

Usage of Reversed Radial Forearm Flap for Reconstruction of Hand and Wrist Defects

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ABSTRACT

Objectives: To highlight the usefulness of reverse radial forearm fasciocutaneous flap in covering various soft tissue defects of hand and wrist.

Study Design: Descriptive, experimental study.

Setting: Department of Plastic & Reconstructive Surgery, Tanta University Hospitals.

Material and Methods: A total of 15 reverse radial forearm flaps were utilized to cover various soft tissue defects of hand and wrist from various etiologies including road traffic accidents, mechanical trauma, and industrial trauma and fireworks injuries were included. Patients with segmental bone loss and those patients having partial of complete amputation of thumb were excluded. The age ranged from 22-43 (mean 22.5) years. Soft tissue defects of dorsum were covered with this flap in 7 cases, 3 cases on palmer aspect and 5 cases for 1st web space and the index finger defects each. Patients were followed for at least three months post-operatively.

Results: We had partial loss of flap in two cases that was managed with debridement and skin grafting. Superficial epidermolysis was found in one case and managed conservatively. Donor site was skin grafted in 13 cases, which was healed uneventfully and quite acceptable to the patients in due course of time and direct closure in 2 cases.

Conclusion: Reverse radial artery flap has a quite long arc of rotation, which brings it great ease to cover the soft tissue defects of various areas of hand like palm, dorsum, first web space.

Key Words: Surgical flaps – Dorsal hand injuries – Dorsal finger injuries – Radial forearm flaps.

INTRODUCTION

Soft tissue defects of hand and wrist with exposed tendons; joints, nerves and bones represent a challenge to plastic surgeons. Such defects necessitate early flap coverage to protect underlying vital structures, preserve hand functions and to allow for early rehabilitation [1].

While small defects can be closed with local transposition flaps, reconstruction of larger defects

should be performed using distant flaps, free flaps or pedicle flaps. Although the application of distant flaps is a useful method, it may be uncomfortable for the patient and several operations may be required [2].

Free flaps provide excellent soft tissue coverage and allow for early rehabilitation, but they have the disadvantages of an extended operation time, and requirements for special equipment and microsurgery training. Pedicle flaps may be taken from both the distal and proximal pedicles, and there is no need for microvascular anastomosis during the defect reconstruction [3].

The aim of this retrospective study was to evaluate the midterm clinical and functional results of 15 patients who underwent reconstruction using reverse flow radial forearm fasciocutaneous flaps for hand and finger dorsal complex defects due to avulsion injuries. We also evaluated whether this method can be reliably applied without microsurgery.

MATERIAL AND METHODS

This descriptive, experimental study was carried out at the Department of Plastic & Reconstructive Surgery, Tanta University Hospitals, from December 2017 to January 2019. Total 15 patients having soft tissue defects of the dorsum of hand and fingers arising from various etiologies including road traffic accidents, mechanical trauma, and industrial trauma and fireworks injuries were included. Age ranges between 20-43 (mean 22.5) years.

Reverse radial forearm flap was found most suitable option in all these cases. Allen's test was performed preoperatively to confirm the continuity of palmar arch. Conventional reverse radial flap was used in all the cases.

During the operation, once the flap has been raised, blood flow through palmar arch was confirmed by applying clamp on the proximal end of radial artery and only then the artery was divided and flap rotated on an arc of 180 degree. In majority of the cases flap was tunneled to the defect site. Only in three of the cases where subcutaneous tunnel was not found satisfactory, it was completely opened. Donor site was covered with split skin graft in 13 cases and direct closure in 2 cases.

RESULTS

Fifteen cases of hand and wrist trauma were provided soft tissue cover with reverse radial forearm flap from December 2017 to January 2019. Eleven patients were males and 4 were females. Age ranges between 22-43 (mean 22.5) years. Most common soft tissue defects 7 cases were in the area of dorsum of hand, in 3 cases this flap was used for the coverage of palmar defects while 5

cases for 1st web space and the index finger defects each.

Web space defects were covered with this flap in 5 cases and yet another required a big flap to cover the soft tissue defects at palm and thumb. Patients were followed for at least three months post-operatively. There was partial loss of two flaps, which was debrided, and skin grafting was done. Superficial epidermolysis was found in only 1 case, which was managed, conservative. Rest of all the flaps in this series survived completely. Table (1) skin graft was applied at donor site in 13 cases, which was taken well and direct closure in 2 cases with small defect. Three patients were not satisfied with the color mismatch of the grafted area.

The difference of color at grafted areas improved in the later follow-ups visits. There was no difficulty in post op movement of the remaining hand function and symptoms of post-operative neuroma were absent.

Table (1): Patients' demographic characteristics of the patients, type of injury and accompanying defects.

