

# Reconstructive Microsurgery

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*INTERNATIONAL PROCEEDINGS*

## Dorsal Ulnar Artery Flap\*

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### Abstract

This study aims at describing the Dorsal Ulnar Artery Flap technique applied to five patients with extensive injuries in the dorsal region of the wrist. Although the covered area by the dorsal ulnar artery is limited, it is included in the available variety of this local cutaneous covering. It is related to a fasciocutaneous pedicle flap and an easy technical employment, as it needs no dissection of the vascular pedicle. The main cause of this flap failure is connected to the precarious vessel drainage in wider flaps. The results were satisfactory, following the approved dimensions encountered in the literature. *Keywords:* Dorsal ulnar flap; dorsal ulnar artery

### Introduction

The artery flaps are indicated to serious injury coverings with exposure of noble structures, such as bone, tendon and nerves. They can be classified according to the location, composition (cutaneous, fasciocutaneous, fasciomiocutaneous, osteomiocutaneous, subcutaneous or muscular)<sup>[1]</sup> and whether they are free or pedicle.

In free flaps, the vascular pedicle is isolated and sectioned from the donor area to have anastomosis in the receiver area. In pedicle flaps, the initial vascularization is originated from the donor area itself (local or at distance) and, afterwards, it develops its own vascularization<sup>[2]</sup>.

The dorsal ulnar artery flap was described for the first time by Becker and Gilbert<sup>[3]</sup> as a pedicle and fasciocutaneous flap, obtained at the dorsal ulnar side of

the forearm. The blood supply is based on the dorsal ulnar artery which emerges from the ulnar artery to a distance from two to five cm from proximal to pisiform which passes under the flexor carpi ulnaris and it is divided into three other branches (1,4,5) (Fig. 1):

- proximal: it irrigates the flexor carpi ulnaris (FCU);
- medial: it directs to the skin, crossing the fascia when it is folded into two small arteriolas (ascendant and descendant). The ascendant arteriola will extend to the medial epicondyle of the humerus, running between the flexor carpi ulnaris and the ulna, irrigating the skin in the medial side of the forearm, corresponding to an area of 10 to 20 cm of length by 5 to 9 cm of width. The descendant arteriola accompanies the dorsal branch of the ulnar nerve, uttering various rami to the skin in the dorsal area of the wrist;
- distal: it will form a vascularization pedicle of the pisiform (pisiform artery).

The pedicle of the dorsal ulnar artery flap can be dissected and taken with the cutaneous covering, characterizing a fasciocutaneous flap on an islet, as described by Karacalar<sup>(5)</sup>. Another choice is the use of cutaneous uncovered flap in all its length, that is, only fasciosubcutaneous<sup>(3,5)</sup> flaps.

The dorsal ulnar artery flap is usually indicated for covering the anterior side of the wrist, especially when it needs well-vascularized tissue to cover the medial nerve. The covering of the dorsal region of the wrist is restricted, thus, it is indicated when there are small defects due to the length of the arterial pedicle (03 cm), which limits the arc of rotation of the flap<sup>(1)</sup>.

In this study, we will describe the rotation technique of the dorsal ulnar fasciocutaneous flap, conducted with five patients with extensive lesions in the dorsal region of the wrist or the hand.

## Surgical technique

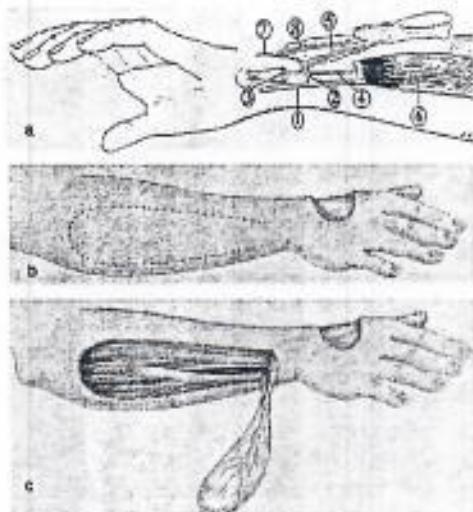
### 1. Identification

A line is delineated between the pisiform bone and the medial epicondyle of the humerus which correspond to the medial flap. The ulnar artery, the dorsal cutaneous branch (5 cm from proximal to pisiform) and the ulnar border of the tendon of flexor carpi ulnaris are delimitated (Fig. 1).

### 2. Dissection

It begins in the flap apex raised with the fascia and the superficial vessels of the muscular body of the flexor carpi ulnaris in direction from proximal to distal. The dissection extends to the visualization of the dorsal ulnar branch entry in the profound surface of the graft. This visualization can be unnecessary if the dissection is interrupted 5 cm from proximal to pisiform (Fig. 1).

