

ORIGINAL ARTICLE

USE OF REVERSE LATERAL ARM FLAP FOR COVERAGE OF ELBOW IN BURN PATIENTS

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Background: Flap coverage is superior to graft for elbow defects secondary to burns to preserve range of motion. Reverse lateral arm flap is one of the few local options available with good colour and contour match and no sacrifice of major blood vessel. There has been few clinical series describing its use. The aim of this study is to describe its usefulness in both acute and post burn deformities for coverage of elbow defects. **Methods:** Patient's record with burns and elbow defects covered with this flap was reviewed for this descriptive case series. **Results:** Six patients; three males and three females, underwent one stage reverse lateral arm flap for elbow defects from February 2012 to March 2013. Two patients had acute electrical burns, one had acute flame burn and three patients had post burn antecubital contractures. All flaps survived completely providing stable coverage and good range of motion after three months. **Conclusion:** reverse lateral arm flap must be kept in the armamentarium of a plastic surgeon for coverage of elbow defects

Keywords: Reverse lateral arm flap, Elbow, Burns, Contracture

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INTRODUCTION

Special reconstructive effort is required when elbow joint is affected by acute burn or post burn contracture. Similarly, early mobilization is mandatory to preserve range of motion. There are a few local axial flaps available around elbow joint. Reverse lateral arm flap is one of the useful options being reliable, does not sacrifice major artery, obviates the need of long term immobilization and provide adequate coverage of medium sized elbow defects. However, few case series have reported its usefulness worldwide and none in Pakistan. This case series describes usefulness of reverse lateral arm flap for coverage of anterior or posterior elbow defects due to burns with the aim of promoting its use in elbow coverage.

MATERIAL AND METHODS

After institutional approval, cases treated with reverse lateral arm flap were reviewed from February 2012 to March 2013 for this case series. Patient's characteristics were evaluated and outcome of flap in terms of complications and function were compiled.

Neurovascular Anatomy of flap: Posterior radial collateral artery, the artery of lateral arm flap, arises from radial collateral artery which in turn is branch of profunda brachii. It runs through the intermuscular septum between triceps posteriorly and brachialis and brachioradialis anteriorly supplying the overlying skin through numerous septocutaneous perforators. At the elbow, it takes a superficial course to join olecranon vascular network which is fed additionally by ulnar collateral arteries from proximally and the radial and ulnar recurrent arteries from distally. Lower lateral coetaneous nerve of arm

and posterior coetaneous nerve of forearm lie along pedicle of the flap.

Flap was designed along an axis from deltoid insertion to lateral epicondyle (figure 1b) confirming course of vessel by hand held Doppler. Anterior and posterior markings were made by pinch test so as to close donor site primarily, preferably. Dissection was performed in tourniquet control with patient supine and arm flexed on abdominal wall. Posterior incision was made first, flap elevated subfascially till inter-muscular septum reached, vessels identified (figure-1c) and perforators found running in the septum. Then distal and anterior incision were made and fascia separated from brachialis and brachioradialis upto inter-muscular septum. At the level of deltoid insertion, fascia was incised, ligating posterior radial collateral artery. Fascia was incised to the level of the humeral periosteum and the inter-muscular septum was now separated from humerus distally to the level of the lateral epicondyle. Muscle fascia was included to preserve distally based pedicles and a fasciocutaneous base was left intact. Flap was then transferred to elbow region.

RESULTS

There were three females and three males (Table-1). Mean age was 23.8 years with range 13-30 years. All flaps survived completely. In two patients with elbow contracture where defect was larger than flap size, flap was placed in centre of elbow and skin graft placed above and below the graft. It was subsequently seen in follow-up of these patients that after graft healing and subsequent contracture results in increased width of flap. Follow-up ranged from three months to one year and good range of elbow joint was observed in all patients. In first patient of our series, we observed tourniquet palsy that completely recovered in two months.

