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Comparison of Outcome of Adipofascial Sural Flap Versus Sural Fasciocutaneous Flap for non-Weight Bearing Defects of Foot

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ABSTRACT

Objective: To study the outcomes of adipofascial sural flap versus sural fasciocutaneous flap for non-weight bearing defects of foot in terms of operative time and aesthetic outcome.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Plastic Surgery, Combined Military Hospital, Rawalpindi, Pakistan Jun 2020 to 20 Jun 2022.

Methodology: A total of 88 patients diagnosed with lower limb skin defects requiring reconstruction were included in our study. Patients who had received previous surgery or were immunodeficient were excluded. All patients received a sural flap, patients in Group A received a fasciocutaneous flap while those in Group B received adipofascial flaps. Patients were assessed at three months for cosmetic outcomes via a 5-Point Likert scale, as well as for range of motion. Data was analyzed by SPSS 26.0.

Results: Adipofascial flaps have a better cosmetic outcome as compared to fasciocutaneous flaps at three months post-procedure, (p=0.046). Total recipient site complications were 5(11.4%) with fasciocutaneous flaps and 7(15.9%) with adipofascial flaps, (p=0.534). Donor site complications occurred in 5(11.4%) cases with fasciocutaneous flaps, while this number was 2(4.5%) with adipofascial flaps, (p=0.237).

Conclusion: The adipofascial flap has a better cosmetic outcome with a similar frequency of occurrence of complications when compared to fasciocutaneous flaps.

Keywords: Adipofascial sural flap, Fasciocutaneous sural flap, Foot defects.

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INTRODUCTION

Management of traumatic and non-traumatic skin defects of the distal lower limbs is a difficult task, despite recent advances in management.[1] Free tissue transfer is one of the primary weapons in the armory of the plastic surgeon, however, the procedure requires special expertise, something that is not readily available at all centers and mobilization depends on a number of patient factors,[2] thus flaps with pedicles sourced from local tissue serve as an alternative, especially with large defects.[3] The reverse sural flap has been successfully employed in the treatment of lower limb skin defects since as early as 1983, and has come to occupy its own niche, with a series of modifications.[4,5] However, the method is associated with short-term complications such as wound dehiscence, haematoma formation, epidermolysis, venous congestion, as well as partial and complete flap necrosis.[5] Long-term complications include scarring and reduced range of motion.[5]

In an effort to reduce these complications, various authorities have advocated raising the tissue as adipofascial or fasciocutaneous flaps.[6] Fasciocutaneous flaps have the advantage of being able to cover pressure zones well, whereas adipofascial flaps have a higher incidence of recurrence of defect in such areas.[7] However, fasciocutaneous flaps are technically harder to mobilize, associated with higher donor site morbidity, and are bulky which may require secondary procedures to "thin-out" the flap or the patient may require customized foot-wear.[8] Moreover, smoking is seen to be a relative contraindication to the covering a defect using the fasciocutaneous technique due to possible microvascular compromise, thus limiting the pool of patients to whom this type of surgery can be offered.[9] In contrast, adipofascial flaps can be harvested with relative ease and is associated with minimal complications at the donor site.[10]

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The incidence of traumatic lower limb injury is on the rise, with increasing number of road traffic accidents, industrial incidents and blast injuries. Best practices on dealing with skin defects as a result of these injuries is still a matter of debate. Only a small pool of studies is available regarding the role of fasciocutaneous and adipofascial flaps in the treatment of such patients. This study was performed to compare these two separate methods, to ascertain the outcomes and complications associated with these treatment modalities in an effort to understand their role in the management of lower limb defects and reduce morbidity, mortality and financial costs.

METHODOLOGY

This was a quasi-experimental study conducted from Jul 2021 to Jan 2022 in the Department of Plastic Surgery, Combined Military Hospital, Rawalpindi, Pakistan on 88 consenting patients diagnosed with lower limb skin defects requiring reconstruction, chosen via non-probability consecutive sampling. The WHO sample size calculator was used to calculate the sample size keeping a level of significance (α) of 10%, power of the test (1 – β) of 90%, anticipated population proportion 1 (P1) of 25.0%, and an anticipated population proportion 2 (P2) of 5.5%, which were the frequencies of donor site complications for fasciocutaneous flaps and adipofascial flaps, respectively, from Schmidt *et al*.[11]

Inclusion Criteria: Patients between the ages of 18-80 years with a single lower skin defect requiring reconstruction were included in the study.

Exclusion Criteria: Patients who had undergone previous surgery, had defects over pressure points, were ASA scale IV or above, suffered any form of immune-deficiency or were using immunosuppressive drugs, or those who were pregnant or lactating were excluded.

All patients were thoroughly evaluated by history and clinical examination on enrollment in the study and were assigned a treatment Group via lottery method. Patients in Group A received an fasciocutaneous flap, while those in Group B received an adipofascial flap. All surgeries were conducted under general anaesthesia, with the patient being place either in the later decubitus or prone position as required, and tourniquet applied.

