

## Assessment of Reconstruction of Hand Defects Using Radial Artery Distally Based Flaps

ABBAS A.H., M.D.; MOGHAZY A.M., M.D.; EL-BADAWY M.A., M.D.; ADLY O.A., M.D.;  
ALI O.S., M.D. and ABOELNAGA A.M., M.Sc.

*The Department of General Surgery, Plastic and Reconstructive Surgery Unit, Faculty of Medicine, Suez Canal University, Ismailia, Egypt*

### ABSTRACT

**Aim of the Work:** The aim of the study is to find an easy and reliable simple method for reconstruction of hand defects using Radial artery distally based flaps.

**Introduction:** Distally based flaps are commonly the surgeon's first choice in traumatic hand defects whenever the local resources were over passed, it provides a thin, vascularized wound cover and a vascular bed for skin grafting this flap requires pulsatile ulnar artery & positive Allen test.

**Patients and Methods:** This study is a case series study using 28 patients with various types of traumatic hand defects in the plastic surgery division of the department of surgery, Suez Canal university hospital during the period from may, 2011 to October, 2012. Four types of the flap were performed; Adipo-fascial based on artery (Aa), Fascio-cutaneous based on artery (Af), Adipo-fascial based on perforator (Pa), Fascio-cutaneous based on perforator (Pf).

**Results:** The main finding of the the study is that the least complications were in cases of Af flaps (28.6%), followed by Aa and Pa flap cases equally (42.8%), and then the Pf flap cases that was associated with the highest incidence of complications (47.2%).

**Key Words:** *Adipo-fascial based on artery (Aa) – Fascio-cutaneous based on artery (Af) – Adipo-fascial based on perforator (Pa) – Fascio-cutaneous based on perforator (Pf).*

### INTRODUCTION

The frequency of the hand trauma involving major tissue losses has led to the development of new technical solutions, more simple and effective. The regional flaps, such as the distal pedicle Chinese flap, were usually surgeon's first choice whenever the local resources were over passed. Standard forearm flap is vascularized by a pedicle that consists of the radial artery and two vena commi-

tantes that are ligated proximally and turned distally toward the defect in the hand. It provides a thin, vascularized wound cover and a vascular bed for skin grafting. This flap requires pulsatile ulnar artery & positive Allen test. Still, this type of Chinese flap would present an important disadvantage, as they involve the sacrifice of a vascular axis of the hand, sometimes even the dominant one. The surgeon would be able to avoid this inconvenience when using distal radial artery based perforator flaps; moreover, this flap would allow the covering of hand defects extending as far as the metacarpophalangeal joints [1,2]. The reversed flow forearm fascial flaps based on distal perforators of the radial artery is much expanded and the dominant type of flap in the last decade for covering hand and wrist defects without scarifying major vascular shafts or causing bad aesthetic result at the donor site. There is no need for preoperatively additional or clinical investigations such as angiography, Doppler, triplex ultrasonography or Allen test [3,4]. With the advent of perforator flap surgery, it has been made possible to reduce donor site morbidity and improving the functional and aesthetic result [5].

### MATERIAL AND METHODS

This was a case series study conducted in 28 patients at Plastic Surgery unit, Burn Unit and Inpatient ward with patients presented with hand defects at time of acute trauma, post excision of burn eschars or contracted scars.

#### *Flap design:*

The cutaneous element of the flap can be designed as appropriate. The radial artery is iden-

tified and superficial veins that might be suitable for superficial venous anastomosis are identified and marked on the skin surface. Identification of the cephalic and basilic veins can help identify medial and lateral cutaneous nerves in subsequent dissection.

#### *Surgical technique:*

The flap is raised under tourniquet control after exsanguinations by elevation. This does not completely empty the flap and aids identification of the superficial veins. The margins of the flap are incised down to subcutaneous fat and any proximal subcutaneous veins and nerves to be preserved are identified. It is easiest to start elevation of this flap in a subfascial plane at the ulnar border. Incision is carried through the deep fascia on to the muscle bellies proximally and the tendons distally. Elevation of the flap is on the muscle surface proximally and on the paratenon of the tendons distally. Elevation proceeds superficial to the palmaris longus, dividing the intermuscular septae and vessels which pass deeply to supply muscles, nerves, and deeper structures.

