case a choice flap

(Fig. 1). Several flaps have been described in order to allow an appropriate reconstruction. Among these, the posterior interosseous flap is a favoured option [1-3]. It is a pedicled island flap, which receives reverse-flow vascularisation *via* the posterior interosseous artery.

Technique and clinical outcomes

The patient is positioned in dorsal decubitus, the upper limb is placed on an arm table, with forearm in pronation. A pneumatic tourniquet is applied to the root of the limb in order to make the dissection easier. We will describe the technique of the posterior interosseous reverse flap.

A line is drawn from the ulnar styloid to the lateral epicondyle. This line is then divided in four sections. The junction of the proximal third and the distal third corresponds to the area where the cutaneous branches of the posterior interosseous artery emerge (Fig. 2). The

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Fig. 2. Skin landmarks of the posterior interosseous flap

Fig. 3. Harvest of the skin paddle

cutaneous flap including this area is thus located on the two central quarters. The size of the skin paddle corresponds to the measured loss of substance.

The skin is incised through to the antebrachial fascia. The incision should start at the distal part at the level of the distal radio-ulnar articulation, allowing verifying the presence of the anastomosis between the anterior and posterior interosseous artery. This anastomosis is almost always present and allows the vascularisation of the flap. If it is not found due to anatomical or traumatic causes, the indication of the posterior interosseous flap should be discussed [4]. On the straight portion of the incision, the fascia is incised on the tendons of the extensors *carpi ulnaris* (ECU) and *digiti minimi* (EDM) (Fig. 3). A fascia strip containing the septum is then isolated through to the skin paddle. At the level of the skin paddle, the fascia is incised and the skin is fixed together with this one *via* sutures in order to prevent a fascial slippage.

In the next stage, the skin paddle dissection is extended to the radial side. The fascia is gradually lifted from the *extensor carpi radialis brevis* (ECRB) and *digitorum communis* (EDC) muscles. Several septa have to be sectioned (between the ECRB and EDC and between the EDC and EDM) but one has to make sure not to incise the septum between the EDM and the ECU. A good vision of the septum can be achieved by carefully lifting

Fig. 4. Flap rotation arch allowing covering easily the substance loss

Fig. 5. Final appearance of the coverage of the loss of skin substance

the EDM, so that in most cases a large cutaneous branch of the posterior interosseous artery is clearly seen. A single branch is sufficient to vascularise the cutaneous flap. Once this branch is identified, the posterior interosseous artery can be tied off at its proximal part.

A very proximal branch and thus a deep placement of the ligature hindering the dissection may be present. In this case, the release of the posterior interosseous nerve of the artery is required. Moreover, the release of the EDC arch allows achieving a good vision of the point where the artery emerges.

Once the posterior interosseous artery is tied off and the posterior interosseous nerve is isolated, sectioning the septum could raise the skin paddle, level with the ulna (Fig. 4). Some transversal vascular anastomoses destined to EDM and ECU muscles should be tied off in order to ensure a complete release of the pedicle. To increase the pedicle length, it is possible to make a ligature of the perforating rami fixing together the posterior and anterior interosseous artery.

Fig. 6. Skin grafting can be performed during the same surgical time

Fig. 7. Result after healing of the recipient site

The pedicle should not be placed subcutaneously to cover the loss of substance because it is a reverse-flow flap sometimes presenting with venous insufficiency (Fig. 5). Finally, in most cases, the donor site is grafted immediately (Fig. 6).

Discussion and conclusion

The main indication for this flap is the loss of skin substance of the dorsal hand face exposing the extensor tendons. It can extend to the dorsal face of the first phalanxes and the first commissure. It can prove very useful in the secondary cutaneous retractions as the after-effects of burns. It does not destroy any arterial axis, whether radial or ulnar contrarily to Chinese and ulnar flaps. This flap is harvested on the homolateral limb avoiding further weaning and the immobilisation imposed by an inguinal flap. Besides, the thickness of the subcutaneous tissue is perfectly appropriate to that of the hand. The cosmetic result at the level of the recipient site is very often satisfactory (Fig. 7).

This flap can be used in the child since the major arteries are not destroyed. Moreover, owing to fairly good cutaneous elasticity, the donor site can be closed straight away [1,5]. The main contraindication is represented by the injuries extending over the distal radio-ulnar region. Actually, the final anastomosis between the anterior and posterior interosseous artery is then disrupted, flap survival is therefore compromised due to the absence of reverse-flow vascularisation.

It is thus a crucial flap for the coverage of some losses of skin substance, the knowledge of which is indispensable to all specialised hand surgeons.

References

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