No	Age	Gender	Location of defect	Size of the flap (CM)	Outcome	2 nd procedure
1	31	F	Dorsum of the hand	7.2 X 6.3	Survive	–
2	34	F	1 st web space	3.3 X 3	Survive	–
3	28	M	Index finger	10 X 7.4	Survive	–
4	21	M	Dorsum of the hand	8.1 X 6.4	Survive	–
5	43	M	Palm of the hand	5.3 X 7.6	Survive	–
6	39	M	1 st web space	6.6 X 7.8	Survive	–
7	25	F	Dorsum of the hand	6.1 X 8.2	Survive	–
8	26	M	Dorsum of the hand	9.1 X 8.2	Partial necrosis	Debridement and graft
9	34	M	Palm of the hand	8 X 7.3	Survive	–
10	38	M	1 st web and thumb	9.1 X 7.7	Survive	–
11	40	F	Palm of the hand	3.5 X 3	Survive	–
12	20	M	Dorsum of the hand	8.3 X 7.7	Survive	–
13	28	M	1 st web space	6.1 X 4.2	Survive	–
14	37	M	Dorsum of the hand	8 X 7.7	Partial necrosis	Debridement and graft
15	22	M	Dorsum of the hand	6.6 X 8.1	Survive	–



Fig. (1,2): A 28-year old, laborer presented with machine injury of his left hand with severe crush injury of index, middle and ring fingers.



Fig. (3): After debridement, reversed radial forearm flap for soft tissue coverage of the defect of the index was done.



Fig. (4): The patient grasps a piece of paper with the thumb and the reconstructed index fingers (functioning hand).



Fig. (5): Initial marking and incision of the flap.

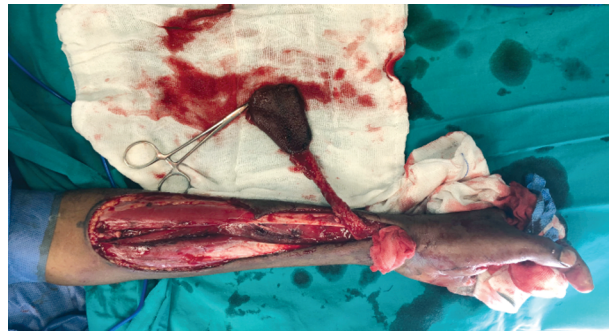


Fig. (6): Flap isolated after division of radial artery.



Fig. (7): (Immediate post-operative) shows grafting of the donor site.



Fig. (8): (Immediate post-operative) shows inset of the flap to cover the defect of the index finger.



Fig. (9): A 35-years old, presented with road traffic accident with severe crush injury of the thinner eminence.



Fig. (10): 2 weeks' post-operative shows covering of the defect with the flap and primary closure of the donor site.



Fig. (11): A 28-years old, presented with road traffic accident with severe crush injury of 1st web space and the base of the thumb.



Fig. (12): Flap inset at the defect after debridement.



Fig. (13): After 6 weeks of procedure shows complete healing.

DISCUSSION

Soft tissue defects of hands require early coverage so that physiotherapy can be commenced as early as possible. Coverage is necessary to replace missing skin and to protect exposed structures [1].

Local flaps represent the first step on the reconstructive ladder; however, the limited arc of rotation and extensive zone of injury produced by these injuries limits their use [4].

Distant flaps of the hand, including the groin and inferior hypogastric flaps essentially have the problems which include specific position of the hand in dressing for minimum of 3 weeks, it is two stage procedure resulting in prolong hospital stay and effects patient financial status due to late return of the patient to work, clinically patient would have stiffness on the all joints of the hand as well as edema which is secondary to prolong immobilization which is necessary for this procedure [5].

When the defect cannot be closed primarily, cannot support STSG or FTSG, and local tissue is not available or sufficient, distant axial pattern flaps are the option of choice [6].

Although several types of flaps are available for reconstructing dorsal hand defects, reverse radial forearm flap is frequently used because of including reliable and pliable tissue [7].

It can be raised as fasciocutaneous flap, supra-fascial or adiposofascial flap and provides robust tissues for soft tissue reconstruction of the hand, as it has constant anatomy, this flap also provide a better contour and avoids the necessity of having to thin the flap. This is a resourceful flap and according to the dimensions of the defects it can be raised in different sizes. Large defects can also be covered and it is documented in the literature that whole of the skin of the forearm can be raised on radial artery leaving 2cm cuff of skin on ulnar aspect dorsally [8].

Microvascular free flap we have various options like anterolateral thigh flap, lateral arm flap, scapular and para-scapular fasciocutaneous flap and deep inferior epigastric flap. In addition to prolong surgical time, requires technical expertise and specialized instruments each free flap has its own drawback. Anterolateral thigh flap, para-scapular and scapular flaps can be extremely thick resulting in poor contour of the hand and requires debulking

later on. Lateral arm flap has a limitation of donor site closure and if skin paddle is >6cm needs skin grafting that produces unacceptable scar in the arm [9].

Radial forearm flaps are extremely suitable for reconstruction of medium to large size soft tissue defects not only on the dorsum of the hand and the palm injuries but also for the proximal of the finger defects.

However, there are some disadvantages to these flaps, the most significant of which is that one of the main arteries of the hand is sacrificed. In addition, when the defect in the area from which it has been taken cannot be closed primarily, it is necessary to close the donor site with a skin graft and from a cosmetic aspect; this is a disadvantage. One of the most distressing complications of this flap during harvesting; is the damage of superficial sensory branch of radial nerve which can give rise to neuroma formation as well as sensory loss to anatomic snuff box area and care should be taken to avoid these problems [10].

Conclusion:

We chose this flap for our patients because the simple one-stage procedure with constant anatomy requires no skill in microsurgery. Also, the flap provide thin, pliable tissue for the hand and excellent non-bulky cover of exposed structures, with a smooth surface for tendon gliding.

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