

ORIGINAL ARTICLE

Usefulness of Reverse Radial Forearm Flaps in Covering Soft Tissue Defects of Hand and WristSARFRAZ AHMED¹, MARIA MALIK², ROMAIZA³, SANA RIAZ HASHMI⁴, TAUQEER NAZIM⁵¹Associate Professor Plastic Surgery Allama Iqbal Memorial Teaching Hospital Sialkot^{2,3}WMO in Allama Iqbal Memorial Teaching Hospital Sialkot⁴Abbas Institute of Medical Sciences Muzaffarabad⁵Assistant Professor Plastic Surgery Sheikh Zayed Hospital LahoreCorrespondence to Dr. Sarfraz Ahmed, Email: drsarfrazplast@gmail.com**ABSTRACT****Aim:** To emphasize on the importance of reverse radial forearm flap (RFF flap) in the coverage of soft tissue defects of hand and wrist.**Study design:** This is a descriptive experimental study.**Study place and duration:** Study was comprised on the period of six months from January 2022 to June 2022. It was conducted in the plastic surgery department of Allama Iqbal Memorial Teaching Hospital Sialkot**Methodology:** Patients with the soft tissue defects of hand and wrist due to road traffic accidents, industrial or mechanical trauma and firearm injury were admitted to the plastic surgery ward. After achieving healthy wound with wound debridement, soft tissue coverage was done using reverse radial fasciocutaneous forearm flap. Patients with amputation of thumb and those with partial or complete bone loss were excluded from the study. Ages of the patients were 17-50 years with mean age of 31.42±5.3 years. Donor site of the flap was covered with split thickness skin graft and follow-up of the patients was done for at least three months.**Results:** 20 cases were included in this study including 16(80%) male and 04(20%) female cases. 15(75%) cases had soft tissue defect on the dorsum of hand, 04(20%) cases had palmar defect and in 01(5%) case there was amputation at transmetacarpal level and flap coverage of the stump was done. Partial loss of the flap happened in one 01(5%) case and it was treated with debridement and skin coverage. In one case superficial epidermolysis was found and managed conservatively.**Practical implication****Conclusion:** Reverse radial forearm fasciocutaneous flap is an excellent option for the coverage of soft tissue defects of hand and wrist due to its greater arc of rotation which makes it easy to apply to the recipient site.**Key words:** Hand trauma, Soft tissue defects of hand, Reverse Radial Forearm Flap, Flap Coverage of Hand**INTRODUCTION**

Trauma of hand is very common in our society.¹ Mechanical trauma in industries, road traffic accidents, toka machine injury and firearm injuries are common causes of hand trauma.² Hand trauma with soft tissue defect is a great challenge for the surgeon to manage as hand is a vital part of the body and its injury exposes tendons, vessels, nerves and bones which needs immediate coverage³.

Available regional flaps for the coverage of hand and wrist soft tissue defects include ulnar artery flap, RRF flap and posterior interosseus artery (PIA) flap⁴. Based on the perforators of radial artery and ulnar artery new operative techniques have been developed for the soft tissue coverage of hand defects. PIA flap is technically difficult and time consuming procedure⁵. There is limited arc of rotation of dorsal ulnar flap because of its short pedicle. Distant flaps include groin and abdominal flaps which need limb immobilization for the period of about 3-4 weeks which is difficult for the patients⁶.

According to Ravikiran et al RRF flap was first described in 1978 by Yuzhi and Yang. This flap has much significance in reconstruction procedures of fingers and hand, head, neck and lower extremity. Lin et al in 1984 first time used this flap.⁷ Free flaps are time taking and need specialized skills. RRF flap is an excellent option for this purpose. It is also known as Chinese flap⁷.

RRF flap is distally based with retrograde blood supply from ulnar artery and palmar arches because branches from proximal radial artery are ligated^{8,9}. This flap was first done in 1978 by Dr. Yang and Dr. Gao during their study on 60 cadavers¹⁰. Reverse radial forearm flap is a local pedicle flap that can be raised easily and have sufficient arc of rotation to cover a significant area of soft tissue defect.

In this study we have reported our experience regarding use of radial forearm flap coverage of different wrist and hand soft

tissue defects without requiring micro vascular flaps. This study will help the surgeons to manage hand soft tissue defects efficiently using RFF flap.

MATERIALS AND METHODS

This is a descriptive experimental study started in January 2022 and completed after six months in June 2022. After permission from Hospital Ethical Review Board, this study was conducted in the Department of Plastic Surgery Allama Iqbal Memorial Teaching Hospital Sialkot. Study sample was calculated using online WHO sample size calculator (n=20). Convenient sampling technique was used in sample selection. Patients with the soft tissue defects of hand and wrist due to road traffic accidents, industrial or mechanical trauma and firearm injury were admitted to the plastic surgery ward. According to exclusion criteria old age >50 years, patients with infected wound, old wounds, with failure of previous flap, immunocompromised patients having chronic diseases, those having any skin disease or peripheral arterial disease were not included in this study. After initial management healthy wound was achieved with wound debridement. These patients were planned for the soft tissue coverage of the hand defects using reverse radial fasciocutaneous forearm flap. During the procedure proximal radial artery was clamped to confirm blood supply of the flap then 180° flap rotation was achieved. In most of the study cases flap was delivered to the recipient site through a subcutaneous tunnel. While in only two cases flap was unable to be delivered through the tunnel so it was completely opened. Coverage was done on the dorsum and palmar aspect of the hand. Patients having complete or partial amputation of thumb and those with segmental fractures or bone loss and infected wounds were excluded from the study. Blood supply of the hand was tested by performing Allens' test preoperatively in all cases. Ages of the patients were 17-50 years with mean age of 31.42±5.3 years. STSG (split thickness skin grafting) was done at the donor site and follow-up of the patients was done for at least three months. Moreover consent was taken from all the patients in study group.

