Journal of Bangladesh College of Physicians and Surgeons
Vol. 43, No. 2, April 2025

Clinical Outcome of Radial Recurrent Artery Flap for Wound Coverage in and Around the Elbow

MM RAHMAN[a], T AHMED[b], MS J KHAN[c], MMR KHAN[d], MS ISLAM[e]

Abstract

Introduction: ***Reconstructive surgeons frequently deal with the treatment of intricate elbow wounds. Burns, road traffic accidents, workplace accidents, tumor excision, post-burn scar contracture release, difficulties with orthopedic reconstruction, etc. are some of the etiologies of wounds. Stable soft tissue covering is required for reconstructive purposes, but early mobilization is permitted to preserve a range of motion. In addition to offering long-lasting coverage for medium-sized elbow deformities, flap coverage, particularly radial recurrent artery flap also promotes early elbow joint range of motion. The aim of the study was to evaluate the clinical outcome of radial recurrent artery flap for coverage of wounds in and around the elbow.***

Materials & Methods: ***This prospective type of observational study was conducted in the Department of Plastic Surgery, Dhaka Medical College and Hospital, Dhaka. Twenty patients were selected according to inclusion and exclusion criteria over 17 months from October 2016 to February 2018. The patients were kept under follow-up of at least 8 weeks postoperatively. Findings of observation were recorded in a preformed data collection sheet and all data were compiled in a master table for analysis.***

Result: ***Total 20 patients were analyzed, where majority of the injured patients (80%) were male. Of them electric burn was 55%, followed by trauma (15%), flame burn (10%), contact burn (5%) and others. Radial recurrent artery flap was used to cover the cubital fossa in 13 patients (65%), the posterior aspect of the elbow in 05 patients (25%), and amputation stump in 02 patients (10%). Here, the mean dimension of the wound was 80.8 cm^2 and the mean dimension of flap was 70.43cm^2. 16 patients recovered without any complications following the reconstruction. Out of 20 cases, only 4 cases have restriction of elbow extension preoperatively. After post-surgical physiotherapy the range of movement was improved significantly in these cases.***

Conclusion: ***This study showed that Radial Recurrent Artery Flap is a suitable option for coverage of soft tissue defects in and around the elbow joint. It is a single stage procedure allowing early mobilization and thereby preventing stiffness of the elbow joint.***

Keywords: ***Radial recurrent artery flap, elbow joint, STSG (Split Thickness Skin Graft)***

(J Bangladesh Coll Phys Surg 2025; 43: 139-144)
DOI: https://doi.org/10.3329/jbcps.v43i2.80809

1. Dr. Mohammad Mahbubur Rahman, Assistant Professor, Department of Plastic Surgery, Noakhali Medical College, Noakhali, Bangladesh.
2. Dr. Tanveer Ahmed, Associate Professor, Department of Plastic Surgery, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh.
3. Dr. Mohammad Saneat Jahan Khan, Associate Professor, Department of Plastic Surgery, Faridpur Medical College, Faridpur, Bangladesh.
4. Dr. Mohammad Mominur Rahman Khan, Junior Consultant, Department of Plastic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh.
5 Dr. Md. Soriful Islam, Assistant Professor, Department of Plastic Surgery, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh

Address of Correspondence: Dr. Mohammad Mahbubur Rahman, Assistant Professor, Department of Plastic Surgery, Noakhali Medical College, Noakhali, Bangladesh, Mobile: 01712717409, Email:rdrmahbub@gmail.com.

Received : 21 September, 2024 Accept: 04 January, 2025

Introduction:

The radial recurrent artery flap was first elaborated by Maruyama and Takeuchi in 1986 as the 'Reverse Upper Arm Flap' depicts the pertinent anatomy.[1]The artery usually originates below the elbow, directly proximal to the brachial artery bifurcation, or from the radial artery. It serves the elbow and the supinator as it ascends. It also passes behind the brachio-radialis and between the superficial and deep branches of the radial nerve before ending up in the lateral intermuscular septum, which runs between the triceps and the brachialis.[2-5]When an acute burn or post-burn contracture affects the elbow joint, more reconstructive work is needed. In a similar vein, the range of motion must be preserved through early mobilization.[6] In Bangladesh, burn injuries are prevalent. With an incidence rate of 243.8 per 100,000 persons annually and a population of 150 million, it

