

Reconstruction of Soft-Tissue Defects Using Local and Regional Flaps: Outcome Analysis

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Abstract:

Background: Soft-tissue defects resulting from trauma, burns, infection, malignancy excision, and chronic wounds continue to pose major reconstructive challenges in plastic surgery. Local and regional flaps remain reliable reconstructive options because of their vascular reliability, technical simplicity, and cost-effectiveness.

Aim: To evaluate the outcomes of reconstruction of soft-tissue defects using local and regional flaps.

Materials and Methods: A retrospective observational study was conducted in the Department of Burns and Plastic Surgery of a tertiary care hospital over a period of 6 months. Sixty patients undergoing reconstruction with local or regional flaps were included. Patient demographics, etiology, anatomical location, flap type, complications, flap survival, hospital stay, and functional outcomes were analyzed statistically using SPSS version 26.

Results: Among 60 patients, 68.3% were males and 31.7% were females. Trauma was the most common cause of soft-tissue defects (46.7%). Lower limb defects accounted for 38.3% cases. Local flaps were used in 60% patients, while regional flaps were used in 40%. Complete flap survival was observed in 91.7% cases. Partial necrosis occurred in 6.7% patients and total flap loss in 1.6%. Regional flaps showed significantly higher postoperative complication rates compared to local flaps, particularly infection, wound dehiscence, venous congestion, and partial flap necrosis ($p < 0.05$). The mean hospital stay was significantly lower in the local flap group compared to the regional flap group (8.2 ± 2.1 vs 12.4 ± 3.8 days; $p = 0.001$). Excellent or good functional outcomes were achieved in 86.7% patients.

Conclusion: Local and regional flaps are dependable reconstructive options for soft-tissue defects with satisfactory functional and aesthetic outcomes. Appropriate flap selection and meticulous surgical planning significantly improve flap survival and reduce complications.

Keywords: Soft-tissue defects; Local flap; Regional flap; Reconstruction; Plastic surgery; Flap survival.

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Introduction

Soft-tissue defects represent a significant reconstructive challenge in plastic surgery and may result from trauma, burns, infection, malignancy, or chronic ulcers.[1] The primary objectives of reconstruction include restoration of function, preservation of vital structures, prevention of infection, and achievement of acceptable cosmetic outcomes.[2]

The concept of the reconstructive ladder remains fundamental in reconstructive surgery, progressing from simple wound closure to advanced microsurgical free tissue transfer.[3] Despite advances in microsurgical techniques, local and regional flaps continue to play a crucial role in reconstruction because of their technical simplicity,

shorter operative time, and dependable vascularity.[4]

Local flaps involve transfer of tissue adjacent to a defect while maintaining its native blood supply.[5] These flaps provide excellent color and texture match and are particularly useful in facial and extremity reconstruction.[6] Common local flap techniques include advancement, rotation, transposition, and rhomboid flaps.[7]

Regional flaps are harvested from neighboring anatomical regions and transferred while maintaining a vascular pedicle.[8] Examples include pectoralis major myocutaneous flaps, groin flaps, reverse sural artery flaps, and deltopectoral flaps.[9] These flaps are especially useful in medium-to-large defects where local tissues are insufficient.[10]

Understanding vascular anatomy is essential for flap survival and surgical success.[11] The angiosome concept introduced by Taylor and Palmer improved flap design and reduced complication rates.[12] Fasciocutaneous and musculocutaneous flaps have become widely accepted because of their robust vascularity and versatility.[13]

The success of flap reconstruction depends on several factors including defect size, tissue quality, vascularity, infection status, smoking, diabetes mellitus, and patient comorbidities.[14] Common postoperative complications include venous congestion, hematoma, infection, wound dehiscence, and partial flap necrosis.[15]

Lower limb reconstruction remains particularly challenging because of limited local tissue availability and frequent exposure of bone and tendons.[16] Regional fasciocutaneous flaps such as the reverse sural flap have demonstrated reliable outcomes in lower extremity reconstruction.[17]

Local and regional flaps continue to be preferred in many institutions because they are cost-effective and do not require sophisticated microsurgical infrastructure.[18] The present study was conducted to analyze the outcomes, complications, flap survival, and functional results of local and regional flap reconstruction in patients with soft-tissue defects.[19]

Materials and Methods

Study Design: Retrospective observational study.

