Original Article

Coverage of The Defects in The Vicinity of Elbow by Reverse Flow Lateral Arm Flap.

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Abstract:

Objective: Reconstruction of soft tissue defects in and around the elbow requires stable and durable coverage in order to initiate early mobilization along with less post- operative complications. This study aimed to evaluate the outcome of reconstruction of soft tissue defect in and around the elbow by Reverse Lateral Arm Flap.

Materials &method: This is a Prospective type of observational study done in the Department of Burn & Plastic Surgery, Dhaka Medical College and Hospital. In this study 15 cases of soft tissue defects around the elbow covered by Lateral arm Flap were reviewed from January 2017 to December 2019**.**

Results: In this study, majority of the respondents were in age group 44-66 years (40%), 9 were male, majority of wound was in cubital fossa (66.66%), most causes of defects for flap coverage were electric burn (5) & burn contracture (5). All the flaps survived well with the exception of 2 where distal 2 cm were lost.

Conclusion: Single stage Reverse Flow lateral Arm Flap is a useful and reliable armamentarium for the reconstructive Surgeon.

Keywords: Reverse Flow, Scar, Contracture, Skin graft, Burn.

Introduction:

Reconstruction of soft tissue defect in and around the elbow is of great concern for the Plastic Surgeons since it is a difficult region to reconstruct from a functional point of view.

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The elbow is also particularly prone to trauma due to its position and high mobility.A multitude of reasons can lead to elbow soft tissue defects including trauma, contracture release, tumor excision, burn, infection and congenital anomalies1[1-3].The principle of reconstructing the elbow defect requires stable and durable coverage with flexible and adaptable tissue, allowing repetitive motion of flexion and extension and authorizing an early mobilization to limit stiffness and contracture risks[4]. Therefore, skin grafts are often not suitable due to the resulting secondary contracture, range of motion limitation and lack of padding over a pressure point.

Considering this, fasciocutaneous flaps from either regional or distant areas are suitable for elbow defect reconstruction and can provide both

stable and durable tissue coverage. Reverse lateral arm flap (RLAF) is one kind of fasciocutaneous flap that has been showing promising result in coverage of elbow soft tissue defect[5]. RLAF is recommend to use in small to medium sized defects over the anterior and posterior aspects of elbow. Katsaroset al. further reported anatomical details and clinical applications of the flap in 1984, and it subsequently gained popularity in the West[6].

The RLAF provides advantages such as being reliable, does not sacrifice major artery, provides good aesthetic result, obviates the need of long-term immobilization, prevents elbow stiffness and provide adequate coverage of medium sized elbow defects [7]. Additionally, it spares the need for skin grafting and donor site wound can be closed primarily up to 6cm[8].

Methods:

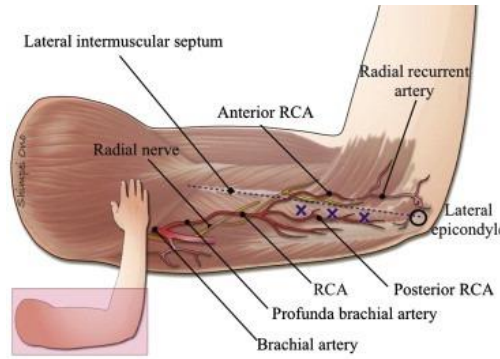
This is a Prospective type of observational study done in the Department of Burn & Plastic Surgery, Dhaka Medical College and Hospital. Total number of 15 patients who were undergoing soft tissue reconstruction in elbow through reverse lateral arm flap were included in this study according to inclusion and exclusion criteria. Informed written consent was taken from each patient. All patients underwent detail history taking, clinical examination & relevant investigations. The procedure was conducted following standard guideline and the patients were followed up post-operatively, during discharge, at 14th, 30th, 45th day and at 3 months. Post-operative management was ensured according to standard guideline. The data collection was done through a pre-structured questionnaire. Collected data were analyzed using the statistical software SPSS-20.

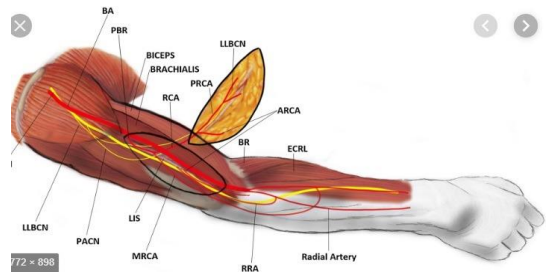
Table I: Sex distribution of the study population (N=15)

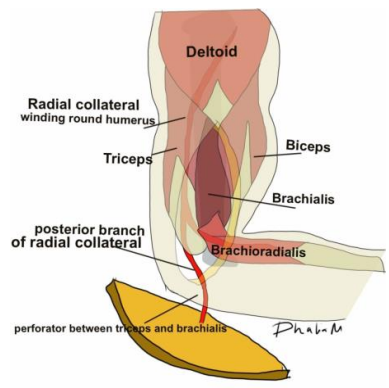
Gender	Number	Percentage
Male	8	53.3%
Female	7	46.7%

Surgical technique:

Surgical technique: The flap is nourished through multiple septocutaneous perforators from the Posterior Radial Collateral Artery (PRCA), a branch of Deep Brachial Artery (Profunda brachii). The largest perforator is 9.7 cm proximal to lateral epicondyle.







