

DONOR SITE MORBIDITY: A COMPARISON OF THE RADIAL FOREARM FREE FLAP AND ANTEROLATERAL THIGH FREE FLAP

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ABSTRACT

Objective: To compare the donor site morbidity of these two flaps in terms of wound infection, wound dehiscence, skin graft take/primary healing, sensory abnormalities, functional loss and subjective analysis of donor site appearance.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: The study was conducted at Shifa international hospital over a period of 2 years, from Jan 2015 to Apr 2017.

Patients and Methods: A total of 53 patients who demanded reconstruction, either with RFFF or ALTF were included in the study. A detail preoperative workup was performed. All the free flaps were harvested, using standard surgical techniques. The fore-mentioned variables were recorded on follow up visit.

Results: The frequency of wound infection was comparable in the two groups. ALTF group was better than RFFF group in terms of graft take (87% vs 81%), sensory deficit (37% vs 62%) and loss of function (6% vs 27%).

Conclusion: Considering its reliability, versatility, ability to provide large amount of tissue, low donor site morbidity and concealed donor site, ALTF has become our work horse flap for reconstruction of pure soft tissue defects.

Keywords: Antero-lateral thigh free flap, Donor Site Morbidity, Radial forearm free flap.

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INTRODUCTION

Plastic surgery has been revolutionized with the introduction of microvascular tissue transfer. The two most commonly employed fascio-cutaneous free flaps for reconstruction of complex composite defects after tumor excision or trauma are the Radial forearm free flap and the Anterolateral thigh flap¹.

The Radial forearm flap (RFFF), is designed and harvested from the volar aspect of the forearm and is based on the radial artery and the concomitant veins². It is well known for its advantages i.e., reliable anatomy, thinness, pliability, long and good caliber pedicle and being a potentially sensate flap. Furthermore, its use as composite osteo-cutaneous flap in reconstruction of orbital rim, small mandibular and maxillary defects, are in addition to stated above³. However, some drawbacks of the flap have also

been reported. These include poor graft take leading to tendon exposure, visible forearm donor site⁴, and significant hand edema and stiffness in cases of large flap harvest⁵.

The Anterolateral thigh flap (ALTF), is designed on septo-cutaneous or musculo-cutaneous perforators of the descending branch of the lateral circumflex femoral artery⁶. It has a good sized pedicle, can be thinned down to 3-5mm thickness, potentially sensate flap, can offer large amount of skin with the ability to incorporate various tissue to reconstruct complex defects and above all, a concealed donor site in everyday clothing⁷. Despite being hidden, the morbidity associated with donor site such as paresthesia and muscle weakness cannot be ignored. This holds especially true in the scenario of large flap harvest when vastus lateralis or rectus femoris muscle is incorporated in flap design⁸ or, when motor nerve to either of the muscles is damaged during flap dissection.

Comparing the two fore-mentioned work horse flaps, some authors have shown that the

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donor site morbidity of ALTF is low when compared to RFFF. However, to our knowledge limited such statistically significant data is reported in population of the subcontinent in recent 5 years. The objective of this study is to compare the donor site morbidity of these two flaps in terms of wound infection, wound dehiscence, skin graft take/ primary healing, sensory abnormalities, functional loss and subjective analysis of donor site appearance.

MATERIAL AND METHODS

This comparative cross sectional study was conducted over a period of 2 years (January 2015 to April 2017). Patients of all age groups, presented in this study period, requiring reconstruction with either RFFF or ALTF were included in the study. The clinical indications for performing RFFF and ALTF are shown in fig-1. The patients with advanced peripheral vascular disease, arthritis of wrist, hip and knee joint, active DVT, end stage multi-organ failure and metastatic malignancies were excluded. A total of 53 patients were included in the study using consecutive non-probability sampling technique. The mean followup was 6 months.

In pre-operative settings, a comprehensive history was taken and clinical examination was performed. This was followed by appropriate imaging (magnetic resonance imaging/ computerized tomography (CT) scan) and pre-anesthesia fitness to undergo prolong surgery. The patients were categorized into two subdivisions: Group1: patients with RFFF or osteocutaneous RFFF reconstruction and group 2: patients in whom free ALTF was used to meet the reconstruction requirements.

