



Original Article

Risk factors of Fournier's gangrene associated with mortality in Sunpasittiprasong Hospital

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Fournier's gangrene, prognosis, risk factors, index, mortality, necrotizing fasciitis

Abstract

Objective: To determine the mortality rate in patients with Fournier's gangrene (FG) in Sunpasittiprasong Hospital and to identify potential risk factors associated with mortality among patients of FG.

Materials and Methods: This retrospective cohort study investigated patients diagnosed with FG in Sunpasittiprasong Hospital from 2016 to 2021. Data related to clinical presentation, demographics, comorbidities, etiology, laboratory investigation, and therapeutic intervention of the patients were recorded. Prognostic severity indexes were calculated. All factors were statistically analyzed using univariate and then multivariate analysis.

Results: Of 62 patients, the mortality rate was 29% (18 of 62). The significant risk factors for death included patients with kidney disease, septic shock, respiratory failure, acute kidney injury, low mean arterial blood pressure (MAP), admission to ICU and prolonged ventilator used. Risk factors from the laboratory data included abnormal coagulogram, high serum creatinine, lactate, and low bicarbonate. Some prognostic scoring systems were able to predict prognosis and mortality. Multivariate analysis revealed that patients with kidney disease ($p = 0.007$) or respiratory failure at presentation ($p = 0.020$) were significantly associated with mortality.

Conclusions: The significant risk factors associated with mortality among patients with FG were kidney disease or respiratory failure. Some prognostic scoring systems may be applied to Thai patients with FG to predict prognosis.

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Introduction

Fournier's gangrene (FG) is severe necrotizing fasciitis (NF) at the perineum and genitalia resulting from synergistic polymicrobial infection. It usually happens in males aged 30-60 years old.¹ FG is a life-threatening disease because of its rapidly progressive and severe nature. The mortality rate in FG ranged from 16 to 40%² even though aggressive debridement and appropriate antibiotics were given. Many studies have shown that factors that affect the outcome of patients with FG can be classified into 3 groups³: host-related factors, disease-related factors, and treatment-related factors. Host-related factors included age^{1,4-9}, gender⁴, underlying hypertension⁷, diabetes mellitus (DM)^{3,10}, cardiac disease^{5,8}, kidney disease^{1,6,7,9-11}, lung disease^{8,9}, and cancer.⁸ Disease-related factors were clinical signs and symptoms, source of infection^{4,12}, extent of the disease^{1,6}, presence of septic shock^{8,9}, respiratory failure, abnormal laboratory test results, electrolyte imbalance^{3,5}, coagulopathy^{5,7,10}, and liver failure.¹¹ Treatment-related factors included time-to-surgery⁸, duration of ventilator-use⁸, estimated blood loss (EBL)⁸, colostomy⁸, and dialysis.⁸ Several studies have described the effective use of scoring systems to predict the mortality of patients with FG including Fournier's gangrene severity index (FGSI)¹¹, Uludag Fournier gangrene's severity index (UFGSI)¹³, and the Age-adjusted Charlson Comorbidity Index (ACCI).¹⁴ These can facilitate the design of the most appropriate and feasible management strategies.

In Thailand, currently, there have been no studies on either mortality in FG or the risk factors contributing to the mortality. One study which was related to the issue was a retrospective study from Yasothorn Hospital that found a mortality rate associated with necrotizing fasciitis (NF) for 19%¹⁵. Therefore, we conducted this study with the aim of clarifying the risk factors that affect the mortality in FG to predict the prognosis and assist in early intervention to prevent the progression of the disease.