The vascular axis of the flap was marked by a line connecting the mid-point between the Achilles tendon and the lateral and the mid-popliteal point, with the pivot point located 4 cm proximal to the bottom of the lateral malleolus. The pedicle was then measured and marked along the aforementioned axis. After making the appropriate incision (depending on the Group), dissection was initiated at the proximal point and moved gradually distally. In case of adipofascial flaps, minimal fat was left over the underlying fascia. Once the dissection was complete the flap was elevated in the proximal-to-distal direction, this was associated with transection and ligation of both the sural nerve and the lesser saphenous vein. The flap would then be placed onto the defect and the defect closed, which was followed by closure of the donor site as well. Post-procedure, the operated limb was elevated for five days, following which compression stockings were applied. Normal activity was advised after two weeks, and the stockings were removed after two months. Patients assessed their own cosmetic account with a 5-Point Likert scale score at three months as per Table-I.

Table-I: 5-Point Likert Scale Score for Cosmetic Outcome

Question: How satisfied are you with how your limb looks now?				
1	2	3	4	5
Not Satisfied	Mildly Satisfied	Satisfied	Very Satisfied	As Good as Before

Data was analyzed using Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows version 26, IBM Corp; Armonk, USA). Mean and SD was calculated for quantitative variables specifically age, total operation time and aesthetic 5-Point Likert score at three months. Qualitative variables like gender, presence of comorbidities (diabetes mellitus, hypertension, ischaemic heart disease), cause of skin defect, occurrence of complications at recipient site (wound infection, flap necrosis, coverage failure), and occurrence of complications at donor site (haematoma, infection, epidermolysis) were recorded in terms of frequency and percentage. Chi-square test was applied to all qualitative variables, while the independent samples t-test was applied to quantitative variables for comparison between the Groups. The *p*-value of ≤0.05 was considered significant.

RESULTS

We studied a total of 88 patients, the mean age of whom was 41.27±13.02 years. Males were in majority in our sample: 59(67.0%). A total of 55(62.5%) cases of skin defects as a result of non-traumatic causes. A total of 33(37.5%) patients in the sample suffered from

diabetes mellitus, while hypertension and ischaemic heart disease were present in 25(28.4%) and 13(14.8%). Pre-surgery patient characteristics and their comparison across both Groups is shown in Table-II.

Table-II: Patient Characteristics Pre-Surgery (n=88)

Variable	Group A (n=44)	Group B (n=44)	*p*-value
Gender			
Male	26(59.1%)	33(75.0%)	0.112
Female	18(40.9%)	11(25.0%)	
Age (years)	39.34±14.36	43.20 ±13.3	0.165
Cause of Defect			
Traumatic	18(40.9%)	15(34.1%)	0.509
Non-Traumatic	26 (59.1%)	29(65.9%)	
Co-Morbidities			
Diabetes Mellitus	20(45.5%)	13 (29.5%)	0.123
Hypertension	16(36.3%)	9 (20.5%)	0.098
Ischaemic Heart Disease	5(11.4%)	8(18.2%)	0.367

Fasciocutaneous flap surgery took far longer to perform, with a Mean±SD difference in operative time of 30.31±0.76 minutes between Group A and Group B. Group B had a higher 5-Point Likert scale score at three months, indicating that patients had a better cosmetic outcome, (p=0.046). Total recipient site complications were 5(11.4%) in Group A, and 7(15.9%) in Group B, (p=0.534), with wound infection being the most common complication, occurring in 4(9.0%) and 3(6.8%) cases in Group A and B, respectively, (p=0.694). Donor site complications occurred in 5(11.4%) cases in Group A, while this number was 2(4.5%) in Group B, (p=0.237). The most common donor site complication was also wound infection, which occurred in 3(6.8%) cases in Group A, while in Group B 1(2.3%) case was affected, (p=0.306). The results post-surgery are displayed in Table-III.

Table-III: Results Post-Surgery (n=88)

Variable	Group A (n=44)	Group B (n=44)	*p*-value
Total Operation Time	130.20±9.08	99.89±8.32	<0.001
5-Point Likert Score at Three Months	3.00(IQR: 3.00)	3.00(IQR:1. 00)	0.046
Recipient Site Complications			
Wound Infection	4(9.0%)	3(6.8%)	0.694
Flap Necrosis	2(4.5%)	4(9.0%)	0.398
Coverage Failure	1(2.3%)	0(0%)	0.315
Total Recipient Site Complications	5(11.4%)	7(15.9%)	0.534
Donor Site Complications			
Haematoma	2(4.5%)	1(2.3%)	0.557
Wound Infection	3(6.8%)	1(2.3%)	0.306
Epidermolysis	1(2.3%)	0(0%)	0.315
Total Donor Site Complications	5(11.4%)	2(4.5%)	0.237

DISCUSSION

Inelasticity and scarcity of skin forming the outer layer of lower leg makes repairing skin defects in this region a plastic surgeon's nightmare.[12] The skin here is thinner as compared to other regions of the body, which results in the underlying muscles, tendons and bones being exposed with relatively minor trauma.[13] When free tissue transfer is not feasible, the reverse sural flap is the go-to option for covering the defect.[11] These flaps can be raised as either a fasciocutaneous flap or an adipofascial one, each with its own advantages and disadvantages.[11]

