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Clinical Profile, Management, and Predictors of Mortality in Fournier's Gangrene: A Retrospective Study

Dr. Divyansh Kesharwani[1], Dr. Varushi[2], Dr. Uddhav[3], Dr. Amit Katlana[4]

[1]Resident, Department of General Surgery, Index Medical College, Hospital and Research Centre, Indore, Madhya Pradesh, India

[2]Resident, Department of General Surgery, Index Medical College, Hospital and Research Centre, Indore, Madhya Pradesh, India
Email: *varushi0104[at]gmail.com*

[3]MBBS Student, Department of General Surgery, Index Medical College, Hospital and Research Centre, Indore, Madhya Pradesh, India

[4]Professor and Head, Department of General Surgery, Index Medical College, Hospital and Research Centre, Indore, Madhya Pradesh, India

Abstract: ***Fournier's Gangrene (FG) is a rapidly progressive polymicrobial necrotizing fasciitis of the perineal, perianal, and genital regions requiring immediate surgical intervention. This retrospective observational cohort study evaluated the clinical presentation, microbiological spectrum, management strategies, and predictors of mortality among 64 patients managed at an Indian tertiary care teaching hospital from January 2021 to December 2025. Data were analyzed using univariable screens and a prespecified parsimonious multivariable logistic regression model. The overall in-hospital mortality rate was 15.6% (10/64). Type 2 Diabetes Mellitus (56.3%) and chronic alcoholism (43.8%) were the primary comorbidities, with Escherichia coli isolated as the dominant pathogen (51.6%). Non-survivors demonstrated advanced physiological derangements at triage, including marked hyponatremia and severe metabolic acidosis. Multivariable analysis showed that a presentation delay exceeding 72 hours from symptom onset (Adjusted Odds Ratio [aOR]: 4.65, 95% Confidence Interval [CI]: 1.08–19.92; P = 0.039) and an admission Fournier's Gangrene Severity Index (FGSI) score >9 (aOR: 10.84, 95% CI: 2.05–57.18; P = 0.005) were independent predictors of mortality. Rapid risk stratification using the FGSI tool paired with immediate, aggressive surgical debridement remains critical to optimizing patient survival.***

Keywords: Fournier's Gangrene, Necrotizing Fasciitis, FGSI Score, Surgical Debridement, Sepsis

1. Introduction

Fournier's Gangrene (FG) is a life-threatening, rapidly progressive necrotizing fasciitis of the subcutaneous tissue and superficial fascial layers involving the perineum, scrotum, and perianal anatomy. First clinically formalized as a fulminant idiopathic entity by Jean Alfred Fournier in 1883 [1], modern surgical practice views it as a synergistic polymicrobial infection arising from local urogenital, anorectal, or cutaneous soft-tissue breakdown. The core pathogenesis is driven by a bacterial cascade releasing endo- and exotoxins that trigger endarteritis obliterans-microvascular thrombosis of the nutrient subcutaneous arterioles. This localized vascular collapse generates quick, widespread ischemic necrosis of the overlying skin and subcutaneous planes, occasionally progressing along the Dartos, Colles', and Scarpa's fascial structures into the anterior abdominal wall.

2. Literature Survey

The historical and clinical evolution of risk-calculation metrics in necrotizing fasciitis highlights a global shift toward standardized physiological scoring. Laor et al. (1995) established the Fournier's Gangrene Severity Index (FGSI), utilizing nine acute metabolic and vital parameters to predict clinical outcomes [2]. Over the last decade, international retrospective studies have continually validated this system. Sorensen et al. (2009) evaluated a large population-based cohort, noting a stable baseline mortality of 10.2% driven primarily by age and systemic complications [6]. Recent work by Sparenborg et al. (2019) and Seong et al. (2023) demonstrated that individual laboratory markers, specifically serum creatinine and bicarbonate levels, serve as strong markers of systemic collapse [3, 5]. In India, regional series by Verma et al. (2013) emphasize that while the microbiological spectrum remains stable globally, presentation timelines vary dramatically across developing clinical landscapes, altering the predictive weight of classic baseline markers [9].

3. Problem Definition

In the public healthcare landscape of Central India, patients presenting with pelvic and perineal necrotizing infections face unique socioeconomic challenges. Modesty taboos regarding genitourinary anatomy, structural poverty, low health literacy, and initial encounters with informal, uncertified practitioners collectively cause prolonged delays in seeking definitive surgical care. Consequently, patients frequently arrive at tertiary emergency departments in advanced septic shock, with deep infections extending across extensive soft-tissue planes. Because existing risk indices were validated primarily in high-resource Western cohorts with short presentation windows, there is a clear clinical need to identify independent metabolic and clinical predictors of mortality within an advanced-stage, resource-limited demographic.