Materials and Methods

The data was retrospectively reviewed from medical records. Patients diagnosed with FG, who were admitted to Sunpasittiprasong Hospital from January 2016 to June 2021 were included in this study. Diagnosis was confirmed using

a combination of clinical, gross anatomic and microbiologic findings. Exclusion criteria were patients for whom the mortality data could not be tracked and when previous debridement had been carried out before visiting Sunpasittiprasong Hospital. Patients who died within 30 days from the date of hospital admission were classed as the nonsurvival group and those who survived within 30 days from the date of hospital admission as the survival group. The data from the two groups were compared to identify the factors associated with death. The study protocol was approved by the Ethical Committee of Sunpasittiprasong Hospital (Protocol number: 052/64 R).

All patient records were analyzed to determine host-related factors, including age, preexisting illnesses, bedridden status, smoking, alcohol use, herb or steroid use and length of hospital stay (LOS). Clinical-related factors included symptoms on admission, physical findings on admission, laboratory results, site of origin of the necrotizing infection, extent and depth of spread, and microbiology of tissue cultures. Treatment related factors included debridement status, number of debridements, time to surgery, operative time, estimated blood loss (EBL), colostomy or suprapubic cystostomy (SPC) performed, and post-operative factors such as duration in ICU or ventilator use. We used 3 prognostic score systems, FGSI, UFGSI, and ACCI, to determine any clinical significance of the factors and their application in Thai patients.

Demographic data and descriptive statistics are presented as mean $\pm$ standard deviation (SD.), or median and interquartile range (IQR). To assess possible risk factors for mortality, univariate analyses were completed initially to aid in determining the variables that should be included in a stepwise logistic regression model. Chi-square test or Fisher exact test were used to compare categorical data between the survival and nonsurvival group. For measured variables, the student T-test or Mann-Whitney U test were used to compare the mean or median values between the two groups. The factors with p-values of <0.05 from the univariate analysis were selected for inclusion in the initial step of the multivariable analysis. The level of statistical significance was set at a value of $p < 0.05$. The statistical analyses were performed using Statistical Package for Social Sciences (SPSS®) Statistics version 22.0.



Results

Eighty-three patients with Fournier's gangrene were admitted to Sunpasittiprasong Hospital from January 2016 to June 2021. There were 62 patients who met the inclusion criteria. The mean age was 55 years, the mean period from onset of symptoms to hospital admission was 3 days, and LOS was 14 days. Patients who survived had a significantly longer length of stay in hospital (17 vs 5 days, p -value 0.001). Eighteen patients (29%) died within 30 days after admission. More than a half of these had at least 1 co-morbid disease (63%). Twenty-two patients (35.5%) had DM and, 15 (24.2%) had hypertension. The other demographic characteristics and medical history or comorbidities are shown as in Table 1. There was no significant correlation between demographic characteristics and the underlying disease and mortality in the nonsurvival and survival group, including age, HIV infection, DM, hypertension, heart disease, liver disease, lung disease, stroke, or cancer. Similarly, behavioral factors such as alcohol consumption, smoking,

bedridden status, herbal or steroid use were not found to be significantly associated with mortality either. Only patients with pre-existing renal impairment showed a significant association with mortality in both univariate and multivariate analysis (p -value 0.006).

In terms of clinical presentation factors, there was a significant association between patients with respiratory failure within 48 hours (p -value 0.001), septic shock (p -value 0.003), acute kidney injury (AKI) (p -value 0.030) or low mean arterial pressure (MAP) (p -value 0.010) and mortality in univariate analysis. There was no association between mortality and other vital sign parameters. The majority of patients had urogenital area involvement (61.3%), followed by pelvic area (30.6%) and beyond pelvic area (8.1%) at first presentation. The primary source of infection was urogenital (53.2%), followed by anorectal (30.6%) and skin infection was 16.1%. We did not find the relationship between area of disease involvement and mortality nor in the site of infection. The neither urogenital, anorectal or skin disease had