Picture: Vascular anatomy

The central axis of the flap is designed on a line drawn from the deltoid insertion near the midpoint of humerus to the lateral epicondyle, which corresponds to the lateral intermuscular septum (LIMS). The flap outline was marked with its upper edge close to the deltoid insertion according to the size of the defect.

The patient is placed in a supine position with the arm lying across the chest and elbow in flexion. The incision was first carried out along the posterior margin of the flap down to the fascia and dissection is continued in a subfascial plane towards the LIMS.

Table III: Site involvement of the study population (N=15)

Site	Number	Percentage
Cubital Fossa	11	73.3%
Back of Elbow	2	13.3%
Lateral Site of Elbow	2	13.3%

The deep fascia is easier to approach from this direction since there are no triceps muscle fibers taking origin from the posterior aspect of the lateral inter muscular septum while fibers of the brachioradialis arise directly from its anterior aspect. During dissection PRCA is visualized close to the insertion of the LIMS into the humerus; it is exposed along the entire length from the deltoid insertion to the lateral epicondyle

Picture: Flap design

Picture: Patient positioning

The artery can easily be located with a hand-held Doppler probe preoperatively if confirmation is required specially in trauma and electric burn patient. The PRCA sends several septal perforating vessels that supply the skin over the lateral arm and they should be meticulously preserved. Two cutaneous nerves are encountered during dissection; the posterior cutaneous nerves of the arm and forearm. Both arise from the radial nerve in the spiral groove and pass superficially within the LIMS. They are frequently sacrificed although preservation is possible with cautious dissection. Care should be taken to avoid injury to the radial nerve which is just anterior to the PRCA for a short distance prior to entering the space between Brachialis and Brachioradialis muscle.

Picture: Flap dissection

The vascular pedicle and the cutaneous nerve branches are dissected out and separated from the Radial nerve and the skin is then incised along the anterior border of the flap. Here sharp dissection is necessary to divide the fibers of the Brachialis

and Brachioradialis muscles from the LIMS and any muscular and periosteal branches of PRCA are clipped and divided or cauterized with bipolar diathermy. The vascular pedicle is transected proximally and the flap is elevated in a proximal to distal direction, ensuring inclusion of the vessels and perforators lying within the LIMS. The PRCA anastomoses with the radial and interosseous recurrent arteries around the lateral epicondyle, and sufficient number of adipose tissues and its underlying fascia should be included with the distal vascular pedicle for the purpose of protection and enhancement of the arterial input and venous drainage of the flap. The skin bridge between the donor site and recipient wound is incised and the distally based island flap is then transposed to resurface the defect.

Picture: Flap elevation

Results:

Results: In this study, majority of the respondents were in age group 44-66 years (40%). The mean age was 35.8±17.08 (SD) years, 9 were male and

No.	Age	Sex	Site	Cause of defect	Wound size	Flap size	Joint movement	Donor site	Flap survival
1	65	M	Back of elbow joint	Tumor	14x11	15x12	Normal	STSG	100%
2	25	F	Cubital fossa	Electric burn	11x5.5	12x6	Normal	Primary closure	100%
3	14	M	Cubital fossa	Electric burn	14x6.5	15x7	Restricted	STSG	Distal 2 cm loss
4	15	F	Cubital fossa	Burn contracture	9x5	10x6	Normal	Primary closure	100%
5	35	F	Cubital fossa	Burn contracture	8x5	9x6	Normal	Primary closure	100%
6	45	M	Cubital fossa	Tumor	9x6	10x7	Normal	STSG	100%
7	15	M	Lateral site of elbow joint	Electric burn	8x4.5	9x5	Normal	Primary closure	100%
8	30	F	Cubital fossa	Burn contracture	11x6	12x7	Normal	STSG	100%
9	50	M	Cubital fossa	Burn contracture	8x4.5	9x5	Normal	Primary closure	100%
10	55	M	Back of elbow joint	Trauma	9x5	10x6	Normal	Primary closure	100%
11	35	M	Cubital fossa	Trauma	11x6.5	12x7	Normal	STSG	100%
12	12	F	Cubital fossa	Burn contracture	10x6.5	11x7	Normal	STSG	100%
13	50	M	Cubital fossa	Burn contracture	11x7.5	12x8	Normal	STSG	100%
14	31	F	Lateral site of elbow joint	Trauma	10x6.5	11x7	Restricted	STSG	Distal 2 cm loss
15	60	M	Cubital fossa	Electric burn	9x6.5	10x6	Normal	STSG	100%

