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Original Research Article

A CLINICAL STUDY ON FOURNIER'S GANGRENE

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ABSTRACT

Background: Fournier's gangrene is a rapidly progressive necrotizing infection of the perineal and genital regions associated with significant morbidity and mortality. This study evaluated the clinical profile, risk factors, microbiology, management, outcomes, and prognostic utility of the Fournier's Gangrene Severity Index (FGSI). **Materials and Methods:** A prospective observational study was conducted over 18 months in the Department of General Surgery, Government Medical College, Ongole, involving 57 consecutive adults with surgically confirmed Fournier's gangrene. Demographic, clinical, laboratory, microbiological, treatment, and outcome data were collected prospectively. Patients underwent resuscitation, broad-spectrum antibiotics, emergency surgical debridement, serial wound assessment, and delayed reconstruction as indicated. Associations with mortality and FGSI were assessed. **Results:** All 57 patients were male, with a mean age of 51.4 ± 10.9 years. Diabetes mellitus (56.1%) and alcoholism (36.8%) were the commonest risk factors. Pain and swelling were universal, while fetid odour (86.0%) and purulent discharge (63.2%) were frequent. Scrotal involvement predominated (64.9%). Escherichia coli was the most frequently isolated organism (64.9%). Secondary suturing was the commonest reconstruction (61.4%), and 75.4% underwent a single debridement. Overall mortality was 15.8%. Individual risk factors and laboratory abnormalities were not significantly associated with mortality. However, sepsis and renal failure were each associated with 46.2% mortality, while cardiac failure showed 77.8% mortality. Patients with FGSI >9 had 80% mortality compared with 9.6% in those with FGSI ≤9. **Conclusion:** Fournier's gangrene requires early diagnosis, prompt surgical debridement, antimicrobial therapy, and intensive supportive care. Systemic complications were stronger determinants of mortality than individual risk factors. FGSI demonstrated good prognostic discrimination and may be useful for early risk stratification and management planning.

INTRODUCTION

Fournier's gangrene is a rare, rapidly progressive polymicrobial necrotizing fasciitis affecting the superficial and deep tissues of the perineal, anal, scrotal, penile, and vulvar regions. First described by Alfred Fournier in 1883 as spontaneous gangrene of the genitalia in five patients, the condition was initially believed monomicrobial (streptococcal), but twentieth-century microbiology revealed its synergistic polymicrobial nature involving aerobes (E. coli, Staphylococcus) and anaerobes (Bacteroides, Clostridium) that spread along fascial planes, causing rapid tissue destruction and systemic sepsis. Contemporary imaging, surgical advances, and ICU care have reduced historical mortality from 40–50% to 7.5–19.8% in modern series.[1,2]

The disease has an incidence of 1.6 per 100,000 males annually in the US, peaking at 3.3/100,000 in ages 50–79, representing <0.02% of hospital admissions1. Geographic variation shows southern US rates at 1.9/100,000 versus 1.3 elsewhere1. A 1,726-case review reported 16% mortality, with tertiary centers at 20–40% versus population-based 5.8–19.8%. Females (10–15% of cases) exhibit higher mortality (~12.8%), with mean age 50–60 years and age as an adverse prognostic factor15. In India, high diabetes prevalence (especially SGLT-2 inhibitors) and delayed presentation amplify local burden.[3]

Management rests on four pillars: hemodynamic resuscitation, broad-spectrum antibiotics, emergent

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debridement (<12 hours, ideally <6), and ICU support. Antibiotics target Gram-positive (Streptococcus, Staphylococcus), Gram- negative (E. coli, Pseudomonas, Klebsiella), and anaerobes (Bacteroides), using carbapenems + clindamycin or ampicillin-sulbactam + gentamicin (vancomycin for MRSA)12. Surgery evolved from radical to skin-sparing debridement with 24– 48-hour re-look, plus colostomy (10–35% extensive perianal disease) and suprapubic catheterisation. Adjuncts (VAC, HBOT) aid healing; reconstruction (closure, STSG, flaps) follows source control.[4]

