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ORIGINAL PAPER

High mortality and clinical characteristics of Fournier's gangrene: A 10-year retrospective study from an Indonesian tertiary Hospital

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Summary *Introduction: Fournier's gangrene (FG) is a rare but life-threatening necrotizing soft tissue infection with persistently high mortality. Data describing long-term clinical profiles and outcomes of FG in Indonesia remain limited.*

Materials and methods: A retrospective cohort study was conducted including all patients diagnosed with Fournier's gangrene at RSUD Dr. Saiful Anwar Malang between 2014 and 2024. Demographic characteristics, comorbidities, microbiological findings, Fournier's Gangrene Severity Index (FGSI), and outcomes were analyzed descriptively. Associations between age and comorbidity burden were evaluated using one-way ANOVA and chi-square tests.

Results: A total of 119 patients were included, with a mean age of 54.39 ± 12.11 years. Most patients were aged 56-65 years (37.81%). Renal impairment was the most frequently documented comorbidity (26.1%), while 33.6% of patients had no recorded comorbid conditions. Increasing age was significantly associated with greater comorbidity burden ($p < 0.001$). FGSI analysis was available in 44 patients and demonstrated very high mortality among patients with FGSI > 9 (95%). Mortality among patients with FGSI ≤ 9 also remained high (77.3%), suggesting limited prognostic discrimination in this cohort. Microbiological cultures were available in 33 patients, with Escherichia coli as the most common isolate (53.3%). Antibiotic sensitivity testing showed low sensitivity to meropenem (27.27%) and ciprofloxacin (21.21%).

Conclusions: Fournier's gangrene in this tertiary center predominantly affected older patients and was associated with high mortality. Limited prognostic discrimination of FGSI and notable antimicrobial resistance patterns highlight the importance of early recognition and locally tailored management strategies.

KEY WORDS: Fournier's gangrene; FGSI; Mortality; Prognostic.

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INTRODUCTION

Fournier's gangrene (FG) is classically defined as a rapidly progressive, polymicrobial necrotizing fasciitis of the perineal, genital, and perianal regions (1, 2). It is a life-threatening soft-tissue infection that spreads along fascial planes and leads to overwhelming sepsis and multi-organ failure. FG occurs across all ages and both sexes (3, 4), though its incidence remains low at approximately 1.6 cases per 100,000 males annually. Despite this rarity, mortality is persistently high, with contemporary series reporting in-hospital death rates of 20-40% (5, 6).

Patients are typically older males with significant comorbidities, most commonly diabetes mellitus, alcohol misuse, immunosuppression, renal or hepatic disease, malnutrition, and local anorectal or genitourinary infections (7). The usual pathogenic sequence begins with a breach in perineal skin or mucosa leading to synergistic polymicrobial invasion. Up to 10% of cases, however, remain idiopathic. Clinical deterioration is rapid, often presenting with perineal pain, swelling, crepitus, and systemic toxicity (1, 2). In Asian populations, epidemiologic data remain limited. An Indonesian tertiary-care series reported 91% male predominance, median age 52 years, and an in-hospital mortality of 26.2% (8).

Management is aggressive and multidisciplinary. Prompt resuscitation, broad-spectrum antimicrobial therapy, and immediate radical debridement are the pillars of treatment (9). Adjunctive measures may aid wound control but do not replace early source control. Prognostic scoring systems such as the *Fournier's Gangrene Severity Index* (FGSI) assist in stratifying severity (10). Nevertheless, institution-specific data remain scarce (11).

In Indonesia, a large and geographically dispersed population combined with uneven access to healthcare services contributes to delayed hospital presentation in many patients with severe infections, including Fournier's gangrene. Patients frequently arrive at tertiary centers after prolonged symptom duration, often with extensive local tissue necrosis despite relatively early systemic inflammatory or septic manifestations.

This clinical context may partly explain the occurrence of high mortality even among patients presenting with lower FGSI scores at admission, as FGSI primarily reflects physiological derangement rather than the anatomical extent of necrosis.