4. Methodology/ Approach

This retrospective observational cohort study was conducted

within the Department of General Surgery at a tertiary care teaching hospital in Central India. The study covered a five-year window from January 2021 to December 2025. Formal approval was obtained from the Institutional Ethics Committee (Approval No.: IEC/MGM/2026/F-42); a waiver of individual patient informed consent was specifically granted due to the anonymized nature of the retrospective data. Out of 82 screened individuals presenting with perineal infections, 18 were excluded due to localized superficial abscesses without fascial necrosis (n=11), leaving against medical advice preoperatively (n=4), or highly incomplete charts (n=3), leaving a final analytical cohort of 64 patients.

Data were extracted using a standardized clinical proforma tracking demographics, comorbidities, triage vitals, and laboratory parameters obtained within 1 hour of emergency arrival. The baseline admission FGSI score was aggregated for each patient [2]. Statistical calculations were performed via SPSS version 26.0. Continuous data were compared using the independent Student's t-test or the non-parametric Mann-Whitney U test based on normality distributions. Categorical variables were analyzed using Pearson's Chi-square or Fisher's exact test. To ensure stability of the logistic model given the small number of clinical events (n = 10 deaths), we minimized the risk of model overfitting by executing a prespecified parsimonious multivariable logistic regression model restricted exclusively to parameters demonstrating clinical and univariable significance: Presentation Delay (>72 hours) and an Admission FGSI Score > 9. Statistical significance was defined at Plt; 0.05.

5. Results & Discussion

The mean age of the overall cohort (N=64) was 52.4 +/- 11.8 years, with a strict male predominance (93.8%). The overall in-hospital mortality rate was 15.6% (10/64). Non-survivors were significantly older than survivors (64.8 +/- 8.6 years vs. 50.1 +/- 10.9 years; Plt 0.001). Type 2 Diabetes Mellitus was the leading comorbidity (56.3%), showing a significantly higher distribution among non-survivors (80.0% vs. 51.8%; P = 0.041). Delayed hospital presentation exceeding 72 hours from symptom onset was observed in 59.4% (38/64) of the total population, occurring in 90.0% (9/10) of non-survivors (P = 0.034). Systemic shock at triage was noted in 18.8% (12/64) of all cases, heavily concentrated in the non-survivor arm (80.0% vs. 7.4%; P < 0.001). Triage metabolic evaluations demonstrated severe physiological deviations in non-survivor metrics, as summarized in **Table 1**.

Table 1: Triage Laboratory Parameters and Physiological Scores

Laboratory Parameter (Normal Range)	Total Cohort (N=64)	Survivors (n=54)	Non-Survivors (n=10)	P-value
Hemoglobin (13.0-17.0 g/dL)	11.2 +/- 2.1	11.5 +/- 1.8	9.6 +/- 2.4	**0.006**
WBC Count (4,000-11,000 / mu L)	18,450 +/- 5,200	16,800 +/- 4,100	27,360 +/- 6,800	**< 0.001**
Serum Sodium (135-145 mEq/L)	135.0 +/- 4.1	136.1 +/- 3.2	129.2 +/- 4.1	**< 0.001**
Serum Potassium (3.5-5.1 mEq/L)	4.4 +/-0.7	4.2 +/- 0.5	5.3 +/- 0.9	**< 0.001**
Serum Creatinine (0.6-1.2 mg/dL)	1.45 +/- 0.62	1.21 +/- 0.38	2.74 +/- 0.91	**< 0.001**
Blood Urea Nitrogen (7-20 mg/dL)	26.4 +/- 12.8	21.5 +/- 8.4	52.9 +/- 18.6	**< 0.001**
Serum Bicarbonate (22-29 mEq/L)	20.2 +/- 3.8	21.4 +/- 2.9	13.8 +/- 3.1	**< 0.001**
Mean Admission FGSI Score	5.1 +/- 2.9	4.1 +/- 1.8	10.2 +/- 2.4	**< 0.001**

To establish statistical stability despite the low event frequency (n=10 deaths), non-calculated indicators were left out of the multivariable regression. The final model parameters are detailed in Table 2.

Table 2: Parsimonious Multivariable Logistic Regression Model for Predictors of Mortality

Explanatory Clinical Variable	Adjusted Odds Ratio (aOR)	95% Confidence Interval (CI)	P-value
Presentation Delay > 72 Hours	4.65	1.08 – 19.92	0.039
Admission FGSI Score > 9	10.84	2.05 – 57.18	0.005

Synergistic polymicrobial isolation was verified in 68.8% (44/64) of deep operative tissue cultures. *Escherichia coli* was isolated as the dominant pathogen (51.6%), followed by obligate anaerobes (37.5%), *Klebsiella pneumoniae* (28.1%), *Pseudomonas aeruginosa* (21.9%), and *Staphylococcus aureus* (17.2%). Initial empirical antibiotic therapy consisted of a broad-spectrum carbapenem paired with clindamycin or linezolid, subsequently de-escalated based on culture-directed isolates. Emergency surgical debridement was performed within a median of 4 hours from admission.