At this point it is useful to identify the distal end of the radial artery and venae comitantes to ensure that the vessels are in a safe position. Attention now focuses on the radial incision. A decision has to be made whether to preserve the cephalic vein or use it as part of the venous drainage of the flap. The free border of brachioradialis muscle and tendon is identified and retracted to give access to the lateral intermuscular septum. It is important to identify the cutaneous branch of the radial nerve and where possible preserve this intact to avoid subsequent loss of sensation or painful neuromas. Retraction of brachioradialis reveals the lateral intermuscular septum along its length from the styloid process to the insertion of pronator teres. This septum can be divided deep to the vascular pedicle, taking care to secure branches that pass to the periosteum of the radius and to flexor muscles of the forearm. The flap is separated from its deep structures but remains attached by its proximal and distal pedicle and by the proximal subcutaneous tissue. Proximally an extension is made on the ulnar side of brachioradialis. This allows access to the subcutaneous tissue proximally to dissect out any superficial veins and nerves that are to be elevated with the flap. Retraction of brachioradialis allows the proximal vascular pedicle, comprising the radial artery and venae comitantes, to be identified. At this stage it is easiest to divide the pedicle distally and perform a distal to proximal dissection,

mobilizing the proximal vascular pedicle and any superficial veins and nerves.

## RESULTS

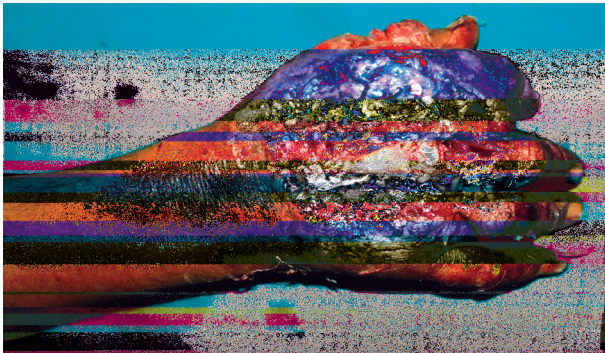
The study was conducted on 28 patients, the sample was equally distributed between four groups of distally based flaps; Adipo-fascial based on radial artery, Fascio-cutaneous based on radial artery, Adipo-fascial based on perforator and Fascio-cutaneous based on perforators. The age among Aa flap cases 85.7% were between 20 and 29 years old while 14.3% were between 30 and 40, as for the Af flap cases 42.8% were between 20 & 29 and 57.2% were between 30 and 40, in the Pa cases 71.4% were between 20 and 29 and 28.6% were between 30 & 40, and for the Pf flap cases 57.2% were between 20 and 29 years while 42.8% were between 30 and 40 years old (Table 1).

According to the associated injuries (including lacerated tendons and fractures) were present in 42.8% of the cases with both the Aa and Af flaps, and with 71.4% of the cases with the Pa flaps, and with 57.2% of the cases with the Pf flaps (Table 2).

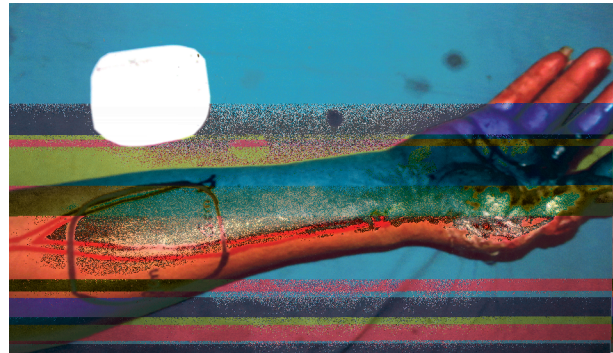
The time of intervention of the soft tissue defect, in Aa flap cases 71.4% were early (within 72 hours of injury) and 28.6% were delayed (after 72 hours of injury), in Af flap cases 85.7% were early and 14.3% were delayed, in Pa flaps 85.7% were early and 14.3% were delayed, in Pf flaps 71.4% were early and 28.6% were delayed (Table 3). According to the complications following flaps placement, in Aa flaps 28.6% of the cases develop local infection, 14.3% graft necrosis and in 57.2% there were no complications, in Af flaps 14.3% of the cases develop local infection, 14.3% graft necrosis and in 71.4% there were no complications, in Pa flaps 28.6% of the cases develop partial graft necrosis, 14.3% flap failure and in 57.2% there were no complications, in Pf flaps 14.3% of the cases develop local infection, 28.6% graft necrosis, 14.3% flap failure and in 42.8% there were no complications (Table 4).