Study Setting: Department of Burns and Plastic Surgery at a tertiary care teaching hospital.

Study Duration: 6 months.

Sample Size: 60 patients.

Inclusion Criteria

- Patients aged above 18 years
- Patients with soft-tissue defects requiring flap reconstruction
- Defects caused by trauma, burns, infection, malignancy, or chronic ulcers
- Patients with complete medical records and follow-up data available

Exclusion Criteria

- Critically ill patients
- Severe peripheral vascular disease
- Uncontrolled diabetes mellitus
- Patients with incomplete medical records or inadequate follow-up data

Preoperative Evaluation: Data regarding history, physical examination findings, vascular assessment, wound evaluation, laboratory investigations, and Doppler studies were obtained from patient medical records.

Surgical Procedure: Patients underwent reconstruction using local or regional flaps based on defect size, location, tissue requirement, and vascular status. Postoperative flap monitoring details were reviewed from inpatient and follow-up records.

Outcome Parameters

- Flap survival
- Complications
- Functional outcome
- Hospital stay

Follow-up: Medical records and follow-up data of patients were reviewed for a mean duration of 3.2 ± 1.1 months (range: 1–6 months) to assess flap viability, complications, functional recovery, and postoperative outcomes.

Statistical Analysis: Data were analyzed using SPSS version 26. Quantitative data were expressed as mean \pm SD. Qualitative variables were expressed as frequency and percentage. Chi-square test and Student's t-test were used. A p-value <0.05 was considered statistically significant.

Ethical Approval: Institutional Ethics Committee approval was obtained prior to commencement of the study. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Informed Consent: Patient confidentiality was maintained throughout the study. Informed consent for surgical procedures had been obtained as part of routine clinical management.

Results

A total of 60 patients with soft-tissue defects underwent reconstruction using local and regional flaps during the study period. Demographic characteristics, etiology of defects, anatomical distribution, flap types, postoperative complications, flap survival, duration of hospital stay, and functional outcomes were analyzed.

Demographic Characteristics: The age of the patients ranged from 18 to 68 years, with a mean age of 39.4 ± 12.1 years. The majority of patients belonged to the 31–40 years age group (30%), followed by the 18–30 years age group (26.7%). Patients older than 60 years constituted the smallest proportion (6.7%), as shown in Table 1.

Table 1: Age Distribution of Patients

Age Group (Years)	Number (n=60)	Percentage (%)
18-30	16	26.7
31-40	18	30.0
41-50	14	23.3
51-60	8	13.3
>60	4	6.7

The study population predominantly consisted of males. Male patients accounted for 68.3% of cases,

whereas females constituted 31.7%, as detailed in Table 2.

Table 2: Gender Distribution of Patients

Gender	Number	Percentage (%)
Male	41	68.3
Female	19	31.7

Etiology of Soft-Tissue Defects: Trauma was the most common etiology of soft-tissue defects, accounting for 46.7% of cases. Burns and post-burn contracture release defects constituted 23.3% of cases. Infection-related defects were observed in

13.3% patients, while defects following malignancy excision and chronic ulcers accounted for 10% and 6.7% respectively, as shown in Table 3 and Figure 1.

Table 3: Etiology of Soft-Tissue Defects

Etiology	Number	Percentage (%)
Trauma	28	46.7
Burns/Post-burn contracture	14	23.3
Infection	8	13.3
Malignancy excision	6	10.0
Chronic ulcers	4	6.7

Figure 1. Etiology of Soft-Tissue Defects (n = 60)