Table 1. Demographic data between the two groups

Demographic data	N	All patients	n	Nonsurvival	n	Survival	P-value
Age (years)	62	54.9 ($\pm$ 16.7)	18	58.2 ($\pm$ 18.0)	44	53.5 ($\pm$ 16.2)	0.312
LOS (days)*	62	14 (7-28)	18	5 (1-12)	44	17 (9-32)	0.001
Co-morbid disease n (%)							
HIV	62	1 (1.6)	18	0 (0)	44	1 (2.3)	1.000
DM	62	22 (35.5)	18	8 (44.5)	44	14 (31.9)	0.346
HT	62	15 (24.2)	18	5 (27.8)	44	10 (22.8)	0.748
Cardiac disease	62	4 (6.5)	18	1 (5.6)	44	3 (6.9)	1.000
Liver disease	62	7 (11.3)	18	4 (22.3)	44	3 (6.9)	0.179
Lung disease	62	3 (4.8)	18	0 (0)	44	3 (6.9)	0.550
Stroke	62	3 (4.8)	18	1 (5.6)	44	2 (4.6)	1.000
Renal impairment*	62	6 (9.7)	18	5 (27.8)	44	1 (2.3)	0.006
Malignancy	62	5 (8.1)	18	0 (0)	44	5 (11.4)	0.309
Comorbidities n (%)							
0	62	23 (37.1)	18	5 (27.8)	44	18 (40.9)	0.331
1	62	20 (32.3)	18	6 (33.3)	44	14 (31.8)	0.908
> 1	62	19 (30.6)	18	7 (38.9)	44	12 (27.3)	0.186
Past history n (%)							
Smoker	62	22 (35.5)	18	9 (50)	44	21 (47.8)	0.871
Alcohol use	62	30 (48.4)	18	7 (38.9)	44	15 (34.1)	0.720
Bedridden	62	15 (24.2)	18	5 (27.8)	44	10 (22.8)	0.748
Herb use	62	5 (8.1)	18	2 (11.2)	44	3 (6.9)	0.622
Steroid use	62	2 (3.2)	18	0 (0)	44	2 (4.6)	1.000

*Significant at $p < 0.05$

LOS = Length of stay, DM = Diabetes mellitus, HT = Hypertension, HIV = Human immunodeficiency virus.

a significant relationship with mortality as shown in Table 2.

Laboratory parameters at the time of admission are summarized in Table 3. We found that most of laboratory parameters did not reflect survivability such as complete blood count (CBC), some electrolytes, blood urea nitrogen (BUN) and liver function test (LFT). However, patients in the nonsurvival group had significantly higher serum creatinine (p-value 0.032), and serum lactate (p-value 0.002) and lower bicarbonate (p-value 0.001) and albumin (p-value 0.016) than those in the survival group. A coagulogram tended to be more prolonged in the nonsurvival patients in the univariate analysis. But none of these factors were significantly associated with mortality in the multivariate analysis.

Table 4 lists the treatment factors. Debridement was carried out in 57 patients, representing 91.9% of the total sample. Of these, the median time to surgery was within 19.5 hours after admission to the hospital and the median number of times undergoing debridement during admission was 3 times (1-3). Most patients were assessed preoperatively using the American Society of

Anesthesiologists (ASA) classification III (37%), median duration of surgery was 45 minutes, Median EBL was 50 mL and the majority of procedures were carried out under general anesthesia (GA) (87.7%). Significantly more of the patients who underwent debridement survived in comparison to those who did not undergo debridement. Considering time to debridement, we found that the time to operation in survivors was slightly longer than in the nonsurvivors (19.5 vs 17.5 hours) but did not achieve statistical significance. Operative time, EBL or number of instances of debridement were not found to be related to mortality. A diverting colostomy was performed in 32.3% of patients in our series, but this was not significantly associated with mortality. Unlike patients who had not undergone suprapubic cystostomy, there was significant association with mortality in the univariate analysis (p-value 0.045). Out of the 62 patients, 30 required admission to the intensive care unit (ICU) (48.4%). The median length of ICU stay was 7 days (2-9). All admitted to ICU required mechanical ventilator support which had median time of 3 days (1-7). We also found that patients who survived had a