Table 3: Healthcare Resource Utilization and Wound Management Timelines

Clinical Variable / Procedure	Total Cohort (N=64)	Survivors (n=54)	Non-Survivos (n=10)	P-value
Median Number of Debridements (Range)	3 (1 – 6)	3 (1 – 6)	2 (1 – 4)	0.42*
Median ICU Length of Stay, Days (Range)	4 (0 – 22)	3 (0 – 14)	9 (1 – 22)	0.002†
Median Total Hospital Stay, Days (Range)	24 (1 – 58)	28 (10 – 58)	9 (1 – 22)	< 0.001†
Urinary Diversion: SPC, n (%)	14 (21.8\%)	13 (24.1\%)	1 (10.0\%)	0.43*
Fecal Diversion: Loop Colostomy, n (%)	9 (14.1\%)	8 (14.8\%)	1 (10.0\%)	0.99*
Definitive Reconstructive Method (n=54)				
* Secondary Intention Healing / Dressing*	—	12 (22.2\%)	—	—
* Secondary Wound Closure / Suturing*	—	24 (44.4\%)	—	—
* Split-Thickness Skin Grafting (STSG)*	—	11 (20.4\%)	—	—
* Scrotal Advancement / Local Flap*	—	7 (13.0\%)	—	—

P-value calculated via Chi-square/Fisher's exact test; †P-value calculated via non-parametric Mann-Whitney U test.

Our investigation demonstrates clear concordance with global series regarding metabolic and microbiological architecture. Type 2 Diabetes Mellitus remains the predominant systemic driver, noted in 56.3% of our patients. This is highly

consistent with the findings of Yılmazlar et al. (57.5%) and Verma et al. (54.7%) [9, 10]. Mechanistically, hyperglycemic microenvironments cause polymorphonuclear leukocyte dysfunction, impairing chemotaxis and intracellular phagocytic burst activity. In contrast to single-variable screenings which frequently implicate advanced age or isolated comorbidities as definitive drivers of mortality, our prespecified parsimonious multivariable regression highlights that systemic decompensation outweighs isolated demographic parameters (**Table 2**). When controlling for overfitted parameters, an admission **FGSI score** was independently associated with mortality, showing a 10.84-fold increase in the odds of death (P = 0.005). This validates the historical threshold originally set by Laor et al. (1995) [2].

A notable finding in our cohort was that **Presentation Delay > 72 hours** was independently associated with mortality (**Table 2**), increasing the odds of death 4.65-fold (P = 0.039). This delay is a critical variable in public tertiary teaching setups across developing regions. When patients delay presentation, the infection moves beyond the well-vascularized Dartos fascia of the scrotum into deep pelvic spaces, the thigh compartments, and up the anterior abdominal wall along Scarpa's fascia. This increase in the anatomical surface area of infection causes substantial fluid sequestration, severe electrolyte imbalances, and rapid endotoxin release, explaining the marked hyponatremia and profound metabolic acidosis seen in our non-survivor subset (**Table 1**). Managing these advanced presentations requires considerable resources from public healthcare setups, including prolonged ICU stays (median 9 days for non-survivors) and complex reconstructive demands (**Table 3**). In our center, as mirrored in the global reconstruction synthesis by Susini et al. (2024) [8], specialized local scrotal advancement flaps or skin grafting (33.4%) were essential to achieve durable cover for exposed testes.

6. Conclusion

Fournier's Gangrene remains a high-acuity surgical emergency in Central India, characterized by advanced presentations and a stable mortality rate of 15.6%. Multivariable analysis (**Table 2**) shows that an admission FGSI score and a presentation delay exceeding 72 hours are strongly associated with poor outcomes. Improving survival rates requires a combination of community-level health education to minimize presentation delays, rapid risk-stratification at triage, and immediate, radical surgical debridement.

7. Future Scope

The clinical insights gained from this baseline review lay the foundation for expanding surgical care pathways within resource-limited hospital settings. Future clinical efforts should focus on transitioning from retrospective data collection to prospective, multi-center registries across Central India to comprehensively map regional microbiological resistance trends against newer empirical carbapenem-sparing antibiotic regimens. Additionally, introducing standardized risk-assessment algorithms directly into emergency triage bays can help clinicians identify high-risk cases earlier, prompting faster operating theater placement. There is also a clear need to conduct long-term post-discharge follow-ups that evaluate functional outcomes, such as chronic perineal pain, scar contractures, and psychological recovery following complex scrotal reconstruction.

A limitation of this study is its retrospective design and relatively small sample size (N = 64). Crucially, the low number of clinical events (n = 10 deaths) restricted the number of variables that could be safely entered into the multivariable regression model without violating mathematical stability or introducing severe overfitting. Consequently, a prespecified parsimonious model was selected (**Table 2**), which may have excluded soft clinical parameters that would express statistical trends within a larger multi-center registry.

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