was projected that burn and electrical injuries caused more than 365,000 injuries each year in Bangladesh, both fatal and non-fatal.[7] As per the Accident Research Centre (ACR) report conducted by BUET, Bangladesh has a relatively high road accident fatality rate, with approximately 60 deaths per 10,000 vehicles annually, compared to just 2 in the United States. In Bangladesh, factors contributing to traffic accidents include urbanization, fast population increase, lack of funding for road safety, violation of traffic rules by drivers and pedestrians, unplanned roads and highways, incomplete road construction works, faulty vehicles on the road, etc.[8] Conventional procedures for reconstructing soft-tissue lesions at the elbow are challenging due to the difficulty of transferring sufficient tissue with appropriate flexibility and sensitive skin. Early mobilization following surgery is necessary to prevent long-term functional damage. The causes of elbow anomalies include surgical wound dehiscence, which exposes bone implants after therapy for elbow fractures, post-traumatic wounds, severe burn injuries, and wounds from tumor excision.[9] Regardless of size or depth, elbow defects should be treated with any modality that allows for early mobility and functional rehabilitation to close the defect and lower the risk of functional deterioration.[10] The radial forearm flap is one of the local flaps that can be rotated 90–180 degrees, however doing so requires sacrificing a major artery, which may cause the hand to become sensitive to cold temperatures.[11]

Elbow defects needs early reconstruction and mobilization for better functional outcome. Before reconstruction we should consider good functional restoration, early mobilization, donor and recipient site morbidity.[12] Among the reconstructive options of elbow defects- skin graft causes delayed elbow mobility and later joint stiffness, radial forearm flap causes sacrifice of major vessels, distant pedicle flaps causes bad patient compliance and later flap division and more hospital stay, free flap is time consuming and technically challenging. On the other hand, radial recurrent artery flap provides- durable, sensate flap coverage; good color and texture match; single stage procedure; less hospital stay; can allow early mobilization and thus prevent elbow stiffness.[13] So, to find out the clinical outcome, we ran this kind of investigation.

Materials & Methods:

This prospective type of observational study was conducted in the Department of Plastic Surgery, Dhaka Medical College and Hospital, Dhaka. Patients were selected according to inclusion and exclusion criteria over 17 months from 1st October 2016 to February 2018 where the sample size was 20. Wounds in and around the elbow region(eg.burn, tumor excision, trauma, road traffic accident, work place accident, post-burn contracture release, etc.) necessary for flap coverage were among the inclusion criteria. Patients with potential injuries to the pedicle of the donor site due to previous trauma or surgery and patients with significant co-morbid conditions either with psychiatric disorders or with poly-trauma and other life-threatening injuries were excluded from the study. The patients were kept under follow-up of at least 8 weeks postoperatively. Findings of observation were recorded in a preformed data collection sheet and all data were compiled in a master table first. Statistical analysis of the results was obtained by using a statistical formula and calculator.

Surgical technique: Radial recurrent artery flap is a fascio-cutaneous flap. The axis of the flap is a line drawn from lateral epicondyle to deltoid muscle insertion. Maximum diameter of the flap is 20x14 cm. Donor site can be closed primarily, if flap width is less than 6 cm (Figure 1 and 2).

Figure 1: *Radial recurrent artery flap design*

Figure 2: *a) Elbow wound, b) Flap inset, c) Follow up 4 weeks postoperatively, d) Elbow wound in another patient, e) Wound creation & flap elevation, f) follow up 1week postoperatively.*

Results

In this study mean age of the patients was 25.4 years. The standard deviation (SD) is 12.46. The age range was 05 to 50 years. Maximum cases were 16-25 years of age. Most of the patients were male (80%) and 50% of the patients received only primary education. 45% of the patients were students and the rest were service holders, housewives, farmers, day laborers, and boatmen (Table I).

Most of the injuries happened due to electric burns (55%) and trauma (15%). Other causes were flame burn (10%), contact burn (05%), tight plaster (05%), the release of post-burn scar contracture (05%), and excision of squamous cell carcinoma (05%). In this study sites of soft tissue defects for flap coverage were cubital fossa in 13cases (65%), the posterior aspect of the elbow in 5 cases (25%), and amputation stump in 2 cases (10%) (Table II).

Mean wound length was 11.28 cm and width was 7 cm. Mean dimension of the wound was 80.8 cm^2. Flap length was 13.3 cm, width was 5.28 cm, and the mean dimension of flap was 70.43cm^2 (Table III).

In our study marginal flap loss in one case (05%), partial flap loss in two cases (10%), and total flap loss in one case (05%) was found. No history of graft loss. Donor sites of flaps and skin grafts healed well. 16 of the patients (80%) showed no complications (Table IV).

Table-I

Demographic profile of the study patients (n= 20)

Demographic Characteristics	Frequency	Percentage (%)
Age		
0-15	4	20
16-25	8	40
26-35	4	20
36-45	3	15
46-55	1	5
Total	20	100
Gender		
Male	16	80
Female	4	20
Total	20	100
Education		
Primary school	10	50
Secondary school	4	20
Higher Secondary school	6	30
Total	20	100
Occupation		
Service	4	20
Student	9	45
House wife	2	10
Farmer	2	10
Day labour	2	10
Boatman	1	5
Total	20	100

Most of the cases 16(80%) showed excellent outcomes. Good outcomes in three cases (distal marginal and partial flap loss) and poor outcomes in one case (total flap loss) (Table V).