This Indian study addresses gaps in resource-limited settings where diabetes/SGLT-2 use and delayed presentation predominate. Future research priorities include institutional pathways, SGLT-2 mechanisms, skin-sparing debridement trials, advanced reconstruction, antimicrobial peptides, and long-term survivor outcomes via multicenter registries. Our institutional analysis characterizes presentation patterns, microbiology, prognostic factors, and outcomes to inform protocols, resident training, and global comparisons, advancing standards for this surgical emergency.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational cohort study was conducted in the Department of General Surgery, Government Medical College, Ongole, over a period of 18 months. All consecutive adult patients diagnosed with Fournier's gangrene during the study period were assessed for eligibility. A total of 57 patients with confirmed Fournier's gangrene were included in the study. The study was conducted in accordance with institutional ethical guidelines and received approval from the Institutional Ethics Committee.

Sample Size

The sample size was calculated based on the primary outcome of **mortality estimation** using the single-proportion formula for a descriptive cohort study:

$n=d2Z2P(1−P)$

Where:

- **n** = minimum required sample size
- **Z** = 1.96 for a 95% confidence level
- **P** = anticipated mortality of 15%
- **d** = absolute precision of 10%

The anticipated mortality was based on previously reported mortality rates, including 11.8% reported by Sockkalingam et al,[4] and approximately 13% reported by Kundan et al,[5] with published literature reporting mortality rates ranging from approximately 7.5% to 19.8%.

Thus:

$n=(0.10)2(1.96)2×0.15(1−0.15)$

$n=0.013.8416×0.1275\ n=0.010.4898=48.98$

The minimum sample size was therefore rounded to **50 patients**.

During the 18-month study period, **57 consecutive eligible patients** were recruited, thereby exceeding the calculated minimum sample size.

Study Population

The study population consisted of adult patients diagnosed with Fournier's gangrene and managed at the Department of General Surgery, Government Medical College, Ongole.

Inclusion Criteria

Patients were included if they fulfilled the following criteria:

- Age ≥18 years.
- Clinical diagnosis of Fournier's gangrene based on features such as acute scrotal/perineal pain, swelling, crepitus, fetid odour and/or systemic toxicity.
- Diagnosis confirmed by surgical exploration and/or histopathological examination.
- Patients managed at the study institution.

Exclusion Criteria

Patients were excluded if they had:

- Isolated cellulitis or abscess without evidence of necrotizing fasciitis.
- Necrotizing fasciitis originating from a non-genital site.
- Refusal to undergo surgical intervention.

Data were collected prospectively using a **structured data collection proforma**.

The demographic and clinical variables were recorded are Age, Gender, Occupation, Relevant medical history, Comorbidities, Portal of entry, Duration of symptoms and Clinical extent of disease

Clinical Examination

A detailed clinical examination was performed at admission. The following parameters were recorded as Vital signs, Local pain and swelling, Erythema, Purulent discharge, Crepitus, Fetid odour, Anatomical extent of involvement, including scrotum, penis, perineum and extension to multiple sites and Presence of systemic toxicity

The **Fournier's Gangrene Severity Index (FGSI)** was calculated at admission to assess disease severity and its relationship with outcome.

Baseline laboratory investigations were performed at admission and included. Particular attention was given to the presence of leucocytosis, anemia, hyperglycemia, increased serum creatinine, hypoalbuminemia and hypocalcemia.

Imaging

Ultrasonography and/or computed tomography (CT) were performed **when clinically indicated** to assess the extent of disease and involvement of deeper tissues. Imaging was not used to delay emergency surgical intervention in clinically evident cases.

