

Complications and Outcomes of Reconstructive Procedures in Burn Patients: A Retrospective Study at a Tertiary Care Centre

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Abstract:

Background: Burn injuries are a major cause of morbidity, disability, and long-term functional impairment worldwide, particularly in low- and middle-income countries. Advances in burn care have improved survival rates, shifting the focus toward reconstructive procedures that restore function, prevent contractures, and improve cosmetic outcomes. Various reconstructive techniques, including split-thickness skin grafts, full-thickness skin grafts, local flaps, regional flaps, and contracture release procedures, are routinely employed. However, postoperative complications such as graft loss, infection, wound dehiscence, hypertrophic scarring, and recurrence of contractures continue to influence surgical outcomes. This study evaluated the complications and outcomes of reconstructive procedures performed in burn patients at a tertiary care hospital.

Aim: To evaluate the complications and clinical outcomes of reconstructive procedures performed in burn patients.

Materials and Methods: A retrospective observational study was conducted in the Department of Plastic and Reconstructive Surgery, Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India, from June 2024 to November 2025. Medical records of 100 burn patients who underwent reconstructive procedures were reviewed. Demographic characteristics, burn etiology, total body surface area (TBSA), anatomical site, type of reconstructive procedure, postoperative complications, duration of hospital stay, graft or flap survival, functional recovery, and aesthetic outcomes were recorded. Primary outcome measures included surgical success and postoperative complications, while secondary outcomes included functional improvement, recurrence of contracture, need for revision surgery, and length of hospital stay. Statistical analysis was performed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were analysed using the Chi-square or Fisher's exact test. A p -value <0.05 was considered statistically significant.

Results: Among 100 patients, split-thickness skin grafting was the most commonly performed reconstructive procedure, followed by contracture release with skin grafting and flap reconstruction. The majority of patients achieved satisfactory graft or flap survival with significant functional improvement. The most frequent postoperative complications were wound infection, partial graft loss, hypertrophic scar formation, and recurrent contracture. Overall surgical success exceeded 85%, while flap-related complications were comparatively infrequent.

Conclusion: Burn reconstructive surgery provides excellent functional and cosmetic outcomes with acceptable complication rates. Early intervention, meticulous surgical technique, and structured postoperative rehabilitation significantly improve long-term patient outcomes and quality of life.

Keywords: Burn Injury; Reconstructive Surgery; Split-Thickness Skin Graft; Burn Contracture; Flap Reconstruction; Functional Outcome; Postoperative Complications.

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Introduction

Burn injuries continue to be one of the main causes of trauma-related morbidity globally and pose a serious public health concern, especially in developing nations. The World Health Organisation estimates that burns cause about 180,000 deaths a year, most of which take place in low- and middle-income nations. Survival rates have significantly

increased as a result of advancements in emergency burn care, resuscitation, infection control, nutritional support, and critical care. As a result, long-term rehabilitation and reconstruction targeted at regaining function, reducing handicap, and enhancing aesthetic appearance have taken precedence over life-saving procedures. When

major joints, the face, neck, hands, feet, or axilla are affected, deep dermal and full-thickness burns often heal with substantial scar development, contractures, deformities, and functional impairment [1].

Burn scar contractures can significantly limit joint mobility, make daily living activities difficult, and negatively impact social reintegration and psychological well-being. Therefore, by correcting deformities, releasing contractures, increasing range of motion, and improving overall quality of life, reconstructive surgery is crucial to comprehensive burn therapy. Depending on the depth of the burn, the characteristics of the scar, the anatomical position, and the availability of donor tissue, a range of reconstructive procedures are available. Due to their ease of use, high graft take rate, and capacity to cover large defects, split-thickness skin grafts continue to be the most widely used reconstructive technique. For more complicated abnormalities requiring long-lasting soft tissue coverage and better aesthetic results, full-thickness skin grafts, local flaps, regional flaps, distant flaps, tissue expansion, dermal replacements, and microsurgical free flaps are utilised [2].

The patient's characteristics, the state of the wound, the vascularity, and the functional needs all influence the technique decision. Long-term results are still impacted by postoperative problems include graft loss, surgical site infection, haemorrhage, flap necrosis, hypertrophic scarring, recurring contracture, and delayed wound healing, even with improvements in reconstructive procedures. Therefore, to maximise reconstructive success, careful patient selection, careful surgical planning, postoperative splinting, physiotherapy, pressure garment therapy, and long-term follow-up are crucial [3].

There is still little information on the reconstructive results of burn patients from Eastern India. Surgical planning and rehabilitation techniques can be improved by analysing the pattern of reconstructive surgeries, postoperative complications, and functional outcomes. In order to assess the problems and results of reconstructive treatments carried out in burn patients over an 18-month period, the current retrospective study was conducted at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya [4].

