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BRIEF REPORT
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Clinical features and treatment outcomes of Fournier's gangrene in a single tertiary emergency hospital: Simplified Fournier's Gangrene Severity Index score is a predictor for death

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Abstract: To assess the predictive reliability of the Simplified Fournier's Gangrene Severity Index Score (SFGSI) for mortality in Japanese patients with Fournier's gangrene (FG), we compared the clinical features and outcomes of a patient sample with the SFGSI. The medical records of 36 patients diagnosed with FG at our hospital between October 2007 and September 2022 were reviewed retrospectively. Clinical and laboratory variables, including SFGSI, were evaluated and predictive factors for fatality were investigated using multivariate logistic regression analysis. The median age and body mass index were 65 and 24.2, respectively. Eight patients had cooccurring chronic kidney disease and 23 had diabetes. None were taking sodium-glucose co-transporter-2 (SGLT-2) inhibitors. The causative organisms were diverse, and no specific trends in causative organisms were observed. 26 patients underwent debridement of necrotic tissue including eight colostomies, two orchiectomies, and one cystectomy. Multivariate logistic regression analysis revealed that SFGSI alone was an independent predictor of case fatality, with an odds ratio of 20.167 (95% CI: 1.66–245.53). In conclusion, the fatality rate was 19.4%, which was comparable to that reported in other studies. The SFGSI was an independent predictor of mortality in this study.

***Keywords*:** debridement, Fournier gangrene, necrotizing fasciitis, orchiectomy, scrotum

Introduction

Fournier's gangrene (FG) is an acute bacterial necrotizing fasciitis originating from the scrotum, external genitalia, and perineum (*1,2*). FG morbidity is reported to occur in 1.6 out of 100,000 males in the United States (3). Although FG is rare, the fatality rate is around 20% and requires multidisciplinary intensive care. Importantly, multidisciplinary intervention under government-led health care system decreased mortality in FG (*4*). Administration of broad-spectrum antibiotics followed by appropriate debridement of necrotic tissue is essential for the treatment of FG. Delayed debridement of the affected tissue leads to poor outcomes and high mortality (*5*).

Risk factors for FG include diabetes, obesity, alcohol abuse disorders, kidney failure, immunocompromised state, *etc*. (*2*). Besides these factors, several scoring systems for predicting the fatality of patients with FG have been reported (*6-9*). Among these scoring systems, Fournier's Gangrene Severity Index (FGSI) and Uludag Fournier's Gangrene Severity Index (UFGSI) are the most commonly used (*10-12*). The problem in clinical use, however, is the complicated and multiple parameters involved in these scoring systems. The Simplified FGSI (SFGSI) consists of three parameters that are extracted from the SFGSI: serum potassium, serum creatinine, and hematocrit (*13,14*). Although it is a convenient tool, there are no reports from Japan on the usefulness of this scoring system. We have performed literature search on the PubMed database with "Fournier's gangrene", "Fournier gangrene", "simplified Fournier's gangrene severity index" and did not find any report from Japanese institutes.

Herein, we report the clinical features and treatment outcomes of 36 FG patients in our tertiary referral center. We also investigated the predictive ability of the SFGSI for fatality.

Patients and Methods

Patients

The medical records of 36 consecutive patients diagnosed

Table 1. Simplified Fournier's Gangrene Severity Index

Variables	+ 4	+ 3	+ 2	+ 1	0	+ 1	+ 2	+ 3	+ 4
Serum potassium (mmol/L)	> 7	6–6.9	-	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	-	< 2.5
Serum creatinine (mg/100 mL)*	> 3.5	2–3.4	1.5–1.9	-	0.6–1.4	-	< 0.6	-	-
Hematocrit (%)	> 60	-	50–59	46–49	30–45	-	20–29	-	< 20

* ×2 for acute renal failure

with FG based on EAU guidelines on Urological Infections (*15*) at our hospital between October 2007 and September 2022 were reviewed retrospectively. Informed consent was obtained in the form of an opt-out on a website. Exclusion criteria were patients who did not consent to participate in this study.

