Usefulness of FGSI and UFGSI scoring systems for predicting mortality in patients with Fournier's gangrene: A multicenter study

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ABSTRACT

BACKGROUND: This study aimed to evaluate the usefulness of Fournier's gangrene scoring index (FGSI) and Uludag FGSI (UFGSI) for predicting mortality in patients with FG.

METHODS: Patients who underwent treatment and follow-up in the A division department of general surgery at two education and research hospitals between January 2012 and December 2015 were evaluated for mortality-related factors. The sensitivities of FGSI and UFGSI scoring systems for predicting mortality-related factors and disease prognosis were evaluated. Patients were grouped as survivors (Group I) or non-survivors (Group II).

RESULTS: In total, 29 patients were included in the study. The mean age (±SD) was 51.52±13.36 years. The mortality rate was 20.6% (six patients). Bacterial growth was observed in wound cultures of 17 patients (58.6%). Of the patients with bacterial growth, 11 (47.8%) were in Group I and six (100%) were in Group II. The presence of bacterial growth was significantly associated with mortality (p=0.028). Fourteen patients (48.3%) had comorbid conditions. The number of comorbid conditions was related (p=0.049). FGSI and UFGSI scores were significantly higher in Group II than in Group I (p=0.002 and p=0.001, respectively). Among UFGSI parameters, extent of disease, body temperature, pulse rate, and HCO3 values were significantly higher in Group II than in Group I (p<0.05). The FGSI and UFGSI scoring systems had 100% sensitivity and 78.2% and 73.9% specificity, respectively, for predicting mortality.

CONCLUSION: The FGSI and UFGSI scoring systems are valuable for predicting mortality in patients with FG. The extent of the disease was an important prognostic parameter in this study. Whichever scoring system is used, we suggest the use of the extent of disease score in UFGSI.

Keywords: Fournier's gangrene; mortality; scoring system.

INTRODUCTION

Fournier's gangrene (FG) is a rare, necrotizing fasciitis of the perineal and genital area and is a life-threatening condition that requires emergency surgery. FG is rapidly progressive and leads to septic shock and death if not promptly treated.

[1] The basis of disease is colorectal, genitourinary, or other infections of the genital area. FG is currently encountered in any age group. However, its prevalence increases after the age of 50 years.[2] The disease is 10-fold more prevalent in males than in females. The lower prevalence in females is suggested to be associated with the fact that the female perineum easily drains through the vagina, thereby possibly preventing the development of the disease.[3,4]

FG has a high mortality rate, despite standard therapies that involve aggressive large debridements and the use of broad-spectrum antibiotics.[5] The following three factors have been advocated to influence disease outcomes: disease-, patient-, and physician-related factors. Physician-related factors include aggressive surgical intervention and appropriate anti-biotherapy selection. Parameters such as age, body temperature, heart rate, and respiratory rate are patient-related factors. The extent of disease is a disease-related factor.[6]

No reliable tool for predicting FG severity is currently available; however, scoring systems can be used to accomplish this task. An ideal scoring system must simply provide clear and effective data regarding the patient and must also detect high complication and mortality rates.[5] In this regard, Laor et al.[7] described a FG severity index in 1995. Many authors have begun using this severity index. Approximately 15 years after that study, Yilmazlar et al.[6] developed the Uludag FGSI (UFGSI) by incorporating age and the extent of disease in the FGSI scoring system. Although other scoring systems have been discussed in the literature, FGSI and UFGSI are the two most widely accepted scoring systems.[5]

This study aimed to evaluate the usefulness of FGSI and UFGSI for predicting mortality in patients with FG.

MATERIALS AND METHODS

Patients with FG who were treated and followed up at two education and research hospitals with high patient load between January 2012 and December 2015 were retrospectively reviewed. Age, sex, comorbid conditions, number of comorbid conditions, length of hospital stay, number of debridements, whether ostomy was performed or not, bacterial growth in wound culture, types of isolated bacteria, presence of diabetes mellitus (DM), and FGSI and UFGSI values were recorded. The sensitivities of the FGSI and UFGSI scoring systems were evaluated for predicting mortality-related factors and disease prognosis. In addition, UFGSI parameters were separately evaluated. Patients were grouped as survivors (Group I) or non-survivors (Group II). Parameters and scores of FGSI and UFGSI scoring systems are shown in Table 1 (FGSI, A; UFGSI, A + B + C).[6] The parameters added to UFGSI were age (aged >60 years = 1 point, aged <60 years = 0 points) and extent of disease (FG confined to urogenital and/or anorectal area = 1 point, confined to pelvic area = 2 points, extended beyond pelvic area = 6 points).