Although prior Indonesian studies have reported demographic characteristics and selected prognostic factors, published data remain largely limited to small case series with heterogeneous reporting of clinical profiles, microbiology, and outcomes. At our institution, previous prognos-

tic work has evaluated mortality predictors in Fournier's gangrene through comparison of FGSI and procalcitonin levels (12), yet comprehensive long-term evaluations describing the full clinical spectrum, microbial patterns, and outcome measures have not been performed. This lack of robust local data limits the ability to contextualize prognosis, calibrate severity scoring, and refine early management pathways for our patient population.

To address these gaps within the context of delayed presentation and healthcare access disparities, we conducted a 10-year retrospective cohort study of all Fournier's gangrene cases treated at RSUD Dr. Saiful Anwar Malang from 2014-2024. Clinical profiles, comorbidities, microbial findings, FGSI scores, and outcomes were systematically evaluated to provide institution-specific data that may inform earlier recognition and context-appropriate management strategies in Indonesia.

Methods

Ethical considerations

This retrospective study was approved by The *Ethics Commission of General Hospital Dr. Saiful Anwar* (No.400/349/K.3/102.7/2025), given the non-interventional design and use of existing medical records. All data were extracted and analysed in a de-identified form to protect patient privacy.

Study design and patient selection

We performed a retrospective descriptive review of consecutive adult patients (≥ 18 years) admitted with a diagnosis of Fournier's gangrene to RSUD Dr. Saiful Anwar Malang between 1 January 2014 and 31 December 2024. Diagnosis was established by clinical documentation supported by physical examination. Exclusion criteria were: (1) patients who were initially managed at another hospital and transferred after primary source control without complete records; (2) patients with do-not-resuscitate (DNR) orders who received only palliative treatment on admission; and (3) records missing key variables required for the prespecified outcomes.

Definitions and clinical parameters

Fournier's gangrene was defined as polymicrobial necrotizing fasciitis of the perineal, genital, or perianal regions. FGSI was calculated from physiologic and laboratory values recorded within the first 24 hours of presentation, using the standard FGSI components (temperature, heart rate, respiratory rate, serum electrolytes, creatinine, haematocrit). Comorbid burden was recorded using clinical history and summarized using relevant indices when available. Source control was defined as any surgical debridement performed at bedside or in the operating theatre. *Multidrug-resistant* (MDR) organisms were defined as isolates resistant to ≥ 3 antibiotic classes, consistent with standard definitions recorded by the microbiology laboratory. In-hospital mortality was the primary outcome for survival reporting.

Data collection

Medical records and electronic charts were reviewed to extract: patient demographics, comorbidities, presenting signs, laboratory values for FGSI calculation (first 24 h), in-hospital mortality, intraoperative and wound culture results, and antimicrobial susceptibility reports.

Microbiological data reflect organisms isolated from intraoperative or wound cultures collected at the time of source control. All data were entered into a preformatted Microsoft Excel spreadsheet and checked for completeness and internal consistency.

Data analysis

All statistical analyses were performed using IBM SPSS Statistics (version 31). Data management and preliminary descriptive summaries were conducted using Microsoft Excel. Categorical variables are presented as counts and percentages, while continuous variables are reported as mean ± standard deviation. Inferential analyses included Chi-square tests, one-way ANOVA, and Spearman correlation, with statistical significance defined as $p < 0.05$.

Results

This retrospective study was approved by the *Institutional Review Board of RSUD Dr. Saiful Anwar Malang*. A total of 119 patients diagnosed with Fournier's gangrene were included in this study. The mean age was 54.39 ± 12.11 years, with the majority of patients aged between 56-65 years (37.81%), followed by those aged 46-55 years (26.89%). Regarding comorbidities, renal impairment recorded at admission was the most frequent (26.1%), followed by diabetes mellitus combined with renal impairment (10.1%), hypertension with renal impairment (11.8%), and isolated diabetes mellitus (7.6%). Renal impairment in this study was defined based on available admission laboratory data, and differentiation between pre-existing chronic kidney disease and acute kidney injury secondary to sepsis could not be consistently established.