Table 2. Clinical and etiology parameters between the two groups

Clinical and etiology	N	All patients	n	Nonsurvival	n	Survival	P-value
Symptom duration (days)	62	3 (2-7)	18	3 (2-7)	44	3 (2-7)	0.826
Clinical condition at admission n (%)							
Metabolic acidosis	18	12 (66.7)	8	7 (87.5)	10	5 (50.0)	0.152
Respiratory failure*	62	19 (30.6)	18	11 (61.2)	44	8 (18.2)	0.001
AKI*	62	28 (45.2)	18	12 (66.7)	44	16 (35.4)	0.030
Septic shock*	62	30 (48.4)	18	14 (77.8)	44	16 (36.4)	0.003
Physical examination n (SD)							
Temperature (°C)	62	37.7 (±1.2)	18	37.4 (±0.9)	44	37.8 (±1.2)	0.134
HR (bpm)	62	99 (±18)	18	104 (±20)	44	100 (±18)	0.423
RR (bpm)	62	20 (20-20)	18	20 (18-24)	44	20 (20-20)	0.993
SBP (mmHg)	62	109 (±21)	18	102 (±23)	44	112 (±20)	0.075
DBP (mmHg)*	62	66 (±12)	18	59 (±14)	44	69 (±10)	0.021
MAP (mmHg)*	62	80 (±13)	18	73 (±15)	44	83 (±12)	0.010
Area involvement n (%)							
Urogenital	62	38 (61.3)	18	13 (72.3)	44	25 (56.9)	0.258
Pelvic	62	19 (30.6)	18	5 (27.8)	44	14 (31.9)	0.754
Beyond pelvic	62	5 (8.1)	18	0 (0)	44	5 (11.4)	0.309
Source of infection							
Skin	62	10 (16.1)	18	4 (22.3)	44	6 (13.7)	0.457
Anorectal	62	19 (30.6)	18	5 (27.8)	44	14 (31.9)	0.754
Urogenital	62	33 (53.2)	18	9 (50)	44	24 (54.6)	0.745

*Significant at $p < 0.05$

HR = Heart rate, RR = Respiratory rate, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, MAP = Mean arterial blood pressure, AKI = Acute kidney injury, MDR = Multiple drug resistance, SD = Standard deviation.

**Table 3.** Laboratory parameters between the two groups

Laboratory	n	Nonsurvival	n	Survival	P-value
Hematocrit (%)	18	27.3 (± 7.1)	44	31.1 (± 7.7)	0.077
Hemoglobin (g/dl)	18	9.0 (± 2.5)	44	10.4 (± 2.6)	0.055
White blood cell ($\times 10^3/\text{mm}^3$)	18	9.97 (1.31-12.22)	44	13.65 (4.94-19.02)	0.092
Platelet count ($\times 10^3/\text{mm}^3$)	18	171.5 (12.0-415.5)	44	203.0 (20.5-298.8)	0.389
Sodium (mmol/l)	18	133 (± 7)	44	133 (± 6)	0.722
Potassium (mmol/l)	18	3.9 (± 0.7)	44	3.6 (± 0.7)	0.181
Chloride (mmol/l)	18	97 (± 8)	44	99 (± 7)	0.424
Bicarbonate (mmol/l)*	18	16 (± 5)	44	21 (± 5)	0.001
Blood urea nitrogen (mg/dl)	18	30 (18-39)	44	22 (20-44)	0.180
Creatinine (mg/dl)*	18	2.37 (1.13-6.80)	44	1.00 (0.95-2.68)	0.032
aPTT (s)*	16	45.2 (32.8-96.1)	33	34.6 (26.6-56.3)	0.006
PT (s)*	16	19.4 (17.7-46.5)	33	16.1 (15.9-22.0)	0.000
INR*	16	1.61 (1.48-4.29)	33	1.35 (1.34-1.86)	0.001
AST (U/l)*	10	145 (17-2275)	19	30 (82-239)	0.044
ALT (U/l)	10	55 (12-220)	19	25 (9-102)	0.085
Alkaline phosphatase (U/l)	10	156 (52-170)	19	105 (51-83)	0.353
Total Bilirubin (mg/dl)	10	1.5 (0.2-3.5)	19	0.7 (0.4-7.1)	0.362
Direct Bilirubin (mg/dl)	10	1.1 (0.1-2.9)	19	0.4 (0.3-5.1)	0.390
Albumin (g/dl)*	10	1.9 (± 0.7)	19	2.5 (± 0.7)	0.016
Lactate (mmol/l)*	6	20.9 (4.7-23.1)	7	2.9 (1.5-6.5)	0.002