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RESULTS

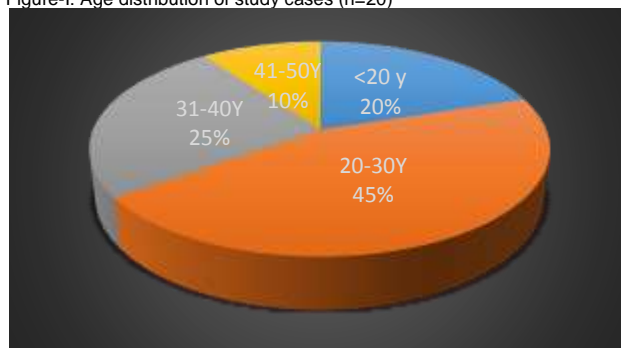
Twenty cases with trauma of wrist and hand were operated for soft tissue coverage using RRF flap. There were 16(80%) male and 4(20%) female cases. Dorsal aspect of the hand was most commonly injured with soft tissue defect in 15(75%) cases, on the palm in 4(20%) and on the transmetacarpal level in 1(5%) case. Flap survived without complications in 18(90%) cases while partial necrosis of the flap happened in one case and wound debridement followed by skin grafting was done in that case. Superficial epidermolysis occurred in one case which was managed conservatively (Table-I).

Table-I: Demographic data of the patients and characteristics of radial forearm flap

Gender	Location of the defect	Outcome	Management
F	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Palm of hand	Partial necrosis of flap	Wound debridement and skin grafting
M	Dorsum of hand	Flap survived	-
M	Palm of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Superficial epidermolysis	Managed conservatively
F	Dorsum of hand	Flap survived	-
M	Transmetacarpal level	Flap survived	-
M	Palm of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
F	Dorsum of hand	Flap survived	-
F	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Palm of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-
M	Dorsum of hand	Flap survived	-

In our study 4(20%) were having age <20 years, 9(45%) cases were between 20-30 years of age, 5(25%) cases between 31-40 years and 2(10%) cases were between 41-50 years of age (Figure-I). Mode of injury of hand and wrist was road traffic accident in 08(40%) cases, firearm injury in 4(20%), machine injury in 6(30) and firecracker injury in 02(10%) cases. Mean duration of the procedure was 70.3±18.6 minutes. Mean duration of hospital stay was 2.5±1.4 days.

Figure-I: Age distribution of study cases (n=20)



DISCUSSION

Traumatic injuries of the hand are very common reporting emergencies in our hospitals. Its common causes are road traffic accidents, industrial trauma, fireworks injuries¹¹. Hand injuries involve deep structures like tendons, vessels, nerves, ligaments,

joints and bones making them exposed. In plastic surgery department hand trauma with soft tissue deficiency always remain challenging to manage so that good function of the hand may be achieved and taking care of the cosmesis as well¹². In previous studies different flaps have been mentioned for the coverage of defects on dorsum and palmar aspect of hand. Most of the time dorsal aspect of the hand has more serious injuries exposing tendons, bones and neurovascular structures¹³. There are various options of local flap coverage in the hand which deal with only small size wounds but for large size wounds options are limited. Soft tissue flaps are classified as local or distant pedicle flaps and free flaps. Local pedicle flaps in forearm are RRF flap, PIA flap, flaps based on radial artery perforator, ulnar artery perforator and ulnar artery¹⁴. Ghareeb et al stated that RRF flap is an option of choice for the defects involving wrist and hand up to MCP joints. According to their study 85% reverse radial forearm flaps survived¹⁵. Rafael et al described that this flap can be obtained as adiposofascial flap or suprafascial flap and provide sufficient tissue for reconstruction of soft tissue defect of hand as this flap has suitable anatomy, better contour and don't need to be thin¹⁶. This flap can be raised in different sizes according to dimension of the defect. According to some studies for large defects whole forearm skin based on radial artery can be raised leaving 2cm wide area of skin on dorsal aspect¹⁷. If donor site is <3cm in diameter, it can be closed primarily. Larger donor site defect need skin grafting¹⁸. According to a study conducted in Saudi Arabia by Abdul Aziz et al, most serious complication of raising reverse radial forearm flap is the injury of branch of radial nerve called superficial sensory nerve, which can lead to loss of sensations in anatomical snuff box and neuroma formation¹⁹. A study conducted in France by Alsajjan et al reported that patient satisfaction score after reverse radial forearm scale using visual analog scale had mean value of 88.3 (SD±2.3), mean operation time was 124.7 minutes (SD±18.2) and mean hospital stay was 5.3 (SD±1.4) days²⁰. There are various options of microvascular free flaps like lateral arm flap, anterolateral thigh flap, deep inferior epigastric flap, scapular and parascapular deep fasciocutaneous flap. RRF flap technique requires surgical expertise. In the traditional technique major arterial supply to the hand is sacrificed which can affect viability of the hand. Literature has stated to reconstruct radial artery using venous graft. Now this technique has been modified and major arterial supply is preserved now. Blood supply of this flap comes from the perforators of ulnar and radial arteries. After application of the flap vacuum assisted devices can be applied for the closure to obtain granulation tissue, early healing with better scar.

CONCLUSION

Trauma of wrist and hand with soft tissue loss is a very common emergency in our setups that can be managed effectively by soft tissue coverage using RRF flap that is local pedicle flap with excellent outcomes, minimum complications, easily obtained from donor site with good blood supply and high rate of survival as compared to other local pedicle flaps.

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