Reconstructive Outcomes of Fournier's Gangrene: A Multi-center Five-Year Retrospective Study at ALERT and Yekatit 12 Specialized Hospitals, Addis Ababa

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LIST OF ABBREVIATIONS

AAU	Addis Ababa University
FG	Fournier's Gangrene
SFGSI	Simplified Fournier's Gangrene Severity Index
STSG	Split-thickness skin graft
FTSG	Full-thickness skin graft
IQR	Interquartile range
SPSS	Statistical Package for the Social Sciences
HIV	Human Immunodeficiency Virus
DM	Diabetes Mellitus
HTN	Hypertension
LOS	Length of stay

Abstract

Background: Fournier's Gangrene (FG) is a fulminant necrotizing fasciitis with high mortality and morbidity. In Ethiopia, data on reconstructive outcomes are scarce. This study evaluates the reconstructive outcomes and determinants of surgical success in FG patients.

Method: multi-center retrospective cohort study was carried out at ALERT and Yekatit 12 Hospitals (August 2020–September 2025). All patients who underwent reconstruction following FG debridement were included. Data on demographics, comorbidities, reconstructive techniques, and outcomes were collected. Success was defined as >90% graft/flap survival without urgent revision. Analysis used SPSS v26 with descriptive statistics and bivariate tests.

Results: Among the 32 patients included, median age was 49 years (interquartile range 39–54), with 96.9% males. Common comorbidities were diabetes (12.5%), hypertension (18.8%), and HIV (3.1%). Reconstructive methods included split-thickness skin grafts (25.0%), delayed closure (28.1%), regional flaps (21.9%), and combination techniques (25.0%). The overall success rate was 78.1%. Factors associated with poor outcomes included a higher SFGSI score ($p=0.016$) and use of regional flaps alone ($p<0.001$). Complication rate was 21.9%, with flap necrosis (85.7% of failures) and graft failure (12.5% of failures) most common.

Conclusion: In our experience regional flaps alone had a high complication rate (85.7%), whereas combination techniques and simpler methods achieved excellent success. Surgical methods that were simpler and less technically demanding had higher likelihood of success with limited complications.

1. Introduction

Fournier's Gangrene (FG) is a rapidly progressing necrotizing fasciitis of the perineal, genital, and perianal regions, first described by Jean-Alfred Fournier in 1883 [1]. It represents a surgical emergency with mortality rates ranging from 20% to 50% in contemporary series [2]. The primary treatment continues to be early and aggressive surgical debridement, which often leaves extensive soft tissue defects requiring complex reconstruction [3].

In Ethiopia, the burden of FG and its reconstructive outcomes remains poorly documented. A previous study from Jimma University Specialized Hospital reviewed necrotizing fasciitis cases but did not focus specifically on FG reconstruction [4]. Understanding which reconstructive techniques yield optimal outcomes in our setting is crucial for improving patient care and resource allocation.

This aim of the study is to evaluate the reconstructive outcomes and identify determinants of surgical success in FG patients managed at two major referral centers in Addis Ababa, Ethiopia.

2. Methods

2.1. Study Design and Setting

A multi-center retrospective cohort study was conducted at ALERT Comprehensive Specialized Hospital and Yekatit 12 Specialized Hospital Medical College in Addis Ababa, Ethiopia. These are national referral centers for plastic reconstructive surgery and general/urological surgery, respectively.

2.2. Study Population

All patients diagnosed with FG who underwent reconstructive procedures between August 1, 2020, and September 30, 2025, were included.

Exclusion criteria included: death before reconstruction, and incomplete medical records.

2.3. Data Collection

Data was extracted from medical records using a standardized questionnaire (Appendix). Variables:

- **Demographics:** age, gender, livelihood
- **Clinical data:** comorbidities, FG severity (SFGSI score), defect characteristics
- **Management:** timing and number of debridement, antibiotic use
- **Reconstruction:** technique (STSG, FTSG, flap), timing
- **Outcomes:** success, complications, length of stay, mortality

2.4. Operational Definitions

- **Reconstructive Success:** >90% graft/flap survival at 2 weeks without urgent surgical revision.
- **SFGSI Score:** Calculated using established criteria [5].

2.5. Sample Size and Sampling

A complete enumeration of eligible cases was performed. Preliminary review identified 36 patients meeting inclusion criteria—included in the total study population.

2.6. Data Analysis

Data was analyzed using SPSS version 26. Descriptive statistics (frequencies, medians, IQR) described the cohort. Bivariate analysis (Fisher's exact test, Mann-Whitney U) identified associations between independent variables and reconstructive success. Statistical significance was set at a p-value of < 0.05.

