

A Comparative Study between Lateral Forearm Fasciocutaneous Flap and Brachioradialis Muscle Flap for Correction of Post-Burn Elbow Flexion Contracture

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ABSTRACT

Background: Burn is a major catastrophe, Post burn contractures are a frequent and late complication after burn insult. Cubital fossa contracture might severely impair elbow joint motion which is essential for upper extremity functions. Sufficient elbow extension with an acceptable aesthetic outcome is the main objectives of contracture release. The aim was to evaluate the value of use of two local flaps for the reconstruction of postburn elbow contractures; comparing lateral forearm fasciocutaneous flap versus the brachioradialis muscle flap with reporting their advantages and disadvantages.

Methods: This is a prospective study of 16 patients with elbow flexion contracture deformity; Patients were equally divided randomly into two groups; Group A was operated with lateral forearm fasciocutaneous flap and Group B was operated by brachioradialis muscle flap.

Results: The studied groups were 16 patients: 4 ♀ (25%) and 12 ♂ (75%) Mean age was $13.17 \pm$ years with range 1.8-42 years. Follow-up ranged from three months to one year. All flaps survived completely. Good range of elbow joint was observed in all patients except one case with severe elbow contracture corrected with brachioradialis muscle flap.

Conclusion: Local flaps could be considered as a good option for resurfacing the defects after post-burn elbow contractures release whenever possible.

Key Words: Burn – Contracture – Cubital fossa – Forearm.

INTRODUCTION

The cubital fossa contracture is a frequent and late complication after burn injury [1], it results in elbow flexion deformity, and it is often associated with other joint contractures [2], this contracture might severely impair elbow joint motion which is essential for upper extremity functions [3].

Direct release of an elbow scar contracture may disclose a large anterior soft tissue defect [4,5], also it might expose important antecubital structures

such as neurovascular bundle, tendons, bones, or joint, that should be covered [5,6].

Many surgical techniques have been suggested for postburn reconstruction of antecubital fossa contracture [7], such as skin grafting, Z-plasty, Y-V flaps, local or distant fasciocutaneous flaps, muscle or myocutaneous flaps, free flaps, tissue expanders and non-surgical orthotics [8].

Sufficient elbow extension with an acceptable aesthetic outcome is the main objectives of contracture release [8]. Other goals include early mobilization and rehabilitation that should be considered to avoid risk of stiffness and functional impairment of elbow joint [6].

In this study, we aimed to evaluate the value of use of two different local flaps for the reconstruction of postburn elbow contractures; comparing lateral forearm fasciocutaneous flap versus the brachioradialis muscle flap with reporting their advantages and disadvantages.

PATIENTS AND METHODS

This is a prospective study of 16 patients with postburn sequel including elbow flexion contracture deformity; the patients were presented to the authors at the Plastic and Reconstructive Surgery Unit of Zagazig University Hospitals, the study period extended from January 2014 to June 2015. Patients were divided randomly into two groups; Group (A) included 8 patients operated with lateral forearm fasciocutaneous flap and Group (B) included 8 patients were operated by brachioradialis muscle flap. Clinical preoperative and postoperative photographic documentation of the contracture were taken.

Inclusion criteria:

- 1- All contractures were cutaneous Postburn Broad-band contracture of the cubital fossa (flexor, radial and ulnar surfaces).
- 2- All patients were examined clinically and degrees of contracture severity were classified into mild, moderate and severe severity as described by Schneider et al., (2006) [9] (Table 1).

Table (1): Range of motion of elbow flexion contracture severity.

Mild	Moderate	Severe
140-93°	92-46°	<46°

- 3- All scars were mature, at least 9 months apart from the time of burn insult.

Flap description:**Brachioradialis muscle flap (B.M.F):**

A dorsoradial skin incision is made directly over the muscle course between the lateral epicondyle to the distal third of forearm. The tendon insertion is divided and the muscle is elevated in a proximal direction until the main vascular pedicle entering the proximal deep muscle belly is visualized. Then the muscle is transferred and sutured

over the defect, and the muscle is covered by a partial thickness skin graft (Figs. 1,2).

Lateral forearm fasciocutaneous flap (L.F.F):

It is designed after release of antecubital contracture, dimensions of defect is centered over lateral forearm skin on a line extending from lateral epicondyle till the distal forearm, dissection is carried on in a proximal direction till lateral epicondyle, then the flap is turned on the antecubital fossa defect, and the donor site is skin grafted (Figs. 3,4).

RESULTS

The studied groups were 16 patients: 4 females (25%) and 12 males (75%) Mean age was 13.17 ± years with range 1.8-42 years.

All flaps were survived completely. Follow-up ranged from three months to one year.

Minor complications: Bulky cubital fossa, Scar enlargement, Wound infection, Partial loss of skin graft (Fig. 5).

Good range of elbow joint motion was observed in all patients except one case with severe elbow flexion contracture corrected with brachioradialis muscle flap (Table 2).

Table (2): Cases of post-burn elbow burn contractures.