A comparison of mean age across the eight comorbidity groups demonstrated a statistically significant difference ($p < 0.000$). Patients with hypertension + renal impairment and those with hypertension + diabetes tended to have higher mean ages, whereas patients without comorbidities had lower mean age values. These findings indicate that increasing comorbidity burden is associated with older age.

Further analysis comparing age groups with a binary comorbidity status (no comorbidity vs ≥ 1 comorbidity) showed a statistically significant association ($p < 0.000$). Patients aged ≥ 56 years were more likely to have at least one comorbidity compared with younger age groups, indicating a strong age-related pattern in comorbidity distribution.

Overall, these results demonstrate that increasing age is associated with a higher prevalence of comorbidities, and that patients with multiple comorbidities tend to be older. This pattern suggests that a greater comorbidity burden is associated with a higher likelihood of disease severity and occurrence, consistent with the known risk profile of Fournier's gangrene.

Bacterial culture results were not available for all patients. Only a subset had complete microbiological data because cultures were not consistently obtained at presentation or

Table 1.
Clinical profile of Fournier's Gangrene patient.

Patient characteristics	N	Percentage (%)
Age (years old)		
Mean ± SD	54,39 ± 12.11	
16-25	3	2.52
26-35	5	4.2
36-45	16	13.44
46-55	32	26.89
56-65	45	37.81
66-88	18	15.13
Total	119	
Comorbid		
Hypertension	9	7.56
DM	6	5.04
Renal Impairment	19	15.97
Hypertension + DM	9	7.56
Hypertension + Renal Impairment	16	13.45
Hypertension + DM + Renal Impairment	7	5.88
DM + Renal Impairment	4	3.36
Total	70	58.82
No Comorbid	49	41.18
Total	119	
Fournier's Gangrene severity Index (FGSI)		
≤ 9	72	60,5
> 9	47	39,49
Total	119	
Bacteria culture result		
E. Coli	24	53.3
Klebsiella pneumoniae	4	8.9
Klebsiella pneumoniae + Proteus mirabilis	3	6.7
Pseudomonas aeruginosa	2	4.4
Total	33	
Antibiotic sensitivity		
Amikacin	17	51.52
Amoxiclav	8	24.24
Ampicillin	2	6.06
Ampicillin Sulbactam	9	27.27
Benzylpenicillin	1	3.03
Cefoperazone Sulbactam	17	51.52
Ceftazidime	3	9.09
Ceftriaxone	2	6.06
Ciprofloxacin	7	21.21
Clindamycin	1	3.03
Cotrimoxazole	15	45.45
Erythromycin	1	3.03
Fosfomycin	1	3.03
Gentamicin	19	57.58
Levofloxacin	6	18.18
Meropenem	9	27.27
Tigecycline	2	6.06
Total	120	

samples were insufficient for processing. Among patients with available culture data, Escherichia coli as the most prevalent organism (53.3%), followed by Klebsiella pneumoniae (8.9%), Klebsiella pneumoniae combined with Proteus mirabilis (6.7%), and Pseudomonas aeruginosa (4.4%). Antibiotic sensitivity testing demonstrated the highest sensitivity to gentamicin (57.58%), cefoperazone-sulbactam (51.52%), and amikacin (51.52%), while moderate sensitivity was observed for cotrimoxazole (45.45%) and ampicillin-sulbactam (27.27%). Lower sensitivity rates were found for ciprofloxacin (21.21%), meropenem (27.27%), and amoxiclav (24.24%), whereas several antibiotics, including benzylpenicillin, clindamycin, erythromycin, and fosfomycin, exhibited minimal effectiveness (< 5%).

Table 2.
Comparison of mean age across comorbidity groups (One-way ANOVA).

Comorbidity group	N	Mean ± SD (years)
Hypertension	9	53.22 ± 6.14
DM	6	55.67 ± 7.26
Renal Impairment	19	61.79 ± 8.40
Hypertension + DM	9	57.56 ± 6.71
Hypertension + Renal Impairment	16	61.75 ± 9.41
Hypertension + DM + Renal Impairment	7	53.75 ± 3.95
DM + Renal Impairment	5	55.00 ± 6.88
No Comorbid	49	48.55 ± 14.26
Total	119	-
One-way ANOVA	-	p < 0.000

DM = diabetes mellitus.