80% of the cases (16) have no preoperative restriction of range of elbow movement. Four cases (20%) have some restriction of elbow joint movement preoperatively. After post-surgical physiotherapy range of movement improved significantly(Table VI).

Table-II

Distribution of Patients by cause of injury (n=20)

Cause of injury	Frequency	Percentage (%)
Cause		
Electric burn	11	55
Trauma	3	15
Flame burn	2	10
Contact burn	1	5
Tight plaster	1	5
Release of post burn scar contracture	1	5
Excision of squamous cell carcinoma	1	5
Total	20	100
Site of soft tissue defect and flap use		
Cubital fossa	13	65
Posterior aspect of elbow	5	25
Below elbow amputation stump	2	10
Total	20	100

Table-III

Dimension of wounds and flaps (n=20)

Mean dimension of wound (cm)	
Length	11.28
Width	7
Wound	80.8
Mean dimension of flap (cm)	
Length	13.3
Width	5.28
Flap	70.43

Table-IV

Distribution of patient by postoperative complication (n=20)

Complication	Frequency	Percentage (%)
No complication	16	80
Marginal flap necrosis	1	5
Partial flap necrosis	2	10
Total flap necrosis	1	5
Total	20	100

Table-V

Distribution of patients according to overall outcome of reconstruction (n=20)

Outcome	Criteria	Percentage (%)
Excellent	Excellent flap adhesion, no infection, no flap loss	80
Good	Distal marginal flap loss, partial flap loss, hypertrophic scar over donor site	15
Poor	Complete flap loss requiring alternate procedure, wound dehiscence over donor site and subsequent ugly scar	5
Total		100

Table-VI

Distribution of patients by post-surgical range of elbow movement (n=20)

Movement	Frequency	Percentage (%)
No restriction	16	80
Restriction of extension of elbow joint	4	20
Total	20	100

Discussion:

In this study, the mean age of the patients was 25.4 years and the age range was 05 years to 50 years where the maximum cases were of 16 to 25 years of age. Similarly, study of Ayub Medical College, Pakistan used a reverse lateral arm flap with an age range from 13-30 years and a mean age of 23.8 years.[6] While considering sex, male prevalence was observed in our study. Out of 20 patients, 80% were male and 20% were female.

Aetiology of soft tissue defects such as electric burn, trauma, flame burn, and others were noticed in this study. Among them, electric burn and trauma were prime reasons for reconstruction resulting in 55% and 15% respectively. The etiology of another study[13] were trauma, cutaneous malignancy excision and radial forearm free flap donor defect whereas the study of Dhaka Medical College Hospital[12] used distally based lateral arm flap to cover elbow defects that occurred by electric burn, trauma, release of post-burn scar contracture and others. Additionally, in present study, we used this flap to cover cubital fossa in 13 cases, posterior aspect of elbow in 5 cases and amputation stump in 2 cases. Likewise, the study of Taiwan[14] used this flap in 7 patients for reconstruction of posterior soft tissue defect of the elbow and another study[15] represented that to cover cubital fossa in a patient this flap was used. Present study shows cubital fossa was mostly used site in 13 patients. In our study wound length was 11.28 cm and width was 7 cm. The mean dimension of the wound was 80.8 cm^2. Flap length was 13.3 cm, width was 5.28 cm and the mean dimension of flap was 70.43cm^2. Study of Germany[9] used this flap with a wound size of 4 to 10 cm and an average wound area of 30 to 80 cm^2, which is close to the present study. Among 20 cases in the current study, no complication was observed in 16 study cases followed by marginal flap loss in one case, partial flap loss in two cases, and total flap loss in one case. Correspondingly, the study of Dhaka Medical College Hospital[12] showed out of his 30 cases, there was marginal flap loss in 03 cases, significant flap loss in 02 cases, complete flap loss in 02 cases, and no loss in 23 cases. Therefore, almost 16 cases showed excellent outcomes, three cases (distal marginal and partial flap loss) showed good outcomes and one case showed poor outcome(total flap loss). Study of Taiwan[16] showed uneventful postoperative outcome, satisfactory cosmetic result in both donor& recipient sites, normal elbow function. There was no history of restriction of range of elbow joint movement preoperatively in 16 cases whereas only 4 cases had restriction of range of elbow joint movement preoperatively[17,18]. In these 4 cases, range of movement of the elbow joint improved significantly after post-surgical physiotherapy. Study of Ayub Medical College, Pakistan[6] used this flap in 6 patients where follow-up lasted from three months to one year and a good range of elbow joint movement was observed in all patients. Therefore, it is found that among all the alternatives, the radial recurrent artery flap is an easy and reliable option for single stage reconstruction of the anterior and posterior aspects of the elbow joint.