Simplified Fournier's Gangrene Severity Index

SFGSI consists of three variables extracted from the original FGSI: serum potassium, serum creatinine, and hematocrit. The SFGSI scoring system is presented in Table 1. Based on previous reports, we set the threshold at SFGSI > 2 (*13,16*).

Statement of ethics

This study was approved by the Ethics Committee of Tokyo Metropolitan Bokutoh Hospital (ID: 04-058). Informed consent was obtained in the form of an opt-out on a website. Patients who were rejected were excluded. This study was conducted in accordance with the Declaration of Helsinki (revised in 2013).

Statistical analysis

Fisher's chi-squared test was used to analyze categorical variables. Multivariate logistic regression analysis was performed to identify the predictors of fatality. Sex, age, number of days from onset to debridement, total number of debridements, and SFGSI were included in the logistic regression analysis. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using SPSS version 24.

Results and Discussion

The patient characteristics are described in Table 2. Of the 36 patients, 26 were male and 21 lived alone. The median age and median body mass index were 65 and 24.2, respectively. Eight patients had chronic kidney disease, and 23 patients had diabetes mellitus. Although a meta-analysis failed to clarify the relationship between sodium-glucose cotransporter-2 (SGLT-2) inhibitor and FG, there exist several reports on FG caused by SGLT-2 inhibitor (*17,18*). Importantly, no patient was prescribed a SGLT-2inhibitor inhibitor in this study.

The median time from FG onset to hospitalization was five days (interquartile range, 1–6 days). The causative bacteria were diverse, including Escherichia coli, Klebsiella pneumoniae, and proteus. Of the 36 patients with FG in our study, 34 underwent debridement. One did not because the infection foci in the scrotum had already self-destructed and opened, while the other did not due to advanced rectal cancer and multiple liver metastases. Additionally, of those who underwent debridement, there were also eight colostomies, two orchiectomies, and one cystostomy (Table 3). Among our sample, seven patients died of FG. The fatality rate in our study was 19.4% (7/36 cases). There was no difference in fatalities between the early and late intervention groups (21.7% and 15.4%, $p = 0.644$).

Table 2. Patients' characteristics

Characteristics	Cases
No. patients	36
Sex (%)	
Male	26 (72.2)
Female	10 (27.8)
Median age (IQR)	65 (51–75)
Median BMI (IQR)	24.2 (21.0–29.0)
Type of residence	
Home	33 (91.7)
Hospital	2 (5.6)
Nursing home	1 (2.8)
Living alone, *n* (%)	
Yes	21 (58.3)
No	14 (41.7)
Comorbidity, *n* (%)	
CKD	8 (22.2)
Diabetes mellitus	23 (63.9)
Dyslipidemia	6 (16.7)
Medication, *n* (%)	
Insulin injection	9 (25.0)
STLG-2 inhibitor	0 (0)

Abbreviations: BMI, body mass index; CKD, chronic kidney disease; IQR interquartile range; STLG-2, sodium-glucose cotransporter-2.

The results of univariate analysis are presented in Table 4. Amongst the variables, only SFGSI was a predictor for case fatality with an odds ratio of 6.563 (95% confidence interval (CI): 1.05–40.95) For patients with SFGSI > 2, the fatality rate was 38.5%. Furthermore, multivariate logistic regression analysis revealed that only SFGSI was an independent predictor of case fatality, with an odds ratio of 20.167 (95% CI: 1.66–245.53) (Table 5).

Despite advances in treatment, FG is still a life-threatening disorder with a fatality rate of 20–40%

(*3*). The fatality rate was 19.4% in this study, which was comparable with other reports. Owing to the rapid progress of FG, immediate debridement and broad — spectrum antibiotics are mandatory, as delay in intervention leads to poor prognosis (*5*). In the current study, among 34 patients who required debridement, 33 (97%) underwent debridement within two days of hospitalization. Hence, we did not detect any difference in fatalities between the early and late intervention groups.