Table 3.
Association between age group and comorbidity status (Chi-square Test)

Age Group (years)	No Comorbidity n (%)	≥ 1 Comorbidity n (%)	Total
16-25	3 (100%)	0 (0%)	3
26-35	5 (100%)	0 (0%)	5
36-45	14 (87.5%)	2 (12.5%)	16
46-55	9 (28.1%)	23 (71.9%)	32
56-65	12 (26.7%)	33 (73.3%)	45
66-88	6 (33.3%)	12 (66.7%)	18
Total	49 (41.2%)	70 (58.8%)	119
Chi-square test		p < 0.000	

Discussion

Fournier's gangrene predominantly affects males in their fifth and sixth decades of life. Our finding of a mean age of 54.39 ± 12.11 years is consistent with previous reports showing that Fournier's gangrene predominantly affects patients in the fifth to sixth decades of life. Reported mean ages in prior studies generally fall within a similar range (13).

The concentration of cases in the 56-65 year age group (37.81%) in our cohort further supports the classification of FG as a disease predominantly affecting older adults. Importantly, our statistical analysis demonstrated a significant association between increasing age and comorbidity

burden, with older patients more likely to present with ≥ 1 comorbidity ($p < 0.000$), reinforcing the age-dependent risk profile of FG.

Differences in comorbidity patterns are prominent. Previous studies consistently identify diabetes mellitus as the most prevalent predisposing factor, reported in 20-70% of cases (14). In contrast, our study identified isolated Renal Impairment (26.1%), while isolated DM was present in only 7.6% of cases. This deviation suggests a critical difference in the local patient risk profile, although chronic renal failure is widely acknowledged as a predisposing factor. Furthermore, 33.6% of our patients presented without any recorded comorbid conditions, a figure substantially higher than the typically reported idiopathic rate of approximately 10%. Importantly, the comparison of mean age across the eight comorbidity groups demonstrated a statistically significant difference ($p < 0.000$), with hypertension + renal impairment and hypertension + DM showing higher mean ages. This supports the conclusion that increasing comorbid burden is strongly age-related in this cohort.

Similarities exist in the identified pathogen spectrum. FG is classically recognized as a polymicrobial infection typically involving synergistic aerobic and anaerobic organisms (11, 13). Our finding that Escherichia coli (E. coli) was the most prevalent organism isolated (53.3%) is highly consistent with global literature. E. coli is frequently cited as the most common isolate, often found in deep tissue or blood cultures (43%-47%) (13). However, the microbiological dataset in this study was incomplete because cultures were not obtained for all patients, either due to variability in clinical practice or insufficient specimen quality. This limitation may influence the apparent distribution of pathogens and observed antibiotic sensitivity patterns.

The *Fournier's Gangrene Severity Index* (FGSI) remains a vital objective tool for quantifying the extent of metabolic aberration and predicting outcomes. Previous studies demonstrate that a FGSI score of 9 or greater is strongly associated with adverse outcomes (15, 16). Laor et al., in the original series, found that patients with FGSI > 9 had roughly a 75% probability of mortality. Other studies similarly report higher FGSI scores among non-survivors compared to survivors (9.0 ± 4.8 *vs.* 3.9 ± 3.3, $p < 0.001$), confirming its prognostic value (15). A more recent Indonesian study also demonstrated the utility of FGSI when compared with biochemical markers such as procalcitonin, where higher FGSI scores correlated strongly with increased mortality risk (12).

Our findings confirm FGSI's predictive reliability. Patients with FGSI > 9 experienced a 95% mortality rate. This figure is markedly higher than the 75% rate cited in the original series but affirms that high FGSI scores denote extremely poor prognosis. Theoretically, FGSI ≤ 9 is associated with substantially lower mortality (< 20-30%), suggesting that FGSI may be less predictive in this cohort. This discrepancy may reflect delayed presentation, in which extensive anatomical necrosis had already occurred despite relatively preserved laboratory parameters at admission, delays in initial surgical or antimicrobial management, local antimicrobial resistance, or unmeasured confounding factors. The restricted sample size for FGSI analysis (44 patients) due to incomplete documentation may also contribute to the deviation from prior studies.