Aim: To evaluate the complications and clinical outcomes of reconstructive procedures performed in burn patients.

Objectives

Primary Objectives

1. To evaluate the postoperative complications associated with reconstructive procedures in burn patients.
2. To assess the overall clinical outcomes following reconstructive surgery.

Secondary Objectives

1. To determine the demographic and clinical characteristics of burn patients undergoing reconstruction.
2. To evaluate the distribution of different reconstructive procedures performed.
3. To compare complication rates among various reconstructive techniques.
4. To assess graft and flap survival rates following reconstruction.
5. To evaluate functional recovery following reconstructive surgery.
6. To determine the recurrence rate of burn scar contractures requiring revision surgery.
7. To assess the duration of postoperative hospital stay.
8. To identify factors associated with unfavorable surgical outcomes.

Materials and Methods

Study Design: Retrospective observational study.

Study Setting: Department of Plastic and Reconstructive Surgery, Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India.

Study Duration: June 2024 to November 2025 (18 months).

Study Population: Patients with healed burn injuries who underwent reconstructive surgical procedures for burn sequelae.

Sample Size: A total of 100 patients were included.

Sampling Technique: Universal sampling of all eligible patients who underwent reconstructive surgery during the study period.

Inclusion Criteria

1. Patients of all age groups who underwent reconstructive surgery for post-burn deformities.
2. Patients with complete medical records.
3. Patients who completed postoperative follow-up until discharge.

Exclusion Criteria

1. Patients managed conservatively without reconstruction.
2. Incomplete hospital records.
3. Active burn wounds requiring acute burn management.
4. Patients lost to postoperative follow-up.

Data Collection: Data were retrieved from hospital medical records, operative notes, discharge summaries, and follow-up records. The following variables were recorded:

- Age and gender
- Etiology of burn injury
- Total Body Surface Area (TBSA) burned
- Anatomical site involved
- Time interval between burn injury and reconstruction
- Type of reconstructive procedure
- Operative duration
- Postoperative complications
- Graft or flap survival
- Functional improvement
- Cosmetic outcome
- Duration of hospital stay
- Need for revision surgery

Outcome Measures

Primary Outcomes

- Overall surgical success
- Postoperative complications (infection, graft loss, flap necrosis, wound dehiscence, hypertrophic scar, recurrence)

Secondary Outcomes

- Functional improvement
- Range of joint movement
- Graft/flap survival
- Cosmetic outcome
- Hospital stay

- Revision surgery

Ethical Considerations: Institutional Ethics Committee approval was obtained before commencement of the study. Patient confidentiality was maintained by anonymizing all extracted records.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range depending on data distribution. Categorical variables were summarized as frequencies and percentages. Normality of continuous variables was assessed using the Shapiro–Wilk test. Comparisons between groups were performed using the independent Student's t-test or Mann–Whitney U test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables. Multivariate logistic regression analysis was performed to identify independent predictors of postoperative complications and unfavorable outcomes. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A two-tailed p-value <0.05 was considered statistically significant.

Results

A total of 100 burn patients who underwent reconstructive procedures following burn injury were included in the study. Demographic characteristics, burn profile, reconstructive procedures, postoperative complications, and surgical outcomes were analysed.

Table 1: Baseline Demographic Characteristics of Burn Patients (n=100)

Variable	Frequency (n)	Percentage (%)
Age (years)		
<20	18	18.0
21–40	44	44.0
41–60	28	28.0
>60	10	10.0
Gender		
Male	62	62.0
Female	38	38.0
Mean age (years)	36.8 $\pm$ 15.2	

Interpretation: The majority of patients belonged to the 21–40-year age group (44%), followed by 41–60 years (28%). Males constituted 62% of the study population, indicating a higher incidence of burn

injuries requiring reconstructive procedures among economically active adult males. The mean age was 36.8 $\pm$ 15.2 years.

Table 2: Burn Characteristics Among Study Participants

Variable	Frequency (n)	Percentage (%)
Cause of burn		
Flame burn	58	58.0
Scald burn	18	18.0
Electrical burn	14	14.0
Chemical burn	10	10.0
TBSA burned		
<20%	42	42.0
20–40%	38	38.0
>40%	20	20.0
Time to reconstruction		
<6 months	24	24.0
6–12 months	46	46.0
>12 months	30	30.0

Interpretation: Flame burns were the predominant mechanism of injury (58%), followed by scald burns (18%). Most patients had burns involving less than 40% TBSA. Nearly half of the reconstructive

procedures were performed between 6 and 12 months after the initial burn injury, indicating delayed reconstruction after scar maturation.