Microbiological Assessment

Wound specimens were obtained during surgical management for microbiological examination. Wound swabs and blood cultures, when indicated, were subjected to organism identification and antibiotic sensitivity testing. The bacterial isolates

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were subsequently categorized according to the organisms identified, including **E. coli, Staphylococci, Streptococci, Klebsiella, Proteus, Pseudomonas and Bacteroides**.

Management Protocol

All patients were managed according to a standardized institutional treatment protocol.

On admission, patients underwent immediate resuscitation, including Intravenous fluid administration, Hemodynamic stabilization, Correction of metabolic abnormalities and Broad-spectrum intravenous antibiotics

The initial antibiotic regimen consisted of:

- **Piperacillin-tazobactam 4.5 g intravenously every 6 hours**
- **Clindamycin 600 mg intravenously every 8 hours**

Antibiotic therapy was subsequently modified according to clinical response and microbiological sensitivity results where applicable.

Surgical Management

Emergency surgical debridement was performed, with the aim of achieving complete removal of devitalized and necrotic tissue. Radical excision was continued until healthy, bleeding tissue was identified. Where the viability of tissue was equivocal, intraoperative frozen-section assessment was used as an adjunct to surgical decision-making. The timing of initial debridement was targeted to occur within **24 hours of presentation**.

Intensive Care Management

Patients with **FGSI >9 and/or systemic instability** were monitored in the intensive care unit as clinically indicated. Patients were closely monitored for the development of sepsis, renal failure, cardiac failure and other systemic complications.

Serial Debridement

Following the initial operation, wounds were reassessed regularly. Repeat surgical exploration and debridement were performed when residual or recurrent necrotic tissue was identified.

Wound Reconstruction

Following adequate source control and development of a healthy wound bed, reconstruction was performed according to the extent and location of tissue loss. Reconstruction methods included:

- Secondary suturing
- Split-thickness skin grafting (STSG)
- Testicular repositioning
- Orchidectomy with subsequent wound closure, when required

Adjunctive Procedures

Additional procedures such as colostomy and suprapubic catheterization were performed when clinically indicated according to the extent of perineal involvement and associated contamination or urinary involvement.

Outcome Measures

The primary outcomes assessed were Mortality, Duration of hospital stay and Number/frequency of surgical debridements

Secondary outcomes included as Development of sepsis, Renal failure, Cardiac failure, Pneumonia, Microbiological profile, Association between FGSI and mortality, Reconstruction procedures, Reconstruction outcome and Functional recovery at discharge, including sexual and urinary status where documented

Statistical Analysis

Data were entered and analysed using SPSS version 25.

Continuous variables were summarized using mean ± standard deviation (SD) for normally distributed data and median with interquartile range (IQR) where appropriate. Categorical variables were expressed as frequencies and percentages.

For comparison between groups:

- **Student's *t*-test** was used for comparison of normally distributed continuous variables.
- **Mann–Whitney U test** was used for non-normally distributed continuous variables.
- **Chi-square test** was used for categorical variables where applicable.
- **Fisher's exact test** was used when expected cell frequencies were small.

The association between **FGSI and mortality** was assessed using logistic regression analysis. Kaplan–Meier survival analysis was planned to evaluate temporal mortality patterns.

A **p-value <0.05** was considered statistically significant.

Ethical Considerations

The study was conducted after obtaining approval from the **Institutional Ethics Committee of Government Medical College, Ongole**. The study adhered to institutional ethical requirements for research involving human participants. Patient confidentiality was maintained throughout data collection, analysis and reporting.

RESULTS

Table 1: Demographic Characteristics and Risk Factors of the Study Population

Parameter	Number (n)	Percentage / Mean ± SD
Age (years)		**51.4 ± 10.9**
Age range		29–78
Male gender	57	100%
Risk Factors		
Diabetes mellitus	32	56.1%
Alcoholism	21	36.8%
Trauma/Post-operative	7	12.3%
HIV/Immunocompromised	5	8.8%

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The study included 57 male patients with a mean age of 51.4 ± 10.9 years (range 29–78 years). Diabetes mellitus was the most common associated risk factor, present in 56.1% of patients, followed by alcoholism in 36.8%. Trauma/post-operative status and HIV/immunocompromised status were present in 12.3% and 8.8% of patients, respectively. Thus, diabetes mellitus and alcoholism were the predominant risk factors in this study population.