*Significant at $p < 0.05$

aPTT = Activated partial thromboplastin time, PT = Prothrombin time, INR = International ratio, AST = Aspartate transaminase, ALT = Alanine aminotransferase.

Table 4. Treatment factors between the two groups of patients

Laboratory	n	All patients	n	Nonsurvival	n	Survival	P-value
Debridement* n (%)	62	57 (91.9)	18	13 (72.3)	44	44 (100)	0.001
Time to Surgery (hour)	57	19.5 (8.8-23.8)	13	17.5 (5.0-22.0)	44	19.8 (9.1-24.0)	0.387
Op time 1st DB (minutes)	57	45 (33-63)	13	50 (33-88)	44	45 (31-60)	0.789
Number of DB (time)	57	3 (1-3)	13	2 (1-3)	44	3 (1-4)	0.289
EBL (ml)	57	50 (40-100)	13	50 (40-125)	44	100 (35-100)	0.690
Diverting Colostomy n (%)	57	20 (32.3)	13	5 (38.5)	44	15 (34.1)	0.754
SPC* n (%)	57	11 (17.7)	13	0 (0)	44	11 (25)	0.045
Post op care							
ICU stay (days) n (SD)*	30	7 (2-9)	16	4 (1-8)	14	8 (5-10)	0.120
On Ventilator (days) n (SD)	30	3 (1-7)	16	4 (1-12)	14	3 (2-5)	0.448

*Significant at $p < 0.05$

Op = operative, DB = debridement, EBL = Estimate blood loss, SPC = Suprapubic cystostomy, ICU = Intensive care unit, SD = Standard deviation.

significantly statistic longer length of ICU stay.

The FG prognostic score systems are shown in Table 5. In our study, the average FGSI, UFGSI and ACCI scores were all higher in the nonsurvival group. Mean FGSI and UFGSI score was more

than 9 in the nonsurvival group. Using a FGSI and UFGSI threshold value of 9, there was a 94% probability of death with a score greater than 9, and below 9 was associated with an 81% probability of survival).^{3,11} The prognostic scores that

Table 5. Prognostic score

Prognostic score n (SD)	Prognostic score n (SD) Nonsurvival group n = 18	Survival group n = 44	P-value
FGSI*	12.0 (7.5-21.3)	6.5 (8.0-15.3)	0.001
UFGSI*	13.5 (8.5-22.3)	9.0 (10.0-17.8)	0.005
ACCI	3.5 (0.3-2.0)	2.0 (1.8-3.3)	0.215

*Significant at $p < 0.05$

SD = Standard division, FGSI = Fournier's gangrene severity index score, UFGSI = Uludag Fournier's gangrene severity index score, ACCI = Age-adjusted Charlson comorbidity index.