The pedicle can be swiveled up to 180° after making the tubing of the flap base, without involving blood supply. The dissection region is covered with skin graft, and a drain of *Penrose* is placed under the graft. The hand is kept



*Figure 1: a - 1- Ulnar artery/ 2 - Dorsal ulnar artery/ 3 - Pisiform artery. 4 - Branch to the FCU / 5 - Dorsal ascendant branch of the ulnar artery. 6 - flexor carpi ulnaris (FCU) / 7 - Dorsal descendant branch of the ulnar artery. 8 - Superficial vessels. b - Delimited area for rotation of the dorsal ulnar flap. The advisable sites are: pisiform, flexor carpi ulnaris and medial epicondyle. c - The dorsal ulnar flap with fasciocutaneous pedicle. The blood vessels are shown entering the profound surface of the flap.*

elevated for five days to facilitate the venous return.

Another choice is to schedule the skin graft at the moment the pedicle disconnection occurs, in about three weeks, as part of the flap can return to the forearm.

## Clinical Cases

### Case I

Female, 57, serious injury with tendinous exposure (4 x 4 cm) in the dorsal region of the secondary left wrist to the chemotherapeutic extravasation (Epirubicina). It was attempted to use the rotation of the Chinese flap and the posterior interosseous flap. However, due to the intense chemotherapeutic impregnation in the dorsal radial area of the forearm, there was destruction of the concomitant vessels, the radial artery and the posterior intraosseous. In a second moment, the rotation of the dorsal ulnar flap with fasciocutaneous pedicle was chosen. There was a satisfactory evolution, having the pedicle disconnected after three weeks (Fig. 2).

### Case II

Female, 50, with history of malignant mammary neoplasia, being submitted to radiotherapy and chemotherapy. There was extravasation of chemotherapeutic (Doxorubicina), presenting features of compartment syndrome in the left hand. It was submitted to fasciotomy in the first, second and third hand space and posterior debridement of the necrosed tissues. It evolved with extensive injury (9 x 6 cm) and exposure of the extensor tendons. It was preferred for the covering with the dorsal ulnar artery flap (18 x 6 cm), since there was impregnation by evident chemotherapeutic at the site. The donor site was partially closed and, afterwards, covered with skin graft (Fig. 3).

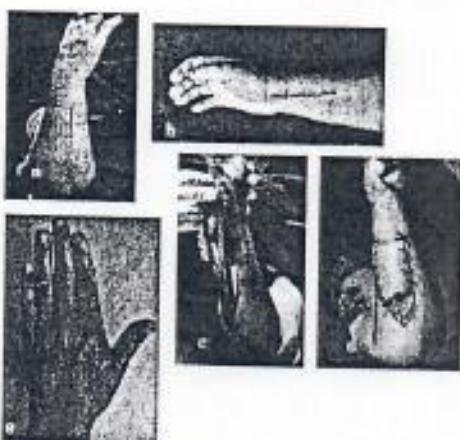


Figure 2: (a) Frustrated attempt of rotating the posterior intraosseous flap. Presence of necrosis in the hand dorsum (4 x 4 cm); (b) Frustrated attempt of rotating the Chinese flap. Obstruction of concomitant vessels. (c) Rotation of dorsal ulnar flap (transoperative appearance); (d) Postoperative appearance after three weeks of follow-up. The flap was partially devolved flap to its origin. Lenninate skin graft in the donor area was used. (e) Final appearance after two years.



Figure 3: (a) Extensive lesion in the dorsal region of the wrist, secondary to the chemotherapeutic extravasation (Doxorrubicina); (b) The region of dorsal ulnar flap is delimited (18 x 06 cm) to cover the area of 9 x 6 cm. (c) Postoperative appearance after 18 months.

### Case III

Male, 52, victim of trauma in the right hand by means of an agriculture machine, with traumatic amputation of the fifth finger (to the level of the metacarpophalangeal rotation), comminutive fractures from the second to the fourth fingers, besides the lesions of soft parts in dorsal side of the hand. Subsequently, the second finger also evolved to amputation. A dorsal ulnar flap was swiveled (06 x 08 cm) for the covering of the dorsal side of the hand (Fig. 4).

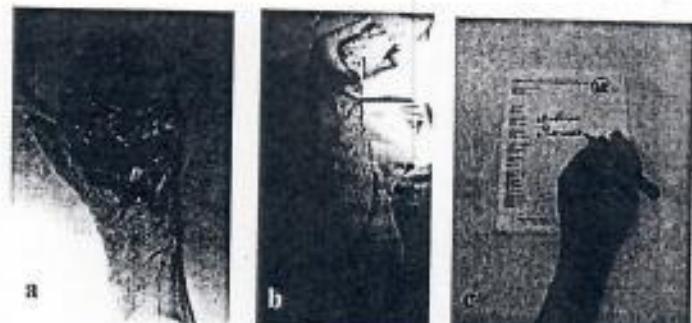


Figure 4: (a) Trauma with agriculture machine. Immediate traumatic amputation of the fifth finger; (b) Appearance of immediate postoperative (skin graft, closing the donor area); (c) One year postoperative. Good function, in a tweezer manner of the hand



Figure 5: (a) Lesion in the left hand ( $8 \times 8$  cm) by burning; (b) The appearance of the hand one year after the release of surgical syndactyly.