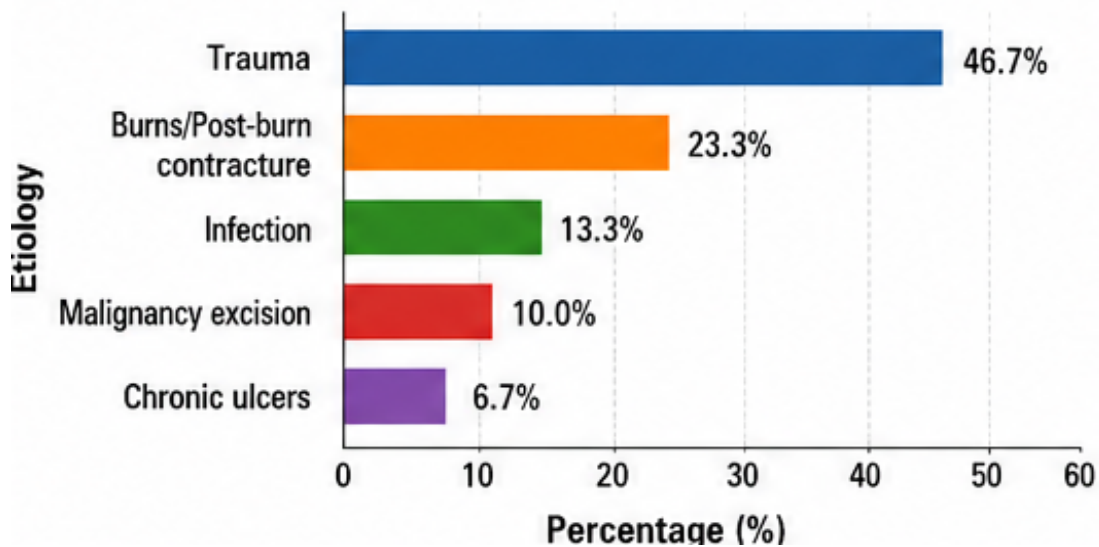


Figure 1: Etiology of Soft-Tissue Defects

Anatomical Distribution of Defects: Lower limb defects were the most commonly encountered, accounting for 38.3% of cases. Upper limb defects

constituted 25%, followed by head and neck defects (20%) and trunk defects (16.7%), as presented in Table 4.

Table 4: Anatomical Distribution of Soft-Tissue Defects

Anatomical Site	Number	Percentage (%)
Lower limb	23	38.3
Upper limb	15	25.0
Head & neck	12	20.0
Trunk	10	16.7

Distribution of Flap Types: Local flaps were more commonly used than regional flaps. Out of 60 patients, 36 patients (60%) underwent

reconstruction using local flaps, while 24 patients (40%) required regional flaps for adequate defect coverage, as summarized in Table 5.

Table 5: Distribution of Flap Types

Flap Type	Number	Percentage (%)
Local flaps	36	60.0
Regional flaps	24	40.0

The distribution of flap types is illustrated in Figure 2.

Figure 2. Distribution of Flap Types (n = 60)

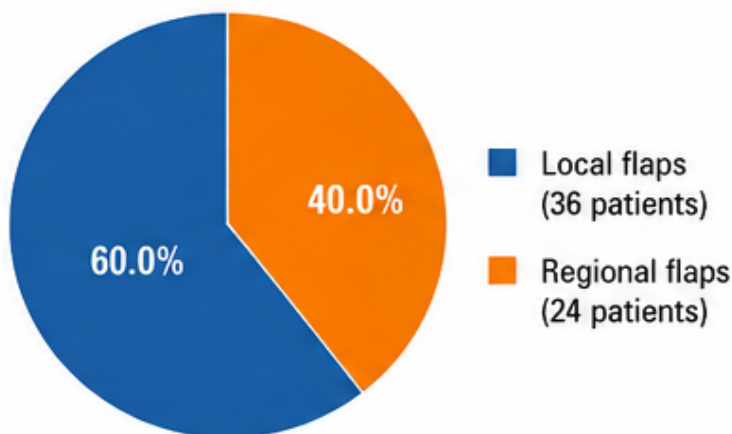


Figure 2. Distribution of Flap Types

The commonly performed local flaps included rotation, advancement, rhomboid, and transposition flaps. Frequently utilized regional flaps included reverse sural artery flaps, groin flaps, deltopectoral flaps, and pectoralis major myocutaneous flaps.

Flap Survival Outcomes: Complete flap survival was achieved in 55 patients (91.7%). Partial flap necrosis was observed in 4 patients (6.7%), while total flap loss occurred in only one patient (1.6%), as shown in Table 6 and Figure 3.