According to the relation between the presence of associated injuries and the occurrence of complication after the procedure, the degree of complications was much higher in the cases with associated injuries, with the Aa flap cases it was 100%, 33.3% in Af cases (compared to 25% in cases with no associated injuries), 100% in Pa cases, and 75% in Pf cases (compared to 33.3% in cases with no associated injuries) (Table 5).

Case (1)



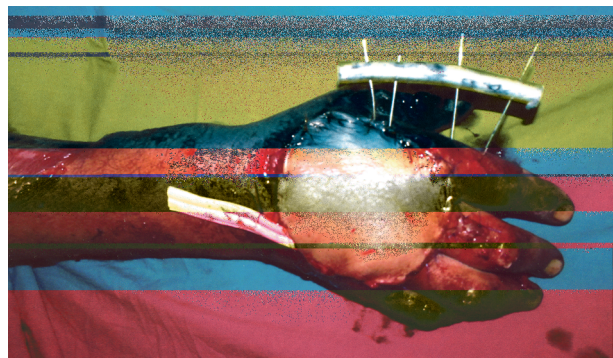
(A): Preoperative appearance.



(B): Flap marking.



(C): Flap elevated with its pedicle of radial artery.



(D): View after complete inseting of the flap and fixation of fractures.



(E): View after 8 months post operative.

39 years old male works as driver patient presented post RTA with lacerated dorsum of the RT hand lacerated extensor tendons fracture proximal phalanges of the RT index finger, Clinical and Doppler allen's test revealed dominant ulnar artery, Procedure Debridement Fixation of the fr with k-wires, Repair of the extensor digitorum superficialis tendon with Palmaris longus tendon graft, Coverage of the wound with reversed fasciocutaneous radial forearm flap based on RT radial artery.

Fig. (1): Steps for radial forearm fasciocutaneous flap.

Table (1): Distribution of age among studied patients.

Variable	No.	%
Age	Aa Male	5 71.4
	Female	2 28.6
Af	Male	4 57.2
	Female	3 42.8
Pa	Male	6 85.7
	Female	1 14.3
Pf	Male	3 42.8
	Female	4 57.2

Table (2): Distribution of associated injuries.

Variable	No.	%
Associated injuries	Aa Present	3 42.8
	Aa Absent	4 57.2
Af	Present	3 42.8
	Absent	4 57.2
Pa	Present	5 71.4
	Absent	2 28.6
Pf	Present	4 57.2
	Absent	3 42.8

cations than late intervention cases, and this occurs in all flap types. It was found that the presence of associated injuries in the bones and tendons markedly increase the incidence of complications in all flap types. Younger patients were associated with little complications when compared with older patients, also this occurs in all flap types. The best cosmetic outcome from the surgical staff point of view- was in case of Aa flaps followed by Pa flaps then Af flaps and finally Pf flaps.

Donor site morbidity was best in cases of Aa flaps and least in cases of Af flaps.

*Conclusion:*

The results showed that there was complete success in 44.4% of the cases, while in the remaining cases there were some complications including local inflammation and graft necrosis, only 10.7% of the cases failed to take in the flap.

Also there was higher association between the occurrence of complications and the contaminated wounds more than less degrees of contamination, and a higher association between the occurrence of complications and presence of associated injuries in the cases.

**REFERENCES**

**DISCUSSION**

The cases of the hand defects among the sample were variable ranging between recent trauma cases and old scar reconstruction.

All flaps were reconstructed to be distally based with an angle of rotation of 180 degrees.

The results showed that the least complications were in cases of Af flaps, followed by Aa and Pa flap cases equally, and then the Pf flap cases that was associated with the highest incidence of complications.

Also cases that received early intervention were associated with much lower incidence of compli-