All the free flaps (RFFF, osteocutaneous RFFF, ALTF) were harvested and microvascular anastomoses were performed by the senior consultant (MR), using standard surgical techniques. RFFFs were harvested either as fascio-cutaneous or osteo-cutaneous flaps while all ALTF flaps were elevated as fascio-cutaneous free flaps. In cases of ALTF dissection, the lateral femoral cutaneous nerve of the thigh and the

motor branches to the vastus lateralis and rectus femoris muscle were identified and preserved were possible. Similarly, superficial branch of the radial nerve was spared in RFFF dissection where it was feasible. All the RFFF donor sites were closed with a split-thickness skin graft of 16/1000-inch thickness. The donor sites of ALTF group, were either closed primarily or resurfaced with skin grafts, depending upon the size of the flap. The skin grafted donor sites were secured with bolster dressings. Splintage was applied for a period of 3 weeks in cases of osteo-cutaneous RFFF.

On follow up complete take, partial take, or complete loss of the split thickness skin graft at the donor site were recorded. The donor site was observed for signs of wound infection and it was

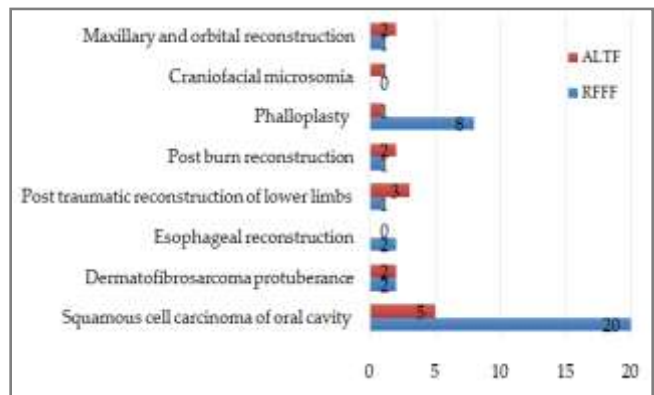


Figure-1: Clinical indications.

labelled as infected only after culture and sensitivity analysis of the wound. The primary closed donor sites of ALTF were looked for wound dehiscence. In ALTF group the anterolateral region of thigh, and in RFFF group the anatomical snuff box region of the donor limb was evaluated for sensory impairment using a cotton tip applicator. The patients reported the stimulus as normal or altered in comparison to contralateral site. In cases of RFFF, the functional impairment was scored in terms of reduced grip strength of the hand. In patients of ALTF, impairment of knee extension was recorded after assessing muscle power using MRC scale. All patients were asked to express their opinion on

the donor site appearance as good/ acceptable/ poor.

For all quantitative variables like age, mean \pm standard deviation was noted. For qualitative variables like gender, wound infection, wound dehiscence, skin graft take/primary healing,

RFFF was 8cm and average length of the flap was 7cm (range). All donor sites of RFFF were skin grafted. In cases of ALTF, 11 donor sites were grafted with split thickness skin graft and 5 were amenable to primary closures. The average width of the defect that could be closed primarily

Table-I: Descriptive statistics.

		Group A (RFFF)	Group B (ALTF)
Total number of cases		37	16
Age (years) Mean \pm SD		44.68 \pm 16.75 years	40.81 \pm 25.79 years
Gender n (%)	Male	28 (75.67)	11 (68.75)
	Female	9 (24.32)	5 (31.25)

Table-II: Comparison of Results Between RFFF and ALTF.

		Group 1: RFFF (n=37) n(%)	Group 2: ALTF (n=16) n(%)	p-value
Wound Infection	Present	2 (5.41)	1 (6.25)	0.903
	Absent	3 (94.59)	15 (93.75)	
Wound Dehiscence	Present	5 (13.51)	2 (12.50)	0.920
	Absent	32 (86.48)	14 (87.50)	
Graft Take	Primary healing	30 (81.08)	14 (87.50)	0.838
	Partial Graft take/Partial wound dehiscence	3 (8.08)	1 (6.25)	
	Complete graft loss/ Complete wound	4 (10.81)	1 (6.25)	
Sensory Deficit	Present	23 (62.16)	6 (37.50)	0.098
	Absent	14 (37.83)	10 (62.50)	
Loss of function	Yes	10 (27.03)	1 (6.25)	0.087
	No	27 (72.97)	15 (93.75)	
Subjective Aesthetic Results	Good	9 (24.32)	7 (43.75)	0.366
	Satisfactory	15 (40.03)	5 (31.25)	
	Poor	13 (35.13)	4 (25.00)	

hypertrophic scarring, sensory abnormalities, functional loss and subjective analysis of donor site appearance, percentages and frequencies were evaluated using Statistical Software for Social Sciences (SPSS version 21). Comparison between two groups was performed using chi-square test. A p -value ≤ 0.05 was considered significant.