Table 2: Clinical Presentation, Anatomical Involvement and Laboratory Findings

Category	Finding	Number (n)	Percentage
Clinical symptoms/signs	Pain	57	100.0%
	Swelling	57	100.0%
	Fetid odor	49	86.0%
	Purulent discharge	36	63.2%
	Fever	20	35.1%
	Erythema	17	29.8%
	Crepitus	16	28.1%
Site of involvement	Scrotum only	37	64.9%
	Penis only	10	17.5%
	Perineum	6	10.5%
	Extended/Multiple sites	4	7.0%
Laboratory findings	Leucocytosis	38	66.7%
	Hyperglycemia	38	66.7%
	Anemia	25	43.9%
	Hypocalcemia	21	36.8%
	Increased serum creatinine	20	35.1%
	Hypoalbuminemia	14	24.6%

Pain and swelling were universal presenting features, occurring in all patients, while fetid odor and purulent discharge were observed in 86.0% and 63.2%, respectively. The scrotum was the most frequently involved anatomical site (64.9%), followed by penis-only involvement (17.5%). Among laboratory abnormalities, leucocytosis and hyperglycemia were the most common, each occurring in 66.7% of patients. These findings demonstrate a predominantly local presentation accompanied by significant systemic and metabolic abnormalities.

Table 3: Microbiological Profile and Complications

Category	Finding	Number (n)	Percentage
Organisms isolated	E. coli	37	64.9%
	Staphylococci	20	35.1%
	Klebsiella	17	29.8%
	Streptococci	15	26.3%
	Pseudomonas	11	19.3%
	Proteus	7	12.3%
	Bacteroides	5	8.8%
Complications	Sepsis	13	22.8%
	Pneumonia	13	22.8%
	Renal failure	13	22.8%
	Cardiac failure	9	15.8%

E. coli was the most frequently isolated organism (64.9%), followed by Staphylococci (35.1%) and Klebsiella (29.8%), demonstrating the polymicrobial nature of the infection. Sepsis, pneumonia, and renal failure each occurred in 22.8% of patients, while cardiac failure occurred in 15.8%. The occurrence of these systemic complications indicates substantial morbidity among patients with Fournier's gangrene.

Table 4: Treatment, Reconstruction and Overall Outcome

Category	Parameter	Number (n)	Percentage
Reconstruction procedure	Secondary suturing	35	61.4%
	STSG (Split Skin Graft)	11	19.3%
	Testicular reposition	8	14.0%
	Orchidectomy + suturing	3	5.3%
Number of debridements	1 debridement	43	75.4%
	2 debridements	14	24.6%
Overall outcome	Discharged	48	84.2%
	Expired	9	15.8%

Secondary suturing was the most frequently performed reconstruction procedure (61.4%), followed by STSG (19.3%). Most patients underwent a single debridement (75.4%). Overall, 84.2% of patients were discharged, while 15.8% expired. The findings indicate that the majority of patients achieved survival following surgical management

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and reconstruction, although mortality remained clinically significant.