Table-1: Patient and flap characteristics

Age	Gender	Diagnosis	Location of defect	Size of flap	Donor site
26	Male	Flame burn	Anterior elbow	14*5 cm	Primary closure
20	Female	Post burn flexion elbow contracture	Anterior elbow	10*6	Primary closure
24	Male	High voltage Electrical burn	Anterior elbow	9*5	Primary closure
30	Male	High voltage electrical burn	Posterior elbow	15*9	Skin grafting
19	female	Post burn elbow contracture	Anterior elbow	9*5	Primary closure
13	Female	Post burn elbow contracture	Anterior elbow	15*6	Skin grafting



Figure-1a: flame burn of anterior elbow



Figure-1b: Design of reverse lateral arm flap

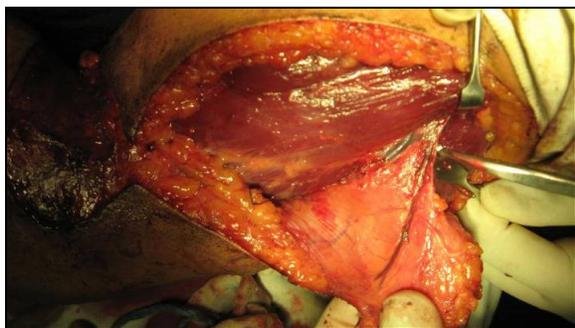


Figure-1c: Perforator emerging from main vessel



Figure-1d: Final healing of flap



Figure-1e: Donor site after primary closure



Figure-2a: Post burn flexion contracture of elbow



Figure-2b: Flap inset with partial graft loss above it



Figure-2c: Final healing with full extension of elbow



Figure-2d: Donor site after healing

DISCUSSION

Various options exist for coverage of elbow defects. Skin grafts can resurface superficial defects without exposure of vital structures. However, they carry a risk of further contracture and need prolonged immobilization.¹ Among local flaps, radial forearm flap can be rotated 90–180 degrees, however involves sacrificing a major artery that can lead to cold sensitivity of the hand.² Proximally based interosseous artery flap is good for smaller defects but involves tedious dissection of fragile and anatomically variable vessels.³ Ulnar artery forearm flap involves sacrificing ulnar artery which is a dominant vessel in 80% of cases.⁴ Brachioradialis muscle flap is suited for small defects and should not be sacrificed in the absence of elbow flexors. Lateral arm flap was described by Song

and colleagues in 1982⁵, however reverse flap based on radial recurrent was described in a case series of two patients by Maruyama and Takeuchi in 1986.⁶ Culbertson *et al.* in 1987 described another lateral arm flap based on recurrent interosseous artery.⁷ There are several advantages to this flap. It has a consistent axial pedicle, with relatively easy dissection. There is no associated functional impairment and no major vessel is sacrificed. Flap is harvested in supine position and does not require intra-operative repositioning. Finally it has multiple design variations like V-Y advancement, rotation advancement and complete island flap.

There are many reports of usefulness of reverse lateral arm flap for elbow coverage. Flap has been used to cover elbow defects due to high voltage electrical injury⁸, post burn antecubital contractures⁹, olecranon bursitis¹⁰, avulsion injury¹⁰ and posterior elbow defects¹¹. Recently a two staged reverse lateral arm flap has been described in three patients for complex post traumatic elbow defects.¹² Our patients belonged to burn group with three falling into acute burn group and two post burn contractures. Flap can be used for medium sized defects following contracture release with donor site closure, however for severe contractures, skin grafts need to be placed above and below the flap to cover the whole defect. However it still is beneficial as the joint area is covered with flap. Immobilization only is required for healing of graft. Graft when healed, subsequently contracted and results in increased width of flap. We have observed this phenomenon in two of our patients.

We observed a major complication in first of our patient and that was tourniquet palsy. Patient had paralysis of median, ulnar, radial and musculocutaneous nerves. Nerve conduction proved it to be neurapraxia and he recovered completely in two months. The cause of palsy was identified as faulty gauge of tourniquet leading to unusual high pressure and was discarded. The incidence of peripheral nerve lesions is one in 5000 for the arm.¹³ The arm palsies fall into two main groups: the largest group involved median, ulnar and radial nerves below the tourniquet, while the slightly smaller group comprised isolated radial nerve lesions. Usual pathology is neurapraxia resulting in demyelination and localized block that recovers in four to five months.¹⁴ The main cause of palsy is pressure that affects larger fibres and relative

sparing of sensation compared with motor function. The main cause of tourniquet paralysis is excessive pressure. This is avoided easily if the apparatus has an accurate gauge. Faulty anaeroid gauges have been reported frequently.¹⁴ As a rule, the sensory changes pass rapidly, whereas the motor symptoms last much longer. However, the overall prognosis is good.¹³

CONCLUSION

Reverse lateral arm flap has a reliable anatomy and should always be considered for elbow defects. It is especially useful in burn patients to prevent further contracture formation and to treat antecubital contractures with early rehabilitation to achieve good range of elbow motion.

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