No.	Age (ys)	Sex	Type of burn	Contracture degree	Duration since burn (ms)	Type of flap	flap size (cmxcm)	Complication	Outcome
1	4	♂	Fire	Mild	10	*L.F.F	11x5	–	Good
2	9	♂	Fire	Mild	12	**B.M.F	Whole muscle	Bulky cubital fossa	Good
3	1.9	♂	Scald	Moderate	9	L.F.F	9x4.5	Scar enlargement	Acceptable
4	18	♂	Fire	Severe	10	B.M.F	Whole muscle	Insufficient extension	Reoperation
5	42	♀	Fire	Mild	14	L.F.F	14x8	–	Good
6	8	♂	Fire	Mild	10	B.M.F	Whole muscle	–	Good
7	1.8	♂	Scald	Moderate	9	L.F.F	9x4	–	Good
8	18	♀	Scald	Moderate	14	B.M.F	Whole muscle	–	Good
9	13	♂	Scald	Severe	10	L.F.F	12x6	Wound infection	Good
10	16	♂	Fire	Mild	12	B.M.F	Whole muscle	–	Good
11	2	♀	Scald	Moderate	9	L.F.F	9x5	–	Good
12	9	♂	Fire	Mild	10	B.M.F	Whole muscle	–	Good
13	32	♂	Electric	Mild	11	L.F.F	14x9.5	–	Good
14	17	♂	Scald	Moderate	15	B.M.F	Whole muscle	–	Good
15	11	♂	Fire	Mild	11	L.F.F	11x6	Partial loss of skin graft	Good
16	8	♀	Fire	Mild	9	B.M.F	Whole muscle	–	Good

*L.F.F: Lateral forearm flap.

**B.M.F: Brachioradialis muscle flap.

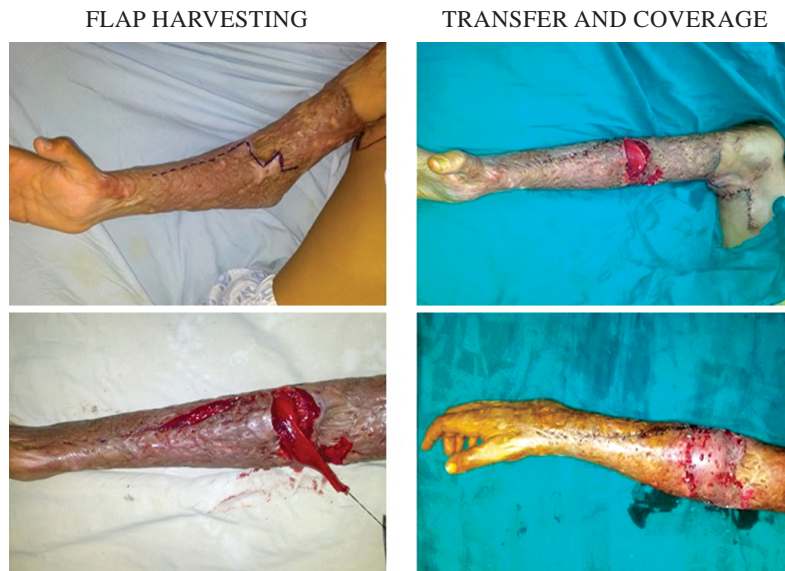


Fig. (1): Brachioradialis muscle flap; operative technique.



Fig. (2): Brachioradialis muscle flap; pre and late post-operative view.

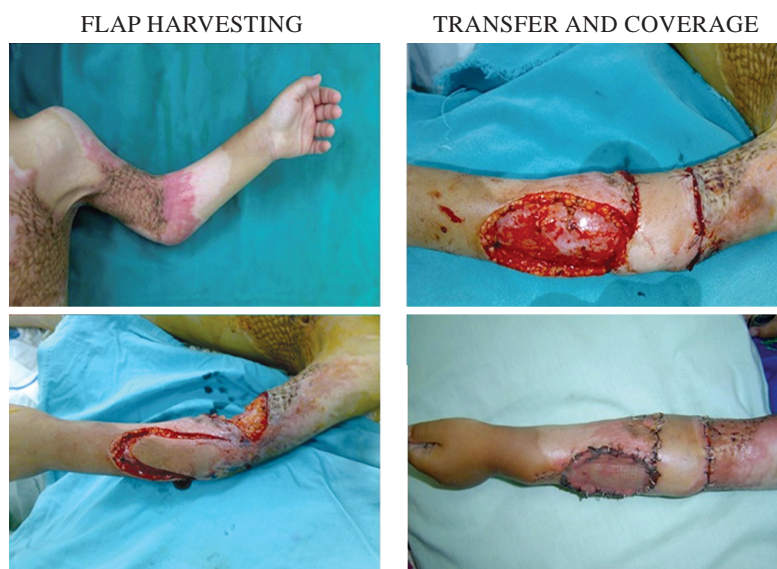


Fig. (3): Lateral forearm fasciocutaneous flap; operative technique.



Fig. (4): Lateral forearm fasciocutaneous flap; pre and late post-operative view.