Table 5: Factors Associated with Mortality

Category	Factor	Mortality when Present	Mortality when Absent	P-value
Risk factors	Diabetes mellitus	21.9%	2/25	0.2894
	Alcoholism	4.8%	8/36	0.1715
	Trauma/Post-operative	14.3%	8/50	1.0000
	HIV/Immunocompromised	40.0%	7/52	0.3616
Clinical features	Fever	15.0%	6/37	1.0000
	Erythema	17.6%	6/40	1.0000
	Purulent discharge	19.4%	2/21	0.5390
	Crepitus	18.8%	6/41	1.0000
	Fetid odor	14.3%	2/8	0.8044
Laboratory findings	Leucocytosis	13.2%	4/19	0.7000
	Anemia	16.0%	5/32	1.0000
	Hyperglycemia	15.8%	3/19	1.0000
	Increased serum creatinine	15.0%	6/37	1.0000
	Hypoalbuminemia	14.3%	7/43	1.0000
	Hypocalcemia	9.5%	7/36	0.5390

None of the evaluated demographic risk factors, clinical symptoms, or laboratory abnormalities demonstrated a statistically significant association with mortality, as all p-values were greater than 0.05. Although HIV/immunocompromised status showed a relatively high mortality rate (40.0%) among affected patients, the association was not statistically significant ($p = 0.3616$). Similarly, purulent discharge had a mortality rate of 19.4%, but this was not statistically significant ($p = 0.5390$). These findings suggest that individual baseline risk factors, clinical signs, and laboratory abnormalities did not independently predict mortality in this cohort.

Table 6: Complications, Microbiology, Hospital Stay and Other Factors Associated with Mortality

Category	Factor	Mortality / Outcome	P-value
Complications	Sepsis	46.2% vs 6.8%	0.0028**
	Pneumonia	23.1% vs 13.6%	0.6985
	Renal failure	46.2% vs 6.8%	0.0028**
	Cardiac failure	77.8% vs 4.2%	0.0000***
Bacterial organisms	E. coli	16.2% vs 15.0%	1.0000
	Staphylococci	10.0% vs 18.9%	0.6166
	Streptococci	13.3% vs 16.7%	1.0000
	Klebsiella	35.3% vs 7.5%	0.0254*
	Proteus	0.0% vs 18.0%	0.5030
	Pseudomonas	18.2% vs 15.2%	1.0000
	Bacteroides	20.0% vs 15.4%	1.0000
Site of involvement	Scrotum only	18.9%	
	Penis only	10.0%	
	Perineum	0.0%	
	Extended/Multiple	25.0%	0.5924
Reconstruction	Secondary suturing	17.1%	
	Testicular reposition	0.0%	
	STSG	18.2%	
	Orchidectomy + suturing	33.3%	0.5144
Debridement	1 debridement	16.3%	
	2 debridements	14.3%	
Hospital stay	Discharged	13.8 ± 3.2 days	0.0900
	Expired	11.9 ± 2.8 days	

***p < 0.05 (Significant); ** p < 0.01 (Highly Significant); *** p < 0.001 (Very Highly Significant)**

Complications demonstrated the strongest associations with mortality. Sepsis and renal failure were associated with significantly higher mortality (46.2% each; $p = 0.0028$), while cardiac failure showed the highest mortality (77.8%) and a highly significant association with mortality ($p < 0.001$). Among the organisms, Klebsiella isolation showed a statistically significant association with mortality ($p = 0.0254$), whereas the other organisms did not. Mortality was highest in patients with extended/multiple-site involvement (25.0%) and among those undergoing orchidectomy with suturing (33.3%), although these associations were not statistically significant. The mean hospital stay was longer among discharged patients than those who expired, but this difference was not statistically significant ($p = 0.0900$).

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DISCUSSION

1. Demographic characteristics and mortality

In the present study, all 57 patients were male, with a mean age of 51.4 ± 10.9 years and an age range of 29–78 years. The age distribution is comparable with that reported by Sockkalingam et al,[4] who reported a mean age of 50 ± 11.13 years in a South Indian cohort, and Kundan et al,[5] who reported a mean age of approximately 48 years. The findings are also consistent with Smith et al,[6] and Yanar et al,[7] who reported that Fournier's gangrene predominantly affects patients in the fifth and sixth decades. The male predominance in the present study is consistent with the observations of other authors. Sockkalingam et al,[4] reported a male-to-female ratio of 33:1, while Yanar et al,[7] also reported a marked male predominance. The predominance of males in our study may reflect the higher frequency of urogenital and perineal predisposing conditions in men.

