DISTAL ULNAR ARTERY PERFORATOR BASED FASCIAL FLAPS FOR COVERING DORSAL AND PALMAR HAND DEFECTS

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ABSTRACT

The clinical effectiveness of a fascial flap based on distal ulnar artery perforators is demonstrated in a series of 10 patients with severe hand injuries with soft tissue defects requiring coverage. There were 6 male and 4 female patients and their age ranged between 23 and 69 years, while the defects were 6 dorsal and 2 palmar, 1 both palmar and dorsal (transcarpal amputation) and 1 radial (lateral). In the patients with a dorsal defect the extensor tendons were intact in 2 cases, reconstructed in another case and left for secondary reconstruction in 3 cases (silicon rods, tendon transfer). A fascial flap based on an ulnar artery perforator was fashioned and used to cover the defect following debridement, covered with a split thickness skin graft and immobilized for 2 weeks. All cases were followed up for at least 6 months. The donor and the recipient sites healed uneventfully, and the functional and aesthetic result was good. The described fascial flap offers several advantages over other local flaps, is easy to perform and covers effectively both dorsal and palmar hand defects.

Key Words: defect, fascial perforator flap, ulnar flap

INTRODUCTION

The reversed ulnar forearm flap described by Lovie, is a septocutaneous flap based on the septocutaneous perforators of the ulnar artery but it can also be harvested as a fascial flap.¹ The use of the fascial flap is indicated in patients with soft tissue defects of the hand.

The ulnar forearm flap combines the presence of a thin and elastic fascia (when purely fascial) and thin and pliable skin (when fasciocutaneous) and it can be harvested with bone, muscle and sensory or motor nerves.¹ With the advent of perforator flap surgery it has been made possible to reduce donor site morbidity, improving the functional and aesthetic result.⁵-⁸

The vascular supply of the flap arises from the ulnar artery.² The main trunk of the pedicle is called ulnordorsal artery and arises from the ulnar artery at a distance of 2-5 cm proximal to the pisiform. (Fig. 1) The artery passes beneath flexor carpi ulnaris and divides
The purpose of this paper is to describe the use of the fascial flap based on distal ulnar artery perforators to cover skin defects. The indications and advantages of this flap are presented.

PATIENTS AND METHODS

Between 2001 and 2003, 10 patients with a posttraumatic soft tissue defect were operated (Table 1, Fig. 2-4). There were 6 males and 4 females, aged between 23 and 69 years. The defect was dorsal in 6 cases, palmar in 2 cases, total hand area (transcarpal amputation) in 1 case and lateral (radial) in another case. All dorsal defects were accompanied by fractures. The combined fractures were located at the metacarpals (4 cases), metacarpal and Galeazzi fracture (1 case) and radius and ulna (1 case). All fractures were stabilized at the index operation using Kirschner wires or plates. In 6 cases extensor tendon laceration was present. The extensor tendon injury was primarily reconstructed in 2 cases, secondarily in 3 cases (silicon rods in 2 cases and tendon transfer in 1 case) and in another case seems to be without importance (amputation). All patients were operated within 2-4 weeks after

Table 1. Presentation of our patients with palmar and dorsal hand defects covered with an ulnar artery perforator based fascial flap.

<table>
<thead>
<tr>
<th>Case</th>
<th>age</th>
<th>sex</th>
<th>Location of defect</th>
<th>Extensor tendon suture</th>
<th>Fractures</th>
<th>Operation after injury</th>
<th>Cause of injury</th>
<th>Initial treatment</th>
<th>Final result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
<td>M</td>
<td>Dorsal</td>
<td>No</td>
<td>Metacarpals</td>
<td>3 weeks</td>
<td>Work</td>
<td>Direct closure</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>F</td>
<td>Dorsal</td>
<td>Yes</td>
<td>Metacarpals-Galeazzi</td>
<td>2 weeks</td>
<td>MVA</td>
<td>Split thickness skin graft</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>M</td>
<td>Palmar</td>
<td>Yes-suture</td>
<td>No</td>
<td>21/2 weeks</td>
<td>Work</td>
<td>Transpalmar replantation</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>M</td>
<td>Dorsal</td>
<td>Yes Silicon rods</td>
<td>Radius-ulna</td>
<td>4 weeks</td>
<td>MVA</td>
<td>Split thickness skin graft</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>42</td>
<td>M</td>
<td>Palmar</td>
<td>No</td>
<td>No</td>
<td>3 weeks</td>
<td>Work</td>
<td>Ulnar nerve repair</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>F</td>
<td>Radial</td>
<td>EPL- Yes Tendon transfer</td>
<td>1° Metacarpal</td>
<td>In emergency</td>
<td>Work</td>
<td>Split thickness skin graft</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>7</td>
<td>67</td>
<td>F</td>
<td>Dorsal</td>
<td>No</td>
<td>Metacarpals</td>
<td>2,5 weeks</td>
<td>Work</td>
<td>Direct closure</td>
<td>Good</td>
</tr>
<tr>
<td>8</td>
<td>54</td>
<td>M</td>
<td>both</td>
<td>-----------</td>
<td>Transcarpal Amputation-Skin necrosis</td>
<td>2 weeks</td>
<td>MVA</td>
<td>Amputation</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>9</td>
<td>33</td>
<td>M</td>
<td>Dorsal</td>
<td>Yes Silicon rods</td>
<td>Metacarpals</td>
<td>7 months</td>
<td>Gunshot</td>
<td>Full thickness skin graft</td>
<td>Good</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>F</td>
<td>Dorsal</td>
<td>Yes suture</td>
<td>Metacarpals</td>
<td>2 Weeks</td>
<td>Work</td>
<td>Split thickness skin graft</td>
<td>Good</td>
</tr>
</tbody>
</table>
the initial trauma, except one case which presented a gunshot hand injury with metacarpals bone defect (after 7 months). The cases with a dorsal defect were initially treated with direct wound closure (2 cases) or split thickness skin grafting (3 cases), and full thickness skin (1 case). The patient with lateral (radial) side hand injury suffered a diaphysial defect of the first metacarpal, EPL tendon defect and a massive skin and soft tissue lost.