#### Case IV

Male, 21, victim of burning in dorsal side, from the second to the fifth fingers of the left hand, extending from the metacarpophalangeal rotation up to the distal interphalangeal rotation. A dorsal ulnar flap was swiveled ( $8 \times 8$  cm) for the covering of the dorsal side of the fingers, forming a surgical syndactyly. Subsequently, the fingers were separated (Fig. 5).

#### Case V

Male, 17, victim of trauma in the right hand by an agriculture machine, presenting traumatic amputation of the third and the fifth fingers to the metacarpal level and the lesion of the soft parts in volar and dorsal sides of the hand. The fourth finger was approximated to the second finger, and a dorsal ulnar artery flap of  $14 \times 9$  cm was swiveled for covering the volar and dorsal sides of the hand (Fig. 6).

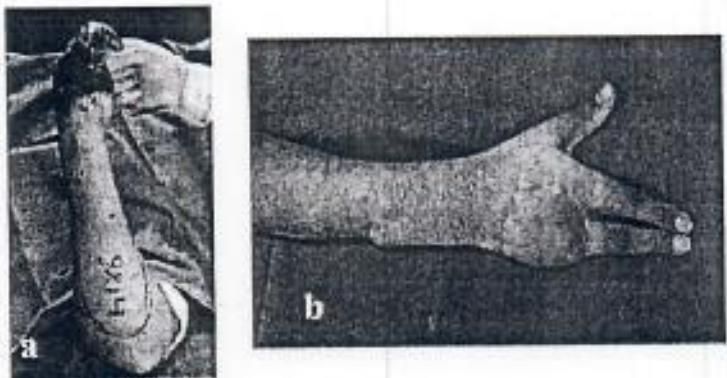


Figure 6: (a) Lesion involving the volar and dorsal sides of the hand. Amputation of the third and the fifth fingers; (b) Appearance two years post-surgery.

## Discussion

The literature shows that there are various choices for covering soft parts lesions in the hand dorsum. The most traditional flaps presented some disadvantages, such as the Chinese flap which sacrifices an important vascular structure, the pedicle flaps which require a far longer period of immobilization of the hand or the free flaps which present a prolonged surgical time, besides needing special care in the immediate postoperative<sup>(3)</sup>.

The dorsal ulnar artery flap was initially described for covering small defects in the volar side of the wrist, especially in the medial nerve<sup>(3)</sup>. In spite of the limitation of the arc of rotation due to the short length of the pedicle, the dorsal ulnar flap can be used to cover defects in the dorsal side of the wrist and the ulnar border of the palmar region<sup>(1,3,4)</sup>. As it is a simple dissection flap, it does not need great microsurgical experience to accomplish it.

The main problem of this flap is the venous drainage which is retrograde and basically conducted by the distal pedicle<sup>(6)</sup>. Thus, some authors have postulated that the maximum dimensions of this flap might reach approximately 10 x 5 cm<sup>(3)</sup>. Holevich-Madjarova<sup>(6)</sup> have suggested to include the superficial vessels with the pedicle to improve venous drainage and, consequently, increase the dimensions of the flap, embodying the whole area supplied by the ascendant branch of the dorsal ulnar artery (20 x 9 cm). This situation is favored when the flap with the fasciocutaneous pedicle is swiveled.

Karacalar<sup>(5)</sup> has modified the technique described by Becker and Gilbert<sup>(3)</sup>, dissecting the subcutaneous pedicle and swiveling a fasciocutaneous flap, on an islet. Karacalar<sup>(5)</sup> has concluded that, by this means, not only did he have a larger arc of rotation, as the flap was passed by a subcutaneous tunnel, but also did not sacrifice the skin between the donor and receiver areas. Another advantage was the primary closure of the donor area. However, Karacalar<sup>(5)</sup> has described only one satisfactory follow-up case.

Gilbert<sup>(3)</sup> has presented two cases of the distal extremity necrosis. In the first case, there was a covering with the remaining pedicle after its disconnection. In the second case, there was the superficial necrosis of the flap. Nevertheless, a granulation bed was formed after its withdrawal which permitted the skin graft placement.

In our study, there was no tissue loss of the flap, yet, it was swiveled with a fasciocutaneous pedicle which needed skin graft to cover the donor area, almost always done after the flap disconnection.

It can be concluded that the dorsal ulnar artery flap is one more choice for covering the lesions with bone exposure, tendinous or nervous of the wrist and the hand. Notwithstanding, the dissection anatomical limits ought to be respected due to the venous drainage limitation.

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