In our study, adipofascial flap surgeries were performed faster, with a mean time of 99.89 8.32 mins, while this time was 130.20±9.08 mins with fasciocutaneous flap surgeries, (p<0.001). Bocchi *et al* reported that the mean operative time for fasciocutaneous flaps in their study was 30 mins, while it was 80 mins for adipofascial flaps, in addition the mean time was shorter for types of procedures than in our study, concluding that fasciocutaneous flaps were quicker to perform.[14] We attribute this difference to a variation in size of defects studied. Schimdt et al reported that the mean operation time for adipofascial flaps was 92.5 mins in their study, while for fasciocutaneous flaps it was 132.5 mins, (p<0.001), findings that were similar to our study.[11] Goil *et al.,* reported significantly shorter times of surgery for both adipofascial and fasciocutaneous flaps, 45 mins and 60 mins, respectively, (p<0.05), while the times were significantly less than in our study, they were in agreement with our conclusion that adipofascial flap surgeries were faster to perform.[15]

Our study showed a total of 5(11.4%) and 7(15.9%) cases with complications at the recipient site with fasciocutaneous flaps and adipofascial flaps, respectively, (p=0.534), of these 4(9.0%) cases had wound infection, 2(4.5%) had partial flap necrosis, and 1(2.3%) developed coverage failure with fasciocutaneous flaps, while these complications were 3(6.8%) and 4(9.0%), respectively, with adipofascial flaps, the difference between the Groups for each individual complication was insignificant. Li *et al.,* reported that no complications occurred at the recipient site in their study,[16] while Parodi *et al.,* reported partial flap necrosis in 25.9% of cases.[17] Schmidt *et al.,* reported a higher frequency of complications with adipofascial flaps, when compared

to fasciocutaneous ones, with 18.2% and 11.4% of patients developing partial flap necrosis, respectively.[11] The percentages for total flap necrosis in this study were comparable; 5.7% with adipofascial flaps versus 6.8% with fasciocutaneous ones.[11] Kim *et al.*, also reported that there was no difference in complications between the two methods.[18] The total recipient site complications seen in Goil *et al.*, was 13.5% of cases with adipofascial flaps, and 36.7% with fasciocutaneous flaps.[15] Of these cases, partial flap necrosis was seen in 5(16.7%) cases in the fasciocutaneous flap Group and 1(2.7%) in the adipofascial flap Group, (p<0.05).[15] This difference may be attributable to the way this study performed the fasciocutaneous flap surgery i.e., in a two-stage delayed surgery.

In our study, the total donor site complications were 5(11.4%) with fasciocutaneous flaps, while they were 2(4.5%) with adipofascial flaps, (p=0.237). In Schmidt *et al.*, donor-site complications were seen in 5.7% cases who received adipofascial flaps versus 25% with fasciocutaneous flaps.[11] Goil reported that the major donor site complication in their study was wound dehiscence, which was seen in 12(32.4%) cases in adipofascial flap Group, and in 10(33.3%) cases with the fasciocutaneous flap Group, concluding that there was no significant difference between the two methods with regards to donor site complications.[15]

With regards to cosmetic outcome, our study showed that patients undergoing adipofascial flap repair had a higher mean satisfaction score than those who received fasciocutaneous flap surgery, 3.00 (IQR: 1.00) versus 3.00 (IQR: 3.00), respectively, (p=0.046). Kim *et al.*, reported that 96.4% of patients undergoing adipofascial repair in their study sample expressed satisfaction with regards to cosmetic outcome in their surgery.[18] Goil *et al.*, demonstrated that the patient satisfaction score was 7.51 out of 10 with adipofascial flap surgery, while it was 5.07 out of 10 with fasciocutaneous flap surgery, (p<0.05).

LIMITATIONS OF STUDY

Adipofascial flaps appear to carry a number of advantages over comparable surgeries, and selection of the appropriate patient can result in significantly decreased morbidity and improved functional and cosmetic outcomes. This study was limited by the duration of follow-up which each case received; a longer duration is required to study the long-term viability of these flaps, and the complications associated with them. In addition, the surgeon performing the procedure was not blind to the outcomes of the study. Further research is required to compare data from our center with that from others, in a large, comparative, randomised and blinded trial to ascertain whether the benefits demonstrated by our study hold true for the population at large.

CONCLUSION

Sural flaps are viable options for distal leg repair when free tissue transfer is not an option. Adipofascial varieties have the advantage of providing superior, aesthetic outcomes (especially with regards to the donor site), shorter operation times, and a comparable frequency of complications to fasciocutaneous flaps, with earlier mobilization times and reduced requirements for follow-up procedures, when compared to fasciocutaneous flaps. However, these flaps have a higher chance of failing if used in weight-bearing and high-pressure areas, where they may undergo flap necrosis. As such, these flaps may be employed on a more frequent basis in carefully selected patients.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FM & MK: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SHC & SF: Data acquisition, data analysis, approval of the final version to be published.

MWUB & UFG: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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