Table 6. Multivariable analysis

	Adjusted OR	95% C.I.	P-value
Renal impairment*	39.19	(2.73-561.67)	0.007
Respiratory failure*	9.99	(1.43-69.84)	0.020
AKI	1.33	(0.23-7.63)	0.748
Septic shock	1.62	(0.24-11.11)	0.626
INR	0.99	(0.81-1.22)	0.955

*Significant at $p < 0.05$

SD = Standard division, FGSI = Fournier's gangrene severity index score, UFGSI = Uludag Fournier's gangrene severity index score, ACCI = Age-adjusted Charlson comorbidity index, OR = Odd ratio, C.I. = Confidential interval, AKI = Acute kidney injury, INR = International ratio.

were significantly associated to mortality were FGSI and UFGSI scores (p-value 0.001, 0.005).

In the multivariate analysis, shown in Table 6, we found that only patients with pre-existing renal impairment or respiratory failure within 48 hours after admission were significantly associated with mortality associated with FG (p-value 0.007, 0.020).

Discussion

Fournier's gangrene is a life-threatening clinical condition, first described by a French dermatologist and venereologist, Jean Alfred Fournier in 1883.¹⁶ FG is an infection caused by aerobic and anaerobic bacteria, spreading along the subcutaneous and fascial plane across the perineum, genital area and sometimes beyond the pelvic area to the lower abdomen or inner thigh. This progressive necrotizing fasciitis of the genitourinary tract has a clinical symptom of an abrupt onset of painful scrotal swelling with rapid progression to gangrene. Systemic signs, including sepsis and septic shock consequently cause respiratory failure or AKI which can occur in 10-40%.^{12,16} In our series it was evident in 48.4%

of cases. FG is still reported as a potentially fatal disease with a high mortality rate of 16-40%.^{2,5,9,16-18} In our study the mortality rate was 29%.

Patients with FG included in this study as well as those described in other reports, had advanced age and higher levels of comorbidity which may be related to the mortality due to FG, especially in the case of DM, and HT. However, our study did not find any association between age or underlying disease and mortality, with the exception of patients who had renal impairment. Several reports have suggested that chronic kidney disease (CKD) was a risk factor for mortality in FG.^{1,6,7,11,18} One report had a hypothesis that sepsis may exacerbate preexisting renal dysfunction especially in CKD patients.¹⁸ This was consistent with our multivariate analysis results, which showed that patients with previous renal insufficiency were significantly associated with mortality.

DM is a factor commonly acknowledged as increasing susceptibility to infection. Some studies have reported that 20-70% of patients with FG had DM.^{16,18-20} Hahn et al.¹⁸ believed that the effect of DM on the progression of the disease was due to a decrease in phagocytic and intracellular



bactericidal activity and neutrophil dysfunction. Many studies, however, have reported that DM was not found to be associated with FG mortality^{8,11,12,16} as was the case in our study.

As mentioned before, FG presents as sudden pain, genital swelling, and rapid progression. Palmer et al.²¹ reported that area affected by FG was associated with the treatment outcome. Logically, an increase in the body surface area (BSA) involved would cause greater severity and result in an increased risk for poor prognosis. Several studies confirmed these findings.^{3,18} Also, Corcoran et al.¹⁷ found that although total BSA involved was suggestive of poor prognosis, only involvement of the lower extremities and abdominal wall was associated with inpatient mortality. However, a few studies did not find a relationship between extended disease and FG mortality as was the case in our study. This may be due to the difficulty of defining and measuring the exact boundaries of an affected area of disease, which can affect the results.

The common causes of FG are urogenital (periurethral abscess, urethral stricture, indwelling catheter, traumatic catheterization, perineal trauma), anorectal (perianal abscess, fistula in ano, rectal biopsy, rectosigmoid malignancy), or cutaneous infection or local trauma.^{2,16} In this current study, the most common etiology was urogenital infection followed by anorectal and skin infection. As was reported in other series, in ours there was no correlation between etiology and mortality.^{16,22} In severe case, sepsis and septic shock may occur, followed by multiple organ failure and finally death. Our univariate analysis found that septic shock, MAP < 65 mmHg, AKI, coagulopathy, high serum lactate and respiratory failure within 48 hours of the time of admission were significantly associated with death, but only patients with respiratory failure within 48 hours were a significant predicting factor for mortality in the multivariate analysis. Metabolic acidosis did not appear to be significantly associated with mortality. Arterial blood gas measurements were not frequently performed at the time of admission which may cause a bias in our results.