Table 3: Anatomical Site of Burn Contracture Requiring Reconstruction

Site	Frequency (n)	Percentage (%)
Hand	28	28.0
Neck	18	18.0
Elbow	14	14.0
Axilla	12	12.0
Knee	10	10.0
Face	8	8.0
Foot/Ankle	6	6.0
Others	4	4.0

Interpretation: Hand contractures were the most common indication for reconstructive surgery (28%), followed by neck (18%) and elbow (14%) contractures. These regions are particularly

susceptible to functional impairment following burn injuries and therefore frequently require reconstructive intervention.

Table 4: Types of Reconstructive Procedures Performed

Procedure	Frequency (n)	Percentage (%)
Split-thickness skin graft (STSG)	48	48.0
Contracture release + STSG	24	24.0
Local flap	12	12.0
Regional flap	8	8.0
Full-thickness skin graft	5	5.0
Z-plasty	3	3.0

Interpretation: Split-thickness skin grafting was the most frequently performed reconstructive procedure (48%), followed by contracture release

combined with skin grafting (24%). Flap reconstruction was reserved for more complex defects requiring durable tissue coverage.

Table 5: Postoperative Complications Following Reconstruction

Complication	Frequency (n)	Percentage (%)
No complication	72	72.0
Wound infection	10	10.0
Partial graft loss	8	8.0
Hypertrophic scar	5	5.0
Wound dehiscence	3	3.0
Flap necrosis	2	2.0

| Overall complication rate | 28 | 28.0 |

Interpretation: Most patients (72%) experienced an uncomplicated postoperative recovery. Wound infection (10%) was the most common complication, followed by partial graft loss (8%).

Flap necrosis occurred infrequently (2%), suggesting satisfactory flap viability and surgical planning.

Table 6: Functional Outcome After Reconstruction

Functional Outcome	Frequency (n)	Percentage (%)
Excellent	40	40.0
Good	38	38.0
Fair	16	16.0
Poor	6	6.0

Interpretation: Excellent or good functional recovery was achieved in 78% of patients, indicating that reconstructive surgery substantially improved

joint mobility and daily functional activities. Only 6% of patients experienced poor functional outcomes.

Table 7: Factors Associated with Postoperative Complications

Variable	Complication Present (n=28)	Complication Absent (n=72)	p-value
TBSA >40%	12	8	0.002
Electrical burn	8	6	0.018
Diabetes mellitus	10	11	0.011
Reconstruction after >12 months	14	16	0.028

Interpretation: Larger burn size (TBSA >40%), electrical burns, diabetes mellitus, and delayed reconstruction were significantly associated with postoperative complications ($p < 0.05$). These

findings suggest that patient comorbidities and burn severity are important determinants of reconstructive outcomes.

Table 8: Overall Surgical Outcome

Outcome	Frequency (n)	Percentage (%)
Successful reconstruction	88	88.0
Required revision surgery	8	8.0
Recurrent contracture	4	4.0

Interpretation: Successful reconstruction was achieved in 88% of patients, demonstrating a high overall success rate. Revision surgery was required

in 8% of cases, while recurrent contracture occurred in only 4%, indicating satisfactory long-term functional restoration in the majority of patients.

Table 9: Mean Hospital Stay According to Presence of Complications

Outcome	Mean $\pm$ SD (days)	p-value
With complications	16.8 $\pm$ 4.5	
Without complications	10.4 $\pm$ 2.8	<0.001

Interpretation: Patients who developed postoperative complications had a significantly longer hospital stay compared with those who recovered without complications ($p < 0.001$). This

finding highlights the clinical and economic impact of postoperative complications following burn reconstruction.

Table 10: Logistic Regression Analysis for Predictors of Unfavourable Outcome

Variable	Odds Ratio (95% CI)	p-value
TBSA >40%	3.42 (1.45–8.10)	0.004
Diabetes mellitus	2.68 (1.12–6.40)	0.021
Electrical burn	2.51 (1.04–6.02)	0.038
Delayed reconstruction (>12 months)	2.94 (1.26–6.88)	0.013

Interpretation: Multivariate logistic regression identified TBSA greater than 40%, diabetes mellitus, electrical burns, and delayed reconstructive surgery as independent predictors of unfavourable postoperative outcomes. Patients with extensive

burns were more than three times as likely to experience poor surgical outcomes compared with those with smaller burn injuries.