2.7. Ethical Considerations

Ethical approval was obtained from AAU College of Health Sciences IRB and hospital administrations. A waiver of informed consent was granted for retrospective data. Patient confidentiality was maintained through anonymization.

3. Results

3.1. Demographic Characteristics and Study Population

A total of 32 patients who underwent reconstructive surgery following Fournier's Gangrene debridement between 2016 and 2025 were included in the final analysis. One patient died during the acute phase before reconstruction and was excluded.

The median age of patients was 49 years (IQR 39–54), with 31 males (96.9%) and 1 female (3.1%). Most patients resided in urban areas (59.4%). Diabetes mellitus was present in 4 patients (12.5%), hypertension in 6 (18.8%), and HIV in 1 patient (3.1%). The median duration of symptoms before admission was 5 days (IQR 3–7). According to the Simplified Fournier's Gangrene Severity Index (SFGSI), 2 patients (6.3%) were classified as high risk (score >2) on admission.

3.2. Clinical Presentation and Disease Characteristics

The most common presenting symptoms were swelling (87.5%), purulent discharge (53.1%), and pain (46.9%). The extent of tissue involvement varied, with 11 patients (34.4%) having scrotal involvement only, while 21 patients (65.6%) had more extensive defects involving the perineum (n=8), abdomen (n=6), thigh (n=4), or penile shaft (n=2).

3.3. Reconstructive Techniques and Outcomes

The distribution of reconstructive techniques and their outcomes is summarized in Table 1. Delayed primary closure was the most common technique (28.1%), followed by split-thickness skin graft (STSG) alone (25.0%), combination techniques (25.0%), and regional flaps alone (21.9%).

Table 1: Reconstructive Techniques and Outcomes (n=32)

Technique	n (%)	Success, n (%)	Failure, n (%)
STSG only	8 (25.0%)	7 (87.5%)	1 (12.5%)
Delayed Closure only	9 (28.1%)	9 (100%)	0 (0%)
Regional Flap only	7 (21.9%)	1 (14.3%)	6 (85.7%)
Combination*	8 (25.0%)	8 (100%)	0 (0%)
Total	**32 (100%)**	**25 (78.1%)**	**7 (21.9%)**

*Combination techniques included: Delayed closure with STSG (n=4), Regional flap with STSG (n=2), Delayed closure with regional flap (n=2), and STSG with testicular thigh pouch (n=1).

The overall reconstructive success rate was 78.1% (25/32). Success rates varied significantly by technique ($p < 0.001$ by Fisher's exact test). Delayed closure and combination techniques achieved a 100% success rate, while STSG alone had an 87.5% success rate. In contrast, regional flaps performed alone had only a 14.3% success rate, with 6 of 7 cases having partial failure requiring further surgical intervention.

3.4. Factors Associated with Reconstructive Failure

Factors associated with reconstructive failure are presented in Table 2. Patients who experienced reconstructive failure had significantly higher SFGSI scores on admission (median 2, IQR 0–2) compared to those with successful reconstruction (median 0, IQR 0–2; p = 0.016 by Mann-Whitney U test). The median length of hospital stay was also significantly longer in the failure group (37 days, IQR 26–51) compared to the success group (25 days, IQR 13–37; p = 0.047).

Table 2: Factors Associated with Reconstructive Failure (n=32)

Factor	Success (n=25)	Failure (n=7)	p-value
Median age (IQR), years	49 (39–54)	50 (45–53)	0.850
Diabetes mellitus, n (%)	3 (12.0%)	1 (14.3%)	1.000
Disease Factors			
Median SFGSI score (IQR)	0 (0–2)	2 (0–2)	**0.016**
High SFGSI risk (>2), n (%)	2 (8.0%)	0 (0%)	1.000
Extensive defect†, n (%)	9 (36.0%)	2 (28.6%)	1.000
Management Factors			
Regional flap only, n (%)	1 (4.0%)	6 (85.7%)	**<0.001**
Median LOS (IQR), days	25 (13–37)	37 (26–51)	**0.047**

†Extensive defect defined as involvement beyond scrotum and perineum (abdomen, thigh, or penile shaft).

The use of regional flaps alone was strongly associated with partial failure, with 85.7% (6/7) of such cases failing compared to only 4.0% (1/25) of cases using other techniques ($p < 0.001$). Diabetes mellitus, patient age, defect extent, and high SFGSI risk classification (>2) were not significantly associated with reconstructive outcomes.

3.5. Complications and Secondary Outcomes

Among the 7 failures, 6 were partial flap failures and 1 was a graft failure. Three of the flap failures required additional debridement and skin grafting, while the remaining 3 were managed with debridement and wound care. The single graft failure did not require regrafting. There was no mortality in the reconstructive cohort, though one patient died during the acute phase before reconstruction could be attempted and was excluded.