6 were female. Majority of wound was in cubital fossa (66.66%). The flap coverage required in 5 patients for electric burn, 5 patients for burn contracture, 3 patients for traumatic wound and 2 patients for malignant disease. All respondents' dominant hand was right hand. The dimension of the wound ranged from 8 to 14 cm in length with a mean length of 10.13 cm and from 4.5 to 11 cm in width with mean value of 5.8 cm. The dimension of the flaps ranged from 9 to 15 cm in length with a mean length of 11.13 cm and from 5 to 12 cm in width with mean value of 6.8 cm.

All the flaps survived well with the exception of 2 where distal 2 cm were lost. The problem was solved by split thickness skin graft. We used SPY technology for the flap with the highest dimension (15 cm x 12 cm) to see its chance of survival after elevation and inset of the flap. In nine cases donor sites were closed by split thickness skin graft. Aesthetic results of the donor site were satisfactory. After 3 weeks most of the patients gained the full range of movement of the elbow joint except two joints.

Table IV: Cause of the study population (N=15)

Cause	Number	Percentage
Burn Contracture	5	33.3%
Electric Burn	5	33.3%
Trauma	3	20.0%
Tumor	2	13.3%

Table V: Functional Joint Movement of the study population (N=15)

Joint Movement	Number	Percentage
Normal	12	80%
Restricted	3	20%

Table VI: Donor site closure of the study population (N=15)

Donor Site Closure	Number	Percentage
STSG	9	60%
Primary Closure	6	40%

Table VII: Outcome of the study population (N=15)

Outcome	Number	Percentage
Survival	13	86.67%
partial flap loss	2	13.33%

Discussion:

Among the respondents, the average age of the patients was 35.8 years with a majority of the in-age group 44-66 years (40%). Ashfaq did a similar study and observed a mean age of 23 years (Ashfaq, 2014) .Prantl et al. used reverse lateral arm flap in age group of 40-70 years(Prantl et al., 2008)9. Islam et al. used this flap in 9 patients ranged from 23-46 years, average 31.8 yreas10(Islam et al., 2017). 60% of the patients were male. Prantl et al. also observed male predominance in similar ratio (Prantl et al., 2008). Babu et al. also observed 85% of the patients were male, 15% were female11(Babu et al., 2017).

Aetiology of soft tissue defect in this study were electric burn and burn contracture release in 33.34% each. Prantl et al. used this flap for coverage of defect from excision of chronic bursitis, septic bursitis, chronic osteomyelitis, excision of histiocytoma and release of post burn scar contracture (Prantl et al., 2008). Huang et al. used this flap in patient with post oncological resection defect12(Huang et al., 2016). Aetiology of Devale et al. studies were post traumatic soft tissue defect around elbow.66.66% of them had their soft tissue defect on cubital fossa and 15% had on posterior surface. Nakao et al. showed 12 patients with cubital fossa defect undergo this flap reconstruction.

Wound length ranged from 8 to 14 cm in length with a mean length of 10.13 cm and from 4.5 to

11 cm in width with mean value of 5.8 cm13.The dimension of the flaps ranged from 9 to 15 cm in length with a mean length of 11.13 cm and from 5 to 12 cm in width with mean value of 6.8 cm. Prantl et al. used this flap with wound size 4 cm to 10 cm , flap dimension ranged from 15 cm to 8 cm (Prantl et al., 2008). Tripathy et al. used this flap with a maximum dimension of 18×8 cm and minimum 10×6 cm (Tripathy et al., 2010). Post-operative complications including distal flap necrosis in 2 cases. Di Summa et al. showed 1 reverse lateral arm flap developed distal flap necrosis requiring secondary flap procedure (di Summa et al., 2020). In this study donor site defect is closed primarily if it is not wider than 6 cm. Tripathy et al. (2010) can close donor site if flap was up to 6-7cm, they consider grafting in donor area as a major disadvantage.

Conclusion:

As a single-stage procedure with a reliable and constant vascular anatomy and the pliable nature of the tissue, the Reverse Flow Lateral Arm Flap has become a very useful and popular armamentarium to the Reconstructive and Hand surgeons to cover the wound around the elbow It is especially useful for the burn patients to help prevent contracture formation and also relieve of established burn contracture. Possibility of early mobilization helps regain full range of motion.

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