The overall mortality in our study was 15.8%, which is comparable with the mortality reported by Sockkalingam et al,[4] (11.8%) and Kundan et al,[5] (approximately 13%), and falls within the range reported by Smith et al,[6] and Yanar et al.[7] The relatively favourable mortality in our series may reflect early recognition, aggressive surgical treatment and improved perioperative supportive care. However, Yanar et al,[7] reported a substantially higher mortality of 40% in their series and identified sepsis at presentation as the only independent predictor of mortality. This difference may reflect differences in disease severity, patient selection, timing of presentation and treatment protocols between studies.

2. Diabetes mellitus and other risk factors

Diabetes mellitus was the most common risk factor in our study, occurring in 56.1% of patients. This was higher than the rates reported by Smith et al,[6] (45–50%), Yanar et al,[7] (40–50%), Sockkalingam et al,[4] (38.2%) and Kundan et al,[5] (31.4%). Thus, diabetes appears to be particularly prevalent in our study population. The high prevalence of diabetes is biologically plausible because hyperglycemia is associated with impaired neutrophil function, reduced phagocytosis, microvascular compromise and impaired tissue healing. These mechanisms can facilitate the development and progression of necrotizing infection. Interestingly, diabetes was not significantly associated with mortality in our study (p=0.2894). This finding is similar to the study by another 50-patient series in which diabetes was present in 34% of patients but was not associated with mortality (p=0.3). In contrast, a study of 45 patients reported diabetes as an independent predictor of mortality, indicating that the prognostic importance of diabetes remains inconsistent across studies. The difference may be related to sample size, severity of diabetes, glycemic control and the presence of other organ dysfunction. Chronic alcoholism was present in 36.8% of our patients. This was slightly higher than the 25–35% reported in the classic literature and higher than the 20.6% reported by Sockkalingam et al.[4] However, alcoholism was not significantly associated with mortality in our study (p=0.1715). Therefore, similar to diabetes, alcoholism appears to be an important predisposing factor, but not necessarily an independent determinant of outcome once FG has developed. Trauma/postoperative status was present in 12.3% of patients, which was comparable with the 10–20% range reported by previous authors. HIV/immunocompromised status was present in 8.8%, also falling within the ranges reported in the literature. Neither factor showed a statistically significant association with mortality in our study.

3. Site of involvement

Scrotal involvement was the most common anatomical finding in our study, occurring in 64.9% of patients. This was consistent with Smith et al,[6] and other published series, in which scrotal involvement has been reported in approximately 60–80% of cases. Perineal involvement alone occurred in 10.5%, while extended or multiple-site involvement was observed in 7.0%. Extended/multiple-site disease had the highest mortality in our cohort (25%), followed by scrotal involvement (18.9%). Penis-only involvement had a mortality of 10%, while no deaths occurred among patients with isolated perineal involvement. These findings are broadly comparable with previous reports showing poorer outcomes with extensive disease. However, the association between site of involvement and mortality was not statistically significant in our study (p=0.5924). Therefore, anatomical site alone cannot be considered an independent prognostic factor in our cohort. This finding is supported by contemporary studies in which anatomical location has not consistently demonstrated a significant relationship with mortality.

4. Clinical presentation

Pain and swelling were present in 100% of patients in our study. This finding agrees with Smith et al,[6] Yanar et al,[7] Sockkalingam et al,[4] and the general literature, where pain and local swelling are among the most consistent manifestations of FG. Fetid odour was present in 86% of patients, which was within the 70–90% range reported by previous authors. Purulent discharge was observed in 63.2%, also comparable with published frequencies. An important finding in our study was the relatively low frequency of fever (35.1%) compared with the 50–75% generally reported in the literature. This observation is clinically relevant because absence of fever should not delay the diagnosis of Fournier's gangrene. Local symptoms may precede systemic manifestations, particularly in patients with diabetes or immunosuppression. Crepitus was present in 28.1%, which was within the lower range reported in previous studies. Thus, while crepitus can support the diagnosis, its absence does not exclude FG.