4. Discussion

4.1. Principal Findings and Clinical Implications

The most important finding in our study is the dramatically high partial failure rate of regional flaps performed alone (85.7%, 6/7 failures) compared to the perfect success rate of combination techniques (100%, 8/8 successes) and excellent outcomes with simpler methods like delayed closure (100%, 9/9) and STSG alone (87.5%, 7/8). This finding has substantial clinical implications, particularly for centers in low-resource settings where surgical expertise and materials may be limited.

Several factors may explain the poor performance of isolated regional flaps. FG defects often involve tissues with compromised vascularity due to the inflammatory process, contributing to flap ischemia. The polymicrobial nature of FG may create a hostile wound environment that challenges flap survival. Patients with FG frequently have comorbidities like diabetes that impair wound healing. Our finding that combination techniques—particularly flap with STSG—achieved perfect success suggests that the STSG may act as a "biological dressing" or safety net, providing reliable coverage even if the flap partially fails.

4.2. Comparison with Existing Literature

Our overall success rate of 78.1% compares favorably with reports from similar settings. A systematic review by Karian et al. (2015) found varying success rates for different reconstruction methods but did not specifically analyze combination techniques [10]. Studies from Nigeria and India have reported success rates of 70–85% for various methods, though none compared the difference between pure flaps and combination approaches that we observed [6, 7].

The association between higher SFGSI scores and reconstructive failure aligns with previous literature demonstrating the prognostic value of this scoring system in terms of how sick these individuals are [5]. However, our finding that defect extent was not predictive of failure contradicts some earlier studies, suggesting that surgical technique may play an important role in determining outcomes.

The significantly longer hospital stay for patients with failed reconstruction (37 vs 25 days, p=0.047) underscores the substantial economic and resource implications of reconstructive failure in resource-constrained healthcare systems and why simpler methods are warranted. Each failed reconstruction added approximately 12 extra hospital days, representing a significant burden in settings with limited bed capacity.

4.3. Surgical Decision-Making Algorithm

Based on our findings, we propose a simplified algorithmic approach to FG reconstruction in resource-limited settings:

1. **Pure regional flaps alone need to be avoided** if possible unless absolutely necessary and done with proper careful patient selection.
2. **When flaps are necessary** (e.g., for extensive defects, exposed vital structures, or cosmetic considerations): Combination techniques (flap + STSG) should be preferred over isolated flaps, as they proved to be more reliable in our study.
3. **For small to moderate defects (<50% scrotal loss):** Delayed primary closure is the first choice, given its high likelihood of success, redundancy of scrotal tissue and simplicity.
4. **For larger defects or those with testicular exposure:** STSG is a good first-line treatment, offering reliability and relatively low technical demands.

4.4. Strengths and Limitations

The strengths of this study include its multi-center design, complete case enumeration over a 5-year period, and comprehensive data collection, including validated severity scores. The retrospective design introduces potential selection bias and limits our ability to control for confounding factors. The relatively small sample size, particularly for subgroup analyses, reduces statistical power, although our sample is comparable to or larger than many published series on this rare condition. We lacked data on long-term functional outcomes and patient satisfaction, which are important aspects of reconstructive success beyond immediate surgical outcomes. Additionally, we could not account for individual surgeon experience and skill, which may influence outcomes.

4.5. Future Directions

Future prospective studies with larger sample sizes are needed to validate our findings. Research should focus on:

1. Identifying specific patient and defect characteristics that predict success with different techniques
2. Evaluating long-term functional and cosmetic outcomes
3. Assessing the cost-effectiveness of different approaches in resource-limited settings
4. Developing standardized protocols for FG reconstruction based on defect classification

5. Conclusion

This study provides evidence-based guidance for FG reconstruction in resource-limited settings. The high partial failure rate of regional flaps performed alone (85.7%) requiring subsequent surgical intervention, compared to the perfect success of combination techniques (100%) suggests that surgeons should strongly consider combination approaches when flaps are indicated. Simpler techniques like delayed closure and STSG alone offer excellent outcomes with lower technical demands. Higher SFGSI scores predict poorer reconstructive outcomes and longer hospital stays, highlighting the importance of careful patient selection and postoperative monitoring. These findings can inform surgical decision-making and potentially improve outcomes for patients with this challenging condition in settings similar to ours.

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7. Funding

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8. Conflicts of Interest

The authors declare no conflicts of interest.

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Declaration

I hereby declare that the thesis is my original work and has not been presented for a degree in any other university. All sources of material used in the document have been duly acknowledged and properly cited.

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