

Dorsal metacarpal artery perforator flap. A case report

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Background

Complex wounds in the hand and fingers are a significant concern in reconstructive surgery for this anatomical area. Local flaps for coverage prove to be a reliable option. The purpose of this case report is to share our experience with the successful use of a dorsal metacarpal artery perforator flap and a full-thickness skin graft in treating an extensive traumatic burn chronic wound on the third finger of the left hand. The report includes a brief literature review of the anatomical features and design of this flap. The dorsal metacarpal artery perforator flap emerges as a safe and effective choice for local hand coverage.

Keywords: DMCAP flap, Hand flaps.

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Case Report

Plastic Surgery



Treating soft-tissue defects can be challenging, especially in specific areas lacking considerable nearby tissue for simple closure, such as fingers. Flaps offer an option for wounds where conventional means may not be suitable, particularly when dealing with considerable size and requiring a one-stage procedure for earlier finger mobilization. In such cases, a dorsal metacarpal artery perforator flap serves as a flexible solution for resurfacing soft-tissue defects in fingers. It consists of a vascular island flap raised on the dorsum of the hand for coverage. Some notable features of this flap include its versatility, minimal donor-site morbidity, ease of raising, and effective coverage for the proximal half of the middle phalanx. The anatomical base of this flap is the distal cutaneous perforator of the dorsal metacarpal artery, emerging at the level of the metacarpal neck in the second to fourth intermetacarpal spaces. Other reported flaps from this donor area, such as the reverse dorsal metacarpal artery flap and the extended reverse dorsal metacarpal flap, depend on the nourishment from the dorsopalmar anastomosis with the palmar arterial system.

Case report

A 33-year-old man sustained a crush and electrical burn injury on the dorsum of his left third finger. He presented with an exposed interphalangeal joint capsule injury, with extensor tendons denuded of paratenon treated with arthrodesis using Kirschner needles. This resulted in a partial circumferential

chronic defect measuring approximately 1.18 x 1.96 inches over the dorsum and lateral area of the left ring finger, extending from the proximal interphalangeal joint to the distal interphalangeal joint.

The flap was designed as a curved ellipse skin island on the dorsal metacarpal artery perforator near the defect. The selected perforator was marked at the level of the metacarpal neck in the intermetacarpal space, representing the pivot point of the flap. The limits of our flap were the distal edge of the extensor retinaculum, the metacarpophalangeal joint, and the external borders of the adjoining metacarpals.

A cutaneous dermal adipose bridge segment flap was chosen due to the dorsal disposition of the defect. The flap was then elevated from proximal to distal under tourniquet control in the loose areolar tissue plane superficial to the extensor tendon paratenon. Veins at the borders of the flap were avoided, and those passing through the midsubstance of the flap, restricting the pivoting, were divided.

The perforator was identified, and efforts were made not to skeletonize it, passing just distal to the juncturae tendinum. The dorsal metacarpal artery was also visualized traversing from below the extensor tendon, under the juncturae right, directly to the web space. Perfusion was evaluated by releasing the tourniquet while the flap remained in its native position for about 15 minutes.

Subsequently, the flap was rotated and reached the defect by passing under a wide, lax dorsal skin tunnel, anchored loosely to the borders of the defect with the proximal interphalangeal and

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Figure 1. Before treatment

metacarpophalangeal joints in extension. Primary closure of the donor defect was performed, and the remaining defect on the lateral side was covered with a full-thickness skin graft.

The wrist was maintained in extension for 7 days with a volar splint to keep the fingers in an extended position. Close monitoring of the flap and the skin graft, along with ambulatory surveillance, and an 8-week follow-up demonstrated an acceptable outcome, avoiding the need for radical treatment. Figures 1 and 2 illustrate the condition before treatment, including the marked area for intervention. Figures 3 and 4 present the depiction of the flap during the surgical procedure. Figure 5 showcases the outcome post-surgery. Finally, figure 6 shows a one month follow up.

Discussion

The manageability, color, and thickness of the skin on the dorsum of the hand are some characteristics that make it an adequate tissue match for dorsal and non-fingertip palmar defects. Primary linear closure of the donor defects is possible in the majority of cases due to the laxity of the tissue in this area. Only in flaps wider than 3 cm might another method of donor site coverage be needed, such as a full-thickness skin graft, for example. (1,2)



Figure 2. Marking before treatment



Figure 3. Dorsal metacarpal flap

Whether the flap includes the dorsal metacarpal artery (reverse and extended reverse dorsal metacarpal artery flap) or is a dorsal metacarpal artery perforator flap raised superficial to the artery, certain anatomical features need to be considered. The dorsal metacarpal artery caliber decreases, and there is a higher incidence of congenital absence of it if you go



Figure 4. Flap during surgery



Figure 5. After surgery

from radial to ulnar (second to fourth dorsal metacarpal artery). (1,6-11) Taking this into account, preoperative Doppler should be considered, especially when considering a reverse/extended dorsal metacarpal artery flap that is more ulnar. This seems not to be a problem when considering a dorsal



Figure 6. One month follow up

metacarpal artery perforator flap; the perforator arises directly from the branches of the deep palmar arch. Even in the absence of the dorsal metacarpal artery, this anatomical feature makes the cutaneous perforator flap a more reliable option. (12) According to the experience of Sebastin, S. J et al., the cutaneous blood supply of the proximal intermetacarpal space is supported by the distal dorsal metacarpal artery, but the skin territory over the extensor retinaculum segment is not guaranteed; hence, that is the anatomic limit of the flap.

Skin island design also depends on the extension of the defect to cover. It could be a straight ellipse for proximal half of the middle phalanx defects or a curved ellipse in more distal defects. In our case, the latter was chosen because it provides an extra 8 to 10 mm. (1)

Another technique for reconstruction in this case would be a groin flap, described as a self-contained vascular territory with a single pedicle using the superficial circumflex iliac artery and vein. Advantages of this technique include non-elaborated preoperative planning and development without the need for microsurgery skills. On the other hand, a disadvantage includes the uncomfortable position required before the division. (13,14)

The reverse dorsal metacarpal artery flap technique is more difficult and requires meticulous dissection. In contrast, of all the cutaneous perforators of the dorsal metacarpal artery, the largest is located at the distal portion of the artery, at the metacarpal neck, serving as an anatomical landmark for dissection through an avascular loose areolar plane just above the extensor tendon paratenon, making it more accessible. The general consensus establishes that the inclusion of the dorsal metacarpal artery (reverse or extended) should only be considered if a compound flap (extensor tendon or metacarpal bone segments) is needed for reconstruction (1,4,6)

Conclusions

The dorsal metacarpal artery perforator flap was the choice in this case because it is indicated for resurfacing dorsal and lateral soft-tissue defects. It is relatively 'easier' to dissect, anatomically more reliable, and the donor skin has a similar color, texture, and thickness to the dorsal defect, although the color match is not ideal on the lateral side. If needed, multiple flaps can be raised to allow coverage of more than one finger simultaneously, and it presents a low donor-site morbidity because the lax dorsal skin makes primary closure possible

Conflicts of interest

There is no conflict of interest in this case

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