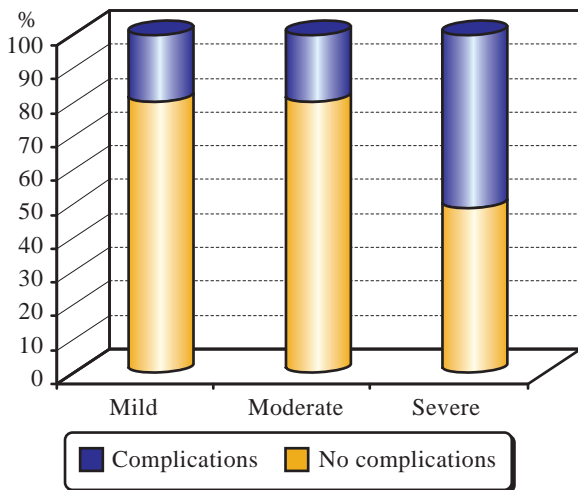


Fig. (5): Incidences of complications related to different contracture degrees.

DISCUSSION

Post burn contractures are still a significant problem in the developing countries [10], where deep burn victims would suffer from the several joint contractures especially after suboptimal primary care and improper management [4,11]. These patients cannot afford the cost of proper care and therefore they are reluctant to prolonged use of splintage, pressure garments, physiotherapy and rehabilitation [10].

Several literatures had advocated correcting postburn deformities after final scar maturation, as Operating an immature scar is technically more cumbersome and will lead to a higher number of complications [12,13,14].

The use of skin graft after release of elbow contracture although it is possible and common in coverage of skin defects, is not preferred. Several authors had been mentioned that it would not be

beneficial, since it had a high tendency to shrink, leading to recontracture [15], Additionally, antecubital exposed tendons or neurovascular structures cannot be covered with skin grafts [7], also it requires prolonged splintage and physiotherapy with the risk of elbow stiffness [6,7].

The use Free Flaps might be limited because of a paucity of appropriate donor sites because of extensive burn tissue destruction, in addition the patient usually has several joint contractures [12].

The use of local flaps has several advantages; they provide better coverage with full thickness resurfacing of cubital fossa, with no risk of recurrence of contracture [10,16].

Also local flaps, allow early mobilization, avoid positional discomfort and minimize the risk of shoulder stiffness resulting from prolonged immobilization as occurred with distant flaps like the abdominal flaps [10,17,18]. Local Flaps do not need rigorous post-operative splinting and physiotherapy and they grow with age especially in children [10].

The B.M.F is characterized by a superficial course and an axial, consistent and robust vascular anatomy as well as a wide arc of rotation; [5,17,19], during this study; its harvesting was easy and safe with no risk of injury to the vessels supplying the muscle.

During this study; in the postoperative follow-up period, we had one patient with insufficient elbow extension, where the resulting defect after contracture release was larger than the muscle flap size, that the muscle is not quite large enough to cover the entire defect, it provided an adequate coverage of the deep neurovascular structures in center of elbow, and skin graft was placed over the rest of the defect, so it is recommended mainly

in small sized defects. Our results were consistent with those by Rohrich [19] and Reece, et al., [5].

The main reported disadvantage of B.M.F is minimal functional morbidity when it is removed; as it is a secondary flexor of the elbow [5,19] also one case in our study was complaining of a bulky swelling in his cubital fossa, this was diminished a few weeks later after surgery.

The lateral forearm flap embraces a very thin pliable skin and subcutaneous tissue [20], during the study flap harvesting was quite simple and straightforward with no flap loss or venous congestion.

In this study, it was possible to harvest a large dimensional flap to resurface from small to moderate-sized defects after release of severe elbow contractures, this is agreed with the indication mentioned by Lanzetta, et al., [20], the donor site after harvesting L.F.F was covered by partial skin graft in all cases, which was considered its main disadvantage.

In this study we had noticed that in cases of broadband contractures extending to neighboring skin beyond the cubital fossa; when using this skin in flap design, sometimes we had to harvest a larger flap as the scarred skin was less pliable and less expandable, so we agreed with the observation of Aslan [8], Ogawa & Pribaz [21] and Kamolz [12] in their studies.

Also El-Khatib, [16] stated that the in most cases of burn cases, injury is limited to the skin and superficial subcutaneous tissue, the vasculature of the deeper fascia is spared so a scarred skin in a fasciocutaneous flaps could be safely elevated and transferred to close an open wound.

Conclusion:

Local flaps could be considered as a good option for resurfacing the defects after post-burn elbow contractures release whenever possible. The flap selection must keep in consideration the characteristics of the defect and the availability of neighboring local unscarred tissues. Harvesting a local flap is technically simple; it permits a single stage correction of the deformity with minimal residual morbidity and gives good results.

Both B.M.F and L.F.F provide effective local flap coverage for antecubital fossa, but B.M.F is a little bit small so it suits small defects, on the other hand the lateral forearm fasciocutaneous flap can be utilized for coverage of small and medium sized defects.

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