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5. Laboratory findings

Leucocytosis was present in 66.7% of patients, which was comparable with the 60–80% reported by Smith et al,[6] and Yanar et al,[7] Hyperglycemia was also present in 66.7%, consistent with the high prevalence of diabetes in our cohort. Anemia occurred in 43.9%, increased serum creatinine in 35.1%, and hypoalbuminemia in 24.6%. These values were generally within the ranges reported by previous studies. Despite the relatively frequent occurrence of these abnormalities, none was significantly associated with mortality in our study. This is an important observation because individual laboratory parameters may indicate systemic illness but may not adequately discriminate survivors from non-survivors. This contrasts with some studies that identified renal dysfunction, anemia, elevated creatinine or other biochemical abnormalities as prognostic factors. For example, a 72-patient study found significantly higher urea, creatinine and lower hemoglobin among non-survivors. The difference may be explained by variations in sample size, disease severity and the statistical approach used.

6. Microbiological findings

The infection was polymicrobial in nature, with E. coli being the most commonly isolated organism (64.9%). This finding was remarkably consistent with the studies included in our comparison. Smith et al,[6] reported E. coli in approximately 60–75% of cases, while Yanar et al,[7] reported approximately 55–70%. Sockkalingam et al,[4] and Kundan et al,[5] also identified E. coli as the commonest organism. Staphylococci (35.1%), Streptococci (26.3%), Klebsiella (29.8%) and Pseudomonas (19.3%) were also isolated in our study, demonstrating the mixed aerobic and anaerobic microbiology characteristic of FG. Anaerobic organisms, represented by Bacteroides, were isolated in only 8.8% of patients despite fetid odour being present in 86%. The relatively low anaerobic culture yield compared with the literature may reflect difficulty in recovering anaerobic organisms from clinical specimens. The discrepancy between the high prevalence of fetid odour and the low isolation rate of anaerobes supports the importance of considering anaerobic infection even when cultures are negative. Interestingly, Klebsiella was significantly associated with mortality in our study (p=0.0254), with a mortality of 35.3% among patients in whom it was isolated. None of the other organisms demonstrated a statistically significant association with mortality. This finding should nevertheless be interpreted cautiously because of the relatively small number of patients and the possibility of polymicrobial infection.

7. Surgical debridement

The majority of patients in our study (75.4%) underwent a single debridement, while 24.6% required two debridements. This was considerably different from the experience reported by Sockkalingam et al,[4] where the mean number of debridements was 2.9 ± 1.42. Our lower number of procedures may reflect more extensive initial debridement and early source control. Kundan et al,[5] reported a mean of approximately 1.7 debridements among survivors, which is closer to the present study. Mortality was 16.3% after one debridement and 14.3% after two debridements, with no significant difference. Therefore, the number of debridements itself did not predict mortality. Similarly, another 50-patient study found that mortality did not differ significantly between patients undergoing single versus repeated debridement. The important determinant is therefore likely to be adequacy and timing of source control rather than the absolute number of operations.

8. Reconstruction

Secondary suturing was the most common reconstruction procedure in our study (61.4%), followed by STSG (19.3%), testicular reposition (14.0%) and orchidectomy with suturing (5.3%). These findings were comparable with the literature, in which delayed/secondary closure is frequently used following adequate infection control. Mortality was 17.1% after secondary suturing, 18.2% after STSG and 33.3% after orchidectomy with suturing, whereas no deaths occurred in the testicular reposition group. However, the difference was not statistically significant (p=0.5144). This suggests that the reconstruction technique is primarily determined by the extent of tissue loss and tissue viability rather than being an independent determinant of survival.