Effective antimicrobial therapy is one of the pillars of FG management, alongside prompt surgical debridement. FG requires broad-spectrum antibiotics covering the polymicrobial flora, including Gram-negative organisms (like E. coli and Klebsiella) and anaerobes (13). The sensitivity data observed in our study highlights critical therapeutic challenges. The organism most frequently isolated was E. coli, which requires targeted management. Our data indicated low sensitivity rates for meropenem (27.27%) and ciprofloxacin (21.21%). Previous studies report increasing antimicrobial resistance, particularly high *extended-spectrum beta-lactamase* (ESBL) rates of up to 50% between 2013 and 2018, supporting the recommendation for carbapenem-based empiric therapy with subsequent de-escalation based on culture results (13-16). However, the markedly low meropenem sensitivity observed in this cohort contrasts with these recommendations and suggests a distinct local resistance pattern. This finding raises concern for healthcare-associated infection in referral patients with prolonged prior hospitalization, rather than purely community-acquired infection, and represents a potential distinguishing feature of our institutional epidemiology.

Our data indicated low sensitivity rates for meropenem (27.27%) and ciprofloxacin (21.21%). Previous studies have reported increasing antimicrobial resistance, including high rates of extended-spectrum beta-lactamase-producing organisms, supporting carbapenem-based empiric therapy followed by de-escalation according to culture results (17, 18). However, the markedly low meropenem sensitivity observed in our cohort suggests a concerning local resistance pattern. Because this was a retrospective study and prior antibiotic exposure and referral status were not consistently documented, we were unable to determine whether this finding was driven by patients

Declarations

Ethical approval and consent for participate: *he author has ethical clearance No. 400/349/K.3/102.7/2025 from Health Research Ethics Committee, Saiful Anwar General Hospital, Malang, Indonesia.*

Consent for publication: *Not applicable.*

Availability of data and material: *All data underlying the results are available as part of the article and no additional source of data are required.*

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referred from other hospitals, prior hospitalization, or previous antimicrobial treatment. These factors may have contributed and should be evaluated in future prospective studies.

Retrospective study designs inherently contain biases. Relying on existing medical records may introduce selection bias and data loss due to missing variables. Although 119 cases were reviewed, single-center data limits generalizability. Microbiological analysis also focused primarily on aerobic organisms. Anaerobic cultures were not routinely performed, potentially underestimating polymicrobial synergy. Additionally, outcome and FGSI analysis could only be conducted in 44 patients due to incomplete documentation, and microbiological results were available for only a portion of the cohort, further limiting interpretability. Despite these limitations, the statistically significant associations observed between age, comorbidity burden, and disease severity contribute meaningful insights into local risk patterns.

The study analyzes a 10-year period (2014-2024), providing valuable local data that remain scarce in FG literature, especially among Indonesian tertiary hospitals. The findings characterize local risk factors, severity patterns, and antimicrobial resistance. Such data are urgently needed to improve early recognition and develop tailored management protocols for our patient population. Overall, the results reinforce that increasing age and greater comorbidity burden significantly elevate the risk of severe disease and poor outcomes in FG, aligning with global evidence.

Conclusions

Fournier's gangrene cases in this 10-year cohort demonstrated that patients commonly presented in their fifth to sixth decades, with renal impairment emerging as the most frequent comorbidity. An age-related pattern was evident, in which older patients were significantly more likely to have one or more comorbidities, indicating that increasing comorbidity burden is closely associated with disease occurrence.

Escherichia coli was the predominant pathogen, accompanied by notable antimicrobial resistance patterns. Mortality increased sharply with higher FGSI scores, particularly in patients with FGSI > 9. These findings highlight the importance of early recognition, severity stratification using FGSI, and the incorporation of local microbiological profiles when formulating management strategies for Fournier's gangrene in our institution.

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