Discussion

The problems and results of reconstructive surgeries carried out on 100 burn patients at a tertiary care teaching hospital were assessed in the current retrospective analysis. The results showed a high overall surgical success rate, with relatively few patients needing revision surgeries and the majority of patients obtaining adequate functional recovery. The most common reconstructive treatment was split-thickness skin grafting (STSG), and the most common postoperative problems were partial graft loss and wound infection. Unfavourable results were substantially correlated with factors such as bigger burn sizes, electrical burns, diabetes mellitus, and delayed reconstruction. According to the demographic profile, the majority of patients were male young adults between the ages of 21 and 40. This pattern is in line with other research showing that males who are economically productive are more likely to be exposed to electrical injuries, household mishaps, and industrial dangers [5].

In the current study, flame burns were the most common cause of harm, followed by scald and electrical burns, which is consistent with the burn epidemiology frequently seen in developing nations. Similar patterns have been noted in recent Asian burn registries, where the bulk of serious burn injuries are still caused by flame burns. The most frequent reasons for reconstructive surgery were hand and neck contractures. Because scar contractures severely limit movement and interfere with daily activities, these anatomical regions are especially susceptible to post-burn functional impairment. To restore function and enhance quality of life, early contracture release and suitable soft tissue coverage are crucial. The current study's findings regarding the majority of upper-limb reconstruction are similar to those documented in recent reconstructive burn literature [6].

Nearly half of all procedures involved split-thickness skin grafting, which was the most common reconstructive treatment. Because of its superior graft take, availability of donor sites, technical simplicity, and capacity to fill extensive defects, STSG continues to be the cornerstone of burn reconstruction. Local or regional flap reconstruction was necessary for more complicated lesions involving exposed tendons, joints, nerves, or bones [7]. While flap repair offers better durability for certain complex abnormalities, STSG continues to produce dependable functional results, according to recent systematic studies. The current study's total postoperative complication rate of 28% is similar to that of other reported series. The most frequent consequence was wound infection, which was followed by hypertrophic scar formation and partial transplant loss. Inadequate vascularity, bacterial colonisation, poor nutrition, diabetic mellitus, or

delayed wound healing can all lead to these problems [8].

Crucially, flap necrosis was rare, which suggests careful surgical planning, proper patient selection, and adequate vascular preservation during reconstruction. Despite advancements in reconstructive procedures, low flap failure rates and ongoing risks of graft-related problems have been identified in recent meta-analyses. The high rate of successful functional recovery was one of the study's main conclusions [9]. Reconstructive surgery significantly improves joint mobility, hand function, neck extension, and general daily activities, as nearly four-fifths of patients achieved excellent or good postoperative functional outcomes. These positive results were probably influenced by early physiotherapy, splinting, scar care, and patient adherence to rehabilitation guidelines. It has been demonstrated that contemporary multidisciplinary burn rehabilitation enhances long-term function while lowering contracture recurrence [10].

Important predictors of postoperative complications were also found in the study. Patients who had electrical burns, diabetes mellitus, delayed reconstruction, or burns that covered more than 40% of their body surface area fared far worse. While diabetes further impairs tissue perfusion and raises the risk of infection, extensive burns are linked to protracted inflammation, nutritional depletion, delayed wound healing, and compromised immunity. Postponing repair could lead to significant contracture creation and increased scar maturation, which would increase the complexity of the procedure. These results highlight the significance of prompt referral, comorbidity optimisation, and customised reconstructive planning [11]. This study's comparatively large sample size, thorough assessment of several reconstructive techniques, and examination of clinically significant functional outcomes are among its strong points. But there are a few restrictions to be aware of. Selection bias may be introduced by the retrospective single-center design, and there was no long-term quality-of-life evaluation. Instead than using standardised scar assessment criteria, cosmetic outcomes were assessed clinically. To further improve reconstructive techniques and maximise rehabilitation following burn injury, future prospective multicenter trials that include patient-reported outcome measures, objective scar assessment, and extended follow-up are required [12].

Conclusion

The current study shows that reconstructive surgery is a dependable and successful method for helping patients with post-burn abnormalities regain function and enhance their quality of life. The most common surgery was still split-thickness skin

grafting, which gave most patients good results. Excellent or good functional recovery was attained in the majority of cases, and overall surgical success was high. While flap-related problems were rare, wound infection and partial graft loss were the most frequent postoperative consequences. Unfavourable results were found to be significantly predicted by larger burn sizes, electrical burns, diabetes mellitus, and delayed reconstructive surgery. To optimise functional recovery and reduce problems, early referral for reconstruction, careful surgical technique, suitable reconstructive treatment selection, and thorough postoperative rehabilitation are crucial. For the best long-term results, multidisciplinary burn care involving plastic surgeons, physiotherapists, occupational therapists, and rehabilitation specialists is still essential. To confirm these results and enhance evidence-based reconstructive procedures, more prospective multicenter studies with longer follow-up are necessary.

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