From the multivariable analysis the risk factors significantly affecting the mortality in FG in our study were patients who had a previous history of renal disease or those presenting with respiratory failure within 48 hours of admission.

However, we still recommend that early recognition, hemodynamic support, aggressive resuscitation, urgent and aggressive surgical debridement, and prompt treatment with empirical broad-spectrum antibiotics are important cornerstones for a successful outcome as described in many other series.^{4,16,23,24} The time interval between the onset of symptoms and initial debridement has been reported as being a major factor of predicting mortality^{25,26}, but not all studies have corroborated that.^{27,28} The results are still controversial, and the exact time to carry out the operation needed to be clarified. A large retrospective study, including 379 FG patients, has suggested that early surgical debridement within 2 days of admission reduces FG mortality.²⁹ Moreover, the data pertaining to the recommended number of instances of surgical debridement performed in each patient is still controversial as some studies found it to be a significant parameter of mortality, while others not.^{28,30,31} Faucher et al.³² stated that initial surgery should be the most important time to debridement, with the aim of resecting all necrotic and infected tissue, regardless of the wound that is created and the potential problems of complete closure. Therefore, a greater number of debridement procedures might not affect the mortality as was the case in our series. A diverting colostomy is sometimes needed to decrease the possibility of contamination, especially in the presence of anorectal involvement or sphincter destruction.⁴ Some studies have shown significantly lower mortality in patients without colostomy^{31,33,34} as well as suprapubic cystostomy, used to adequately divert urine if a Foley catheter cannot be accomplished.^{35,36} However, neither procedure led to a significant difference in survival in our multivariate analysis.

To predict mortality in Thai patients with FG, different scoring systems were used. Our study chose FGSI, UFGSI and ACCI as validated indexes to find whether they were equally applicable in Thai patients. The FGSI score, created in 1995 by Laor et al.¹¹ included 9 clinical and laboratory parameters. The newer and novel UFGSI, which was created by Yilmazar et al. in 2010³, also added age and extent of the disease with a maximum of 43 points. Both scoring systems had a cutoff point of 9 which provides a good discriminatory capacity regarding mortality. ACCI, created by Charlson et al.¹³, is used to classify the comorbid

conditions which might alter the risk of mortality has a cut-off point of 4. In our studies, the prognostic scores that were statistically significantly associated with mortality were FGSI and UFGSI. We can assume, from the results of the study, that both systems could be applied in Thai patients to help in predicting the prognosis of the FG patient. However, we thought that these scores may take time to calculate in real-life clinical practice. We therefore believe that both tools should be studied further and improved to make their application easier and more effective in general practice for physicians in Thailand.

Our retrospective study is associated with inherent limitations. We focused on mortality and perioperative outcomes only in the patients that visited or were admitted to Sunpasittiprasong Hospital during the study period. Therefore, the patients that had been partially treated or debrided in other hospitals before being referred to our tertiary care unit might affect the outcome of the study. In addition, general care techniques and wound management strategies have evolved significantly over the period covered by our patient registry, which may have impacted on our results.

Conclusions

Fournier's gangrene remains a surgical and urological emergency with high morbidity and mortality. Pre-existing renal impairment and patients presenting with respiratory failure are associated with higher mortality. Early recognition, resuscitation and treatment with aggressive debridement with antibiotics remain the best approach to prevent subsequent septic shock and respiratory failure. Early diagnosis and prompt time to surgery are crucial for a successful outcome. FGSI and UFGSI might be appropriate in Thai patients with FG.

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Conflict of interest

The authors declare no conflicts of interest.

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