RESULTS

A total of 53 patients were included in the study. The demographic features were assessed for each group outlined in table-I. Of all these patients, 37 underwent reconstruction with RFFF and 16 had ALTF transfer. Out of 37 cases of RFFF, osteo-cutaneous RFFF was used in 5 patients for reconstruction. The average width of

was 7cm. The average width of the flap that required skin grafting was more than 10cm.

In evaluation of donor site morbidity, in RFFF group, 2 (5%) out of 37 patients suffered wound infection. Of these cases, one patient was managed conservatively while the other underwent skin grafting again. In ALTF group, wound infection followed by complete wound dehiscence occurred in 1 patient only (6%) which was managed with conservative treatment (table-II). None of the patients with primary closed donor site of ALTF had seroma or hematoma formation.

The subjective analysis of the appearance of donor site of two fore mentioned flap is shown in fig-2.

Evaluation of graft take/primary healing of the donor site showed that 14 cases (87%) of ALTF had complete graft take/primary healing in comparison to 30 patients (81%) of RFFF. Complete loss of skin graft at donor site was observed in 4 cases (10%) of RFFF while none of

Sensory deficit was recorded, 6 patients (37%) of ALTF experienced paresthesia/anesthesia's at the anterolateral region of the thigh. Whereas, 23 (62%) of the patients of RFFF experienced sensory loss in the region of

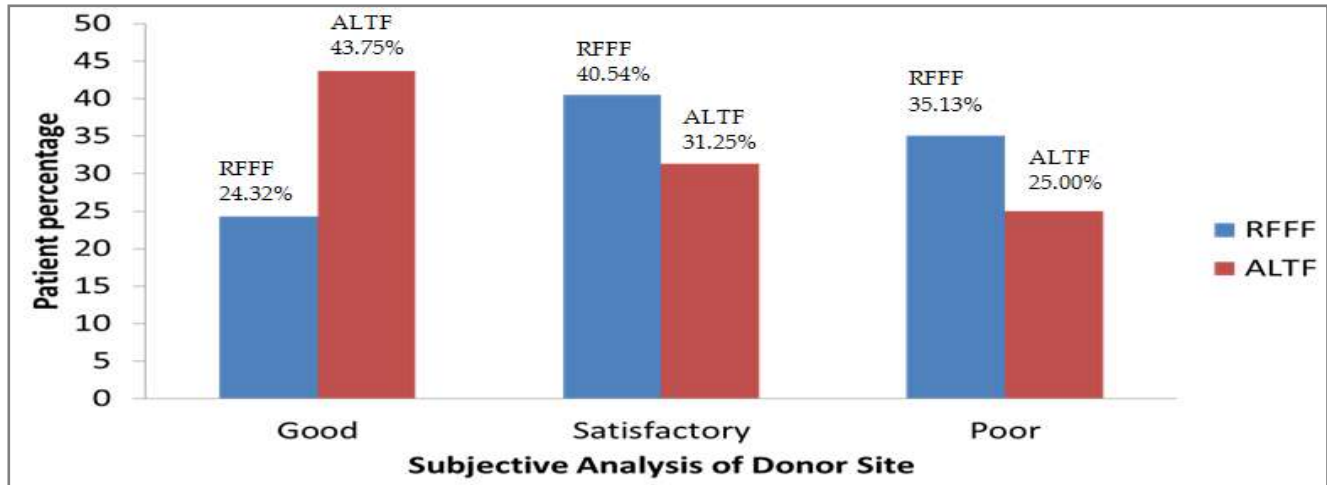


Figure-2: Subjective analysis of donor site.



a) Split thickness skin graft over donor area of ALTF.

b) Split thickness skin graft over donor area of RFFF.

Figure-3: Aesthetic appearance of donor site of ALTF and RFFF.

the cases of ALTF suffered from complete graft loss.

The analysis of functional outcome of the donor site showed that only 1 of the patient of ALTF (6%) presented with transient difficulty in knee extension. On final follow up assessment, this patient was able to perform all his daily activities. In RFFF group, reduced grip strength was reported in 10 cases (27%). However only 4 of these patients (10%) reported functional impairment at last follow up visit.

anatomical snuff box as shown in fig-3.

DISCUSSION

According to our results, the percentage of patients who suffered wound infection were comparable in two groups, being 5% in RFFF group and 6% in ALTF group ($p>0.05$). This percentage in ALTF group is higher than that reported by Mathew *et al* (1% of wound infection)⁶. Similarly, in our study wound dehiscence was found in 12% of the cases of ALTF, higher than that documented by Matthew *et al* (2%) who

presented largest series on donor site morbidity of anterolateral thigh flap⁶. This was possibly because of the fact that most of our patients were immunocompromised who were suffering from cancer (fig-1).