9. Systemic complications and mortality

The most important finding of the present study was the relationship between systemic complications and mortality. Sepsis, pneumonia and renal failure each occurred in 22.8% of patients, while cardiac failure occurred in 15.8%. These frequencies were generally comparable with those reported by Smith et al,[6] Yanar et al,[7] and other published series. However, their effect on mortality was markedly different. Cardiac failure was associated with 77.8% mortality (p<0.001), while both sepsis and renal failure were associated with 46.2% mortality (p=0.0028). Pneumonia, although relatively common, was not significantly associated with mortality. These findings are strongly supported by Yanar et al,[7] who found that sepsis at initial presentation was the only independent risk factor for mortality, with mortality reaching 78% among patients presenting with sepsis. A systematic review and meta-analysis similarly found the highest mortality associated with sepsis and multiple organ failure, further emphasizing that systemic deterioration is a major determinant of outcome. Thus, the present study supports the concept that acute organ dysfunction is more closely related to mortality than the mere presence of a pre-existing comorbidity.

10. Fournier's Gangrene Severity Index

The mean FGSI score in our study was 3.68. Patients with an FGSI ≤9 had a mortality of 9.6%, whereas those with FGSI >9 had a mortality of 80%, demonstrating a marked difference in outcome according to disease severity. This finding is

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consistent with Kundan et al,[5] who demonstrated a strong relationship between increasing FGSI and mortality. In their 156-patient study, survival was 100% among patients with FGSI ≤3, and the predictive performance of FGSI was excellent. Our findings therefore suggest that FGSI provides better prognostic discrimination than individual risk factors such as diabetes or alcoholism and individual laboratory abnormalities. This is particularly important because our study found that most individual baseline parameters were not significantly associated with mortality.

11. Hospital stay and outcome

The mean hospital stay among survivors was 13.8 ± 3.2 days, compared with 11.9 ± 2.8 days among non-survivors. Although survivors remained hospitalized longer, the difference was not statistically significant (p=0.0900). The shorter hospital stay among non-survivors may reflect early death from severe systemic disease rather than faster recovery. A similar pattern was reported in another study in which survivors had a considerably longer hospital stay than non-survivors. Thus, hospital duration in FG should not be interpreted simply as a marker of disease severity; among survivors, prolonged admission may reflect repeated wound assessment, reconstruction and rehabilitation.

The present study demonstrates considerable agreement with previous literature regarding the epidemiology, risk factors, clinical presentation and microbiology of Fournier's gangrene. Diabetes mellitus and alcoholism were common, scrotal involvement predominated, and E. coli was the most frequently isolated organism. These findings are consistent with the pathophysiological and microbiological framework described by Chowdhury et al,[8] and the microbiological literature.[11] However, an important finding of our study was that baseline risk factors and individual laboratory abnormalities did not significantly predict mortality. In contrast, sepsis, renal failure and cardiac failure were strongly associated with death. This indicates that prognosis may depend more on the degree of systemic physiological deterioration than on the presence of individual comorbidities. The strong difference in mortality between FGSI ≤9 and >9 further supports the use of FGSI for early prognostic assessment. This is in keeping with the recent review by Bowen et al,[9] and the 2025 evaluation of FGSI.[10]

CONCLUSION

Fournier's gangrene remains a potentially life-threatening surgical emergency, with mortality determined more by the development of systemic complications and organ dysfunction than by individual predisposing factors alone. Diabetes mellitus and alcoholism were common among affected patients, while E. coli was the predominant organism. Early recognition, prompt and adequate surgical debridement, appropriate antimicrobial therapy, aggressive supportive care, and close monitoring for systemic complications are essential for improving outcomes. FGSI demonstrated useful prognostic discrimination and may serve as a practical bedside tool for early risk stratification and identification of patients requiring intensive monitoring and aggressive management.

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