Table 6: Flap Survival Outcomes

Outcome	Number	Percentage (%)
Complete survival	55	91.7
Partial necrosis	4	6.7
Total flap loss	1	1.6

Figure 3. Flap Survival Outcomes (n = 60)

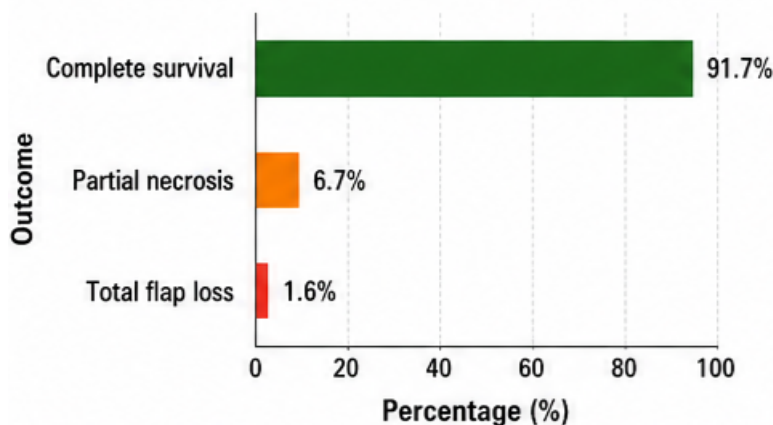


Figure 3: Flap Survival Outcomes

Postoperative Complications: Postoperative complications were observed in a minority of patients. Infection was the most common complication and occurred in 8.3% patients. Wound

dehiscence and partial flap necrosis each occurred in 6.7% cases. Venous congestion was noted in 5% patients, while hematoma developed in 3.3% cases, as shown in **Table 7**.

Table 7: Postoperative Complications

Complication	Number	Percentage (%)
Infection	5	8.3
Wound dehiscence	4	6.7
Hematoma	2	3.3
Venous congestion	3	5.0
Partial necrosis	4	6.7

Table 8: Comparison of Postoperative Complications Between Local and Regional Flaps

Complication	Local Flap (n=36)	Regional Flap (n=24)	p-value
Infection	2 (5.6%)	3 (12.5%)	0.041*
Wound dehiscence	1 (2.8%)	3 (12.5%)	0.038*
Hematoma	1 (2.8%)	1 (4.2%)	0.612
Venous congestion	1 (2.8%)	2 (8.3%)	0.047*
Partial necrosis	1 (2.8%)	3 (12.5%)	0.035*

*Statistically significant.

Regional flap reconstruction demonstrated comparatively higher rates of postoperative complications, particularly infection, wound dehiscence, venous congestion, and partial flap necrosis, compared to local flap reconstruction (Table 8).

Hospital Stay Analysis: Patients reconstructed using local flaps had a significantly shorter duration of hospital stay compared to those reconstructed with regional flaps. The mean hospital stay in the local flap group was 8.2 ± 2.1 days, whereas the regional flap group had a mean hospital stay of 12.4 ± 3.8 days. This difference was statistically significant (p=0.001), as presented in **Table 9**.

Table 9. Comparison of Mean Hospital Stay

Flap Type	Mean Hospital Stay (Days)	Standard Deviation	p-value
Local flap	8.2	2.1	
Regional flap	12.4	3.8	0.001*

*Statistically significant.

Functional Outcome Assessment: Functional outcomes were graded as excellent, good, fair, or poor based on restoration of function, wound healing, mobility, and patient satisfaction. Excellent

outcomes were achieved in 46.7% patients, while good outcomes were noted in 40% cases. Fair and poor outcomes were observed in 10% and 3.3%

patients respectively, as shown in Table 10 and Figure 4.

Table 10: Functional Outcome Grading

Outcome Grade	Number	Percentage (%)
Excellent	28	46.7
Good	24	40.0
Fair	6	10.0
Poor	2	3.3

Excellent and good outcomes together accounted for 86.7% of total cases.