Several prognostic tools have been developed to predict the fatality of FG and help with clinical decision-making. FGSI consists of nine components, including temperature, heart rate, respiratory rate, serum potassium, serum sodium, serum creatinine, hematocrit, white blood count, and serum bicarbonate (*10,11*). UFGSI is an extension of FGSI, with the addition of age and dissemination of disease score (*19,20*). The sensitivity and specificity for FGSI and UFGSI are reported to be 65–88% and 70–100%, respectively (*6,8,13,16,21*). The UFGSI was developed using data from 80 FG patients, and the area under the receiver operator characteristics curve was larger than that of FGSI (0.947 *vs.* 0.843). As we did not measure serum bicarbonate routinely, the FGSI and UFGSI were calculated in only 13 patients. As also reported by others, the limitation of FGSI and UFGSI is the complexity of the variables (*13,16*).

The SFGSI, consisting of parameters of creatinine, hematocrit, and potassium, has been reported to be comparable to FGSI in predicting the prognosis of FG (*13,16*). The sensitivity and specificity of the SFGSI were 87% and 77%, respectively (*15*). In the current study, the SFGSI was the only predictor of FG-related fatality (Table 5). In patients with SFGSI > 2, 5 of 13 patients died of disease (38.5%), while in patients with SFGSI ≤ 2, 2 of 23 patients died (8.7%). The sensitivity and specificity for SFGSI were 71% and 72%, respectively. Considering its easier applicability, the SFGSI may greatly contribute to the assessment of fatality in patients with FG.

The limitations of this study are its retrospective nature and the relatively small number of patients enrolled.

In conclusion, we retrospectively analyzed the clinical data of 36 patients with FG and found SFGSI to be an independent predictor of disease fatality. Large-scale prospective studies are needed to further validate the utility of SFGSI and to establish appropriate treatments for FG.

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Table 3. Treatment outcome

Characteristics	Cases
No. patients	36
Days from onset to hospitalization, median (IQR)	5 (1–6)
Surgical treatment, *n* (%)	
Debridement	34 (94.4)
Colostomy	8 (22.2)
Orchiectomy	2 (7.7% of men)
Cystostomy	1 (2.7)
Penectomy	0 (0)
Number of debridement, *n* (%)	
Once	26 (72.2)
Twice or more	10 (27.8)
Causative bacteria, *n* (%)	
Aerobic	16 (44.5)
Anaerobic	20 (55.5)
Escherichia coli	6 (16.7)
Klebsiella pneumoniae	3 (8.3)
Proteus	2 (5.6)
Catecholamine use on admission, *n* (%)	
Yes	9 (25.0)
No	27 (75.0)
Outcome	
Cure	29 (80.6)
Death	7 (19.4)

Abbreviations: IQR, interquartile range

Table 5. Multivariate logistic regression analysis of case fatality

Characteristics	OR	95% CI	*p value
Female (ref. male)	0.89	0.08–9.65	0.925
Age ≥ 60 (ref. < 60)	1.09	0.09–13.04	0.946
Days onset to debridement > 5 (ref. ≤ 5)	0.37	0.04–3.32	0.372
Number of debridement ≥ 2 (ref. <2)	0.69	0.07–6.98	0.749
SFGSI > 2 (ref. ≤ 2)	20.17	1.66–245.55	0.019

Abbreviations: CI, confidence interval; OR, odds ratio; ref, reference; SFGSI simplified Fournier's Gangrene Severity Index.

Table 4. Univariate analysis of case fatality rates

Characteristics	Case fatality rate, %	OR	95% CI	*p value
Overall	19.4			
Female (ref. male)	20.0	1.014	0.603–1.705	0.645
Age ≥ 60 (ref. < 60)	21.7	1.528	0.252–9.272	0.501
Diabetes mellitus	17.4	0.702	0.131–3.771	0.499
Days onset to hospitalization > 5 (ref. ≤ 5)	16.7	0.7	0.132–3.699	0.5
Days onset to debridement > 5 (ref. ≤ 5)	15.4	0.818	0.128–5.233	0.608
Number of debridement ≥ 2 (ref. < 2)	20.0	1.05	0.168–6.551	0.645
SFGSI > 2 (ref. ≤ 2)	38.5	6.563	1.052–40.946	0.044

Abbreviations: CI, confidence interval; OR, odds ratio; ref, reference; SFGSI, simplified Fournier's Gangrene Severity Index. *Fisher's chi-square test.

Conflict of Interest: The authors have no conflicts of interest to disclose.

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