Regarding the palmar defects, the necrosis occurred in the first case two weeks following a transpalmar replantation and in the second case necrosis of the hypothenar area occurred within two weeks after a compound injury with ulnar nerve repair. In the first case following meticulous debridement the median nerve was left uncovered, while in the second case a group fascicular repair of the motor branch of the ulnar nerve and neurotube interposition for bridging the two sensory branches was carried out.

In all cases the defect area was debrided and the size of the defect was assessed before harvesting the graft. The incision site was outlined on the ulnar side of the wrist and forearm overlying the tendon of flexor carpi ulnaris muscle. The pisiform was identified and the pedicle was located emerging between 2 and 5 cm from it. Subdermal dissection allowed exposure of the fascia and the subcutaneous tissue was preserved. The flap was released on its radial side and retracted progressively until the underlying flexor carpi ulnaris muscle was revealed. The pedicle can be seen in the distal third of the flap. After locating of the pedicle the ulnar side of the flap is released (Fig. 6-7) maintaining a distal hinge. Simple rotation of the flap permits coverage of defect located at the midpalm or the proximal two thirds of the dorsum of the hand. In all cases flap harvesting was carried out within 20 minutes. In all cases the flaps were reflected on the debrided defect area (Fig. 5) and a split skin was applied. The hand was immobilized for two weeks in a plaster slab to protect the flaps.

RESULTS

All patients were followed up for at least 6 months. Both the donor and the recipient sites healed
successfully. The aesthetic (Fig. 8-10) and functional result was good in all cases. Moderate wrist stiffness with less than 20° arc of motion limitation was observed in 2 cases. No infections, necrosis or fracture non-unions were noticed in the patients. Rehabilitation for 2 to 4 months was necessary for recovering and achieving a satisfactory functional result. Permanent loss of finger extension was observed in the patients who declined extensor tendon reconstruction. No complaints from the donor site were reported.

**DISCUSSIONS**

A fascial flap based on septocutaneous perforators of the ulnar artery was described, which was used to cover dorsal and palmar hand defects.

The ulnar fascial flap is mainly used to cover defects on the palmar surface of the wrist, especially when well vascularized tissue is needed to cover the median nerve, which may be surrounded by dense scar tissue following previous injury or surgery.\(^1\)\(^4\) If the skin is of suitable quality it may be preferable to use a fascial flap, which can be wrapped around the nerve in order to protect it.

The ulnar forearm flap can be purely fascial or fasciocutaneous.\(^1\)\(^2\) Harvesting of a fascial graft reduced the overall morbidity without causing additional skin loss.

The distal ulnar artery flap can be used to cover dorsal wrist and hand defects.\(^2\) It has several advantages.
over the radial forearm flap. Flap harvesting is pretty straightforward, no flexor tendons are exposed, a major artery is not sacrificed, there is no need to perform vascular anastomoses, the donor site scar is well covered on the medial side of the forearm and in case of failure other more intricate flap can be easily employed. The ulnar artery perforator-based fascial flap is indicated for the coverage of defects in areas where increased mobility of the underlying structures is mandatory. It can also be used to cover both hand and forearm defects fashioned as a distally or proximally based island flap, respectively. The flap dimensions are 20 cm in length and 9 cm in width, with the ulna lying at its median axis. The fascial ulnar flap can also be based on the proximal perforators of the ulnar artery.3,5

One disadvantage of the flap is the small length of its pedicle (approximately 3 cm), which limits the flap rotation arc. In our patients the extended variant of this flap (up to the middle of the forearm) was employed, which proved sufficient to cover the proximal third of the midpalm or hypothenar areas and more than the proximal 2/3 of the dorsal aspect of the hand.

Several variants of the ulnar artery-based flap have been described such as the neurocutaneous island flap of the dorsal branch of the ulnar nerve, which is based on cutaneous perforators of the ulnar artery.3,5 The same principle of flap vascular supply via perforators can be applied in the radial forearm flap.2 It is described as adipofascial radial flap, based on perforators of the radial artery.5

The ulnar artery perforator-based fascial flap is very useful to cover dorsal and palmar hand defects, is easy to perform and effective. It combines little donor site morbidity and reliability.

REFERENCES