Figure 4. Functional Outcome Distribution (n = 60)

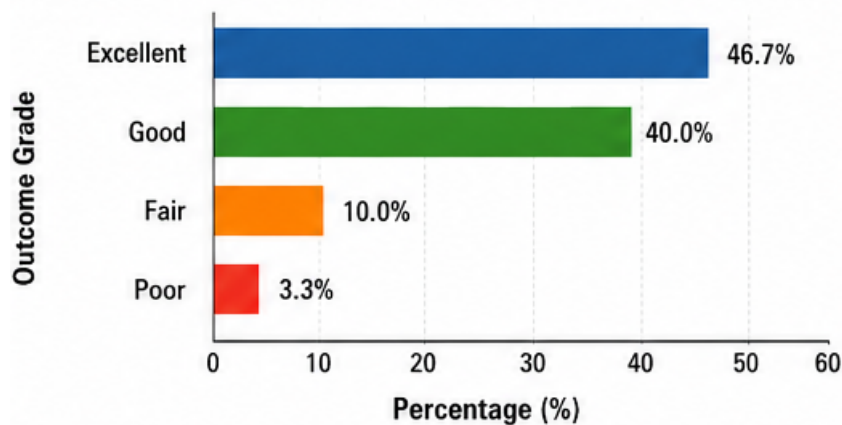


Figure 4: Functional Outcome Distribution

Discussion

Soft-tissue reconstruction remains an essential component of reconstructive plastic surgery aimed at restoring function, structural integrity, and aesthetic appearance.[20] In the present study, trauma was the most common etiology of soft-tissue defects, accounting for 46.7% of cases. Similar findings have been reported in previous reconstructive studies where road traffic accidents and industrial injuries represented the major causes of soft-tissue loss requiring flap coverage.[21]

The majority of patients in the present study were males. This may be attributed to increased occupational exposure, outdoor activities, and higher incidence of traumatic injuries among males. Lower limb defects were the most commonly involved anatomical site, which is consistent with previous studies emphasizing the reconstructive challenges associated with lower extremity defects due to poor vascularity, exposed tendons, and limited local tissue availability.[21]

Local flaps were more commonly used than regional flaps in the present study because of their simplicity, shorter operative time, and superior tissue match.[22] Local flaps offer excellent cosmetic outcomes due to preservation of similar skin texture and color, particularly in facial and upper extremity reconstruction.[22]

Regional flaps remain valuable reconstructive options for larger and more complex defects where adjacent local tissue is insufficient.[23] Reverse sural artery flaps and pectoralis major myocutaneous flaps were commonly employed in the present study. Previous studies have demonstrated reliable vascularity and durable coverage with these regional flap techniques.[23]

Complete flap survival was achieved in 91.7% of patients, which is comparable to previously reported flap survival rates ranging between 88% and 96%.[24] Partial flap necrosis occurred in 6.7% patients and was primarily associated with venous congestion and distal ischemia. Early recognition and prompt intervention helped prevent progression in most cases.[25]

Postoperative infection was the most common complication observed in the present study. Proper wound debridement, meticulous surgical technique, adequate flap handling, and perioperative antibiotic administration contributed to satisfactory postoperative outcomes.[26]

The mean duration of hospital stay was significantly shorter in patients reconstructed using local flaps compared to regional flaps (p = 0.001). Similar observations have been reported in studies comparing local and regional flap reconstruction, where simpler local flap procedures were associated

with faster recovery and reduced hospitalization.[27]

Functional outcomes were satisfactory in the majority of patients, with excellent or good results achieved in 86.7% cases. Restoration of mobility, prevention of contracture, and preservation of limb function remain essential goals of reconstructive surgery.[21]

Despite advances in microsurgical free tissue transfer, local and regional flaps continue to remain highly relevant in resource-limited settings because they are technically less demanding, cost-effective, and associated with acceptable morbidity. [24,25]

Limitations

The present study was limited by relatively small sample size, retrospective study design, shorter follow-up duration, and single-center study design. Long-term multicentric studies with larger populations are required for better assessment of reconstructive outcomes and comparison between local, regional, and free flap techniques.

Conclusion

Local and regional flaps provide reliable reconstruction for soft-tissue defects with high flap survival rates and satisfactory functional outcomes. Local flaps offer shorter hospital stay and good tissue compatibility, while regional flaps are effective for larger and more complex defects. Careful flap selection and meticulous surgical planning are essential for achieving optimal reconstructive outcomes.

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