Limitations of the Study:

The maximum dimension of flap that can be taken to cover elbow defect was not assessed. The study was conducted in a single hospital with a small sample size. For this, the results may not represent the whole community.

Conclusion

Radial recurrent artery flap is dependable and durable with limited donor and recipient site morbidity.When reconstructing a small to moderate sized elbow defect, this is an excellent alternative and a reliable choice for covering elbow region abnormalities. Early postoperative exercise prevent later elbow joint stiffness.

Ethical approval: The study was approved by the Institutional Ethics Committee. Confidentiality was maintained. Proper permission was taken from the department and institution concerned for the study.

Recommendation

For the study to be representative, a larger sample size and more time are required. For a more accurate assessment of the outcome, a multi-centered study should be conducted and tension-filled donor site closure should be avoided.

Conflict of interest: None

References

1. Maruyama Y, Takeuchi S. The radial recurrent fasciocutaneous flap: reverse upper arm flap. Br J PlastSurg 1986;39(1):458–61.
2. Coessens B, Vico P, De Mey A. Clinical experience with the reverse lateral arm flap in soft-tissue coverage of the elbow. PlastReconstrSurg 1993;92:1133–6.
3. Devale MM, Munot RP, Bhansali CA, Bhaban ND. Awkward defects around the elbow: the radial recurrent artery flap revisited. Indian J PlastSurg 2016;49:357–61.
4. Morrison CS, Sullivan SR, Bhatt RA, Chang JT, Taylor HO. The pedicled reverse-flow lateral arm flap for coverage of complex traumatic elbow injuries. Ann PlastSurg 2013;71:37–9.
5. Revol MP, Lantieri L, Loy S, Guérin-Surville H. Vascular anatomy of the forearm muscles: a study of 50 dissections. PlastReconstrSurg 1991;88:1026–33.

6. Ashfaq F. Use of reverse lateral arm flap for coverage of elbow in burn patients; J Ayub Med Coll Abbottabad 2014;26(3):393-5.

7. Mashreky SR, Rahman F, Rahman A, Baset K Ul, Biswas A, Hossain J. Burn injury in Bangladesh: electrical injury a major contributor; Int J. Burn Trauma; 2011;1(1):62-67.

8. Biswas SK, Road Traffic Injuries:an Emerging Problem in Bangladesh; Faridpur Med. Coll.J.2012;7(1):05.

9. Prantl L, Schreml S, Schwarze H, Eisenmann M, Klein, Nerlich M. A safe and simple technique using the distal pedicled reversed upper arm flap to cover large elbow defects;Journal of Plastic,Reconstructive& Aesthetic Surgery 2008;61(2):546-551.

10. Rubayi S, Kiyono Y. Flap surgery to cover olecranon pressure ulce in spinal cord injury patients; Plast. Reconstr. Surg. J 2001;107:1473.

11. Balakrishnan G, Kumar SB, Hussain AS. Reverse-flow posterior interosseous artery flap revisited; Plast. Reconstr. Surg. J 2003;111:2364–9.

12. Khaled MS, Distally based lateral arm flap for elbow coverage, FCPS(Plastic and Reconstructive Surgery); Bangladesh College of Physicians and Surgeons, Mohakhali, Dhaka; July 2014. [FCPS Dissertation].

13. Tiernan E, Healy C. Rotation fasciocutaneous flap repair of upper limb defects; The Journal of hand surgery 19B(1):6.

14. Tung TC, Wang KC, Fang CM, Lee CM. Reverse pedicled lateral arm flap for reconstruction of posterior soft-tissue defects of the elbow. J An Plast Surg. 1997 Jun;38:635–41.

15. Culbertson JH, Mutimer K; The reverse lateral upper arm flap for elbow coverage; AnplastSurg.1987;18(1):62-8.

16. Lai CS, Tsai CC, Liao KB, Lin SD; The reverse lateral arm adipofascial flap for elbow coverage; Ann PlastSurg 1997 Aug;39 (2):196–200.

17. David LW, Alan DR. The radial recurrent artery propeller flap for elbow coverage in an extensive burn, *Journal of Surgical Case Report* June 2022; *2022(*6):rjac283, https://doi.org/10.1093/jscr/rjac283

18. Rahman MM, Ur Rahman M, Mahmood AAD, Alom N, Islam MS, Sarker MK. Assessment of Post-Operative Complications after Radial Recurrent Artery Flap for Management of Wound Coverage in and Around the Elbow Region. Bangladesh Med J [Internet]. 2024 Dec. 11;52(3):41-6.