In our work complete graft take/primary healing was observed in 81% of the cases of RFFF while in ALTF group this variable accounts for 87% of the patients. However, when analyzed independently none of the patients of ALTF transfer suffered graft loss, comparable to work of Kimata *et al*⁸. A smaller number of patients with ALTF suffered partial loss of split thickness skin graft at donor site as compared to RFFF (6% vs 8%). These results of RFFF are similar to work of Selvaggi *et al*⁵ who documented incomplete graft take in 4.8% of patients who underwent phalloplasty in 125 gender reassignment cases⁵. When the donor site defect of ALTF is less than 8cm it is amenable to primary closure thus avoiding the need of skin grafting. This gives ALTF an edge over RFFF.

The medial branch of the lateral cutaneous nerve of the thigh carries sensory innervation to the anterolateral region of thigh. During flap dissection it is usually identified above the fascia lata⁸. In our study sensory loss in the distribution of lateral femoral cutaneous nerve was suffered by 37% of the patients which was significantly less as compared to work of Mathew *et al* and Kimata *et al* who reported sensory abnormality in 84% and 87% of the patients respectively^{6,8}. This difference is attributable to the fact that in majority of our cases the nerve was identified and preserved during flap harvest. In our work, a greater number of patients of RFFF (62%) suffered from sensory deficit in the donor anatomical snuff box region, similar to the results presented in the study of Hanker *et al*⁹⁻¹¹. This difference in sensory deficit between the two study groups can be attributed to the fact that the donor region of ALTF is not as critical in function as that of RFFF. So most of the patients of ALTF group are not much bothered by sensory deficit in this region. While in patients of RFFF, sensory

deficit results in functional impairment of the hand.

In cases of ALTF, weakness of knee extension is attributed to injury of motor nerve to the vastus lateralis and rectus femoris muscles. In our study we found this impairment of function in only 1 patient who underwent reconstruction with ALTF. These results are comparable to work of Mathew *et al*⁶. The reason for this limited functional impairment is probably synergy from the remaining quadriceps muscle. Furthermore, it can be stated that multiple branches supply the vastus lateralis muscle and some of these branches can be preserved even when the major branch is sacrificed. In our study the functional impairment recorded in patients of RFFF group was high (27%) as compared to ALTF group (6%). These results are comparable to work of Camaioni *et al*¹. He documented permanent functional impairment in 37% of his patients who underwent reconstruction with RFFF.

The aesthetic appearance of donor site was rated as good by 37% patients of ALTF in our study compared to 24% patients of RFFF. Similarly, 40% of cases of RFFF were satisfied with aesthetic results of donor site as compared to 31% patients of ALTF. This is primarily because patients in this part of the world prefer to wear full sleeve shirts for cultural reasons. However, a significant dissatisfaction with appearance of donor site of RFFF is reported by patients of phalloplasty because of social stigma associated with the problem. The aesthetic results of RFFF and ALTF are shown in fig-3.

Based on our findings, the donor site morbidity of ALTF appeared to be lower as compared to RFFF. ALTF in comparison to RFFF seemed better in terms of less sensory deficit (37% vs 62%) and loss of function (27% vs 6.3%) at the donor site. However, owing to the small sample size of our study, these results were not statistically significant with *p*-value of both the variables being greater than 0.05 (table-II). Moreover, the donor site defect of RFFF consists of significant surface area of tendons which

predisposes it to relatively more chances of graft take problems than an exposed muscle surface bed (complete graft take 81% cases of RFFF vs 87% of ALTF) (p -value 0.83). Graft loss may lead to tendon exposure thus compromising hand function. ALTF can provide large skin paddle, with an option to include variable volume of vastus lateralis in reconstruction of large and composite defects. Its concealed donor site is another advantage with patient satisfaction documented in our work as 43.8% in cases of ALTF vs 24% cases of RFFF. Although being bulky, the per-operative thinning of ALTF is now a well recognized maneuver. Because of its mentioned advantages, the anterolateral thigh free flap has become our work horse flap for reconstruction of variety of defects. However, in reconstruction of glossectomy defects and phalloplasty where thin and pliable flaps are required, we would still prefer to use RFFF as the thigh skin still proves to be thicker and stiffer in such reconstructions. Similarly, we preferably use RFFF in cases of head and neck tumors where reconstruction may demand incorporation of bone along with soft tissue as in cases of marginal mandibulectomy¹⁴⁻¹⁸.

CONCLUSION

Considering its reliability, versatility, ability to provide large amount of tissue, low donor site morbidity and concealed donor site ALTF has become our work horse flap for reconstruction of pure soft tissue defects.

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CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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