Statistical Analysis

The data were statistically analyzed using IBM SPSS Statistics version 22 software package. Fisher's exact test was used to compare categorical data between the two groups. Mann–Whitney U test was used to compare the two groups if continuous variables showed non-parametric features. The optimum cutoff level of the power of the FGSI and UFGSI scoring systems for predicting mortality was calculated using an ROC analysis. ROC curves were created using IBM SPSS Statistics version 22 software package. AUC, sensitivity, specificity, positive likelihood ratio (LR), negative LR, positive predictive value (PV), negative PV, and confidence intervals for these values were calculated using the Med Calc demo version. A p value of <0.05 was considered to be statistically significant.

RESULTS

In total, 29 patients were included in this study. The mor-

Table 1. The Uludag Fournier's gangrene severity index

	+4	+3	+2	+1	0	+1	+2	+3	+4
a. Physiological parameters									
Temperature (°C)	>41	39–40.9	–	38.5–38.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate	>180	140–179	110–139	–	70–109	–	55–69	40–54	<39
Respiratory rate	>50	35–49	–	25–34	12–24	10–11	6–9	–	<5
Serum potassium (mmol/L)	>7	6–6.9	–	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	–	<255
Serum sodium (mmol/L)	>180	160–179	155–159	150–154	130–149	–	120–129	110–119	<110
Serum creatinine (mg/100 ml)	>3.5	2–3.4	1.5–1.9	–	0.6–1.4	–	<0.6	–	–
(X2 for acute renal failure)									
Hematocrit (%)	>60	–	50–59	46–49	30–45	–	20–29	–	<20
White blood count (X1000/mm³)	>40	–	20–39.9	15–19.9	3–14.9	–	1–2.9	–	<1
Serum bicarbonate, (venous (mmol/L)	>52	41–51	–	32–40	22–31	–	18–21	15–17	<15
b. Dissemination score									
Fournier's gangrene confined to the urogenital and/or anorectal region, add "1"									
Fournier's gangrene confined to the pelvic region, add "2"									
Fournier's gangrene extending beyond the pelvic region, add "6"									
c. Age score									
Age ≥60 years, add "1"									
Age <60 years, add "0"									
Uludag Fournier's gangrene severity index = a+b+c									

Table 2. Characteristics of the groups and related factors according to the mortality rate

	Grup I n (%)	Grup II n (%)	Total n (%)	P
Sex				
Female	8 (34.8)	3 (50)	11 (37.9)	0.646*
Male	15 (65.2)	3 (50)	18 (62.1)	
Stoma status				
Yes	11 (47.8)	3 (50)	14 (48.3)	1.000*
No	12 (52.2)	3 (50)	15 (51.7)	
Isolated bacteria type				
Others	4 (36.4)	3 (50)	7 (41.2)	0.644*
E. Coli	7 (63.6)	3 (50)	10 (58.8)	
Presence of bacteria in the culture				
Yes	11 (47.8)	6 (100)	17 (58.6)	0.028*
No	12 (52.2)	0 (0)	12 (41.4)	
Presence of diabetes mellitus				
Yes	6 (26.1)	3 (50)	9 (31)	0.339*
No	17 (73.9)	3 (50)	20 (69)	
Presence of additional disease				
Yes	9 (39.1)	5 (83.3)	14 (48.3)	0.080*
No	14 (60.9)	1 (16.7)	15 (51.7)	
	Mean±SD (min–max)	**Mean±SD (min–max)**	**Mean±SD (min–max)**	
Age (years)	51.91±13.51 (31–78)	50±13.93 (29–68)	51.52±13.36 (29–78)	0.808**
Surgical debridements (number)	1.78±1.76 (1–9)	1.83±0.98 (1–3)	1.79±1.61 (1–9)	0.456**
Number of additional diseases	0.83±1.03 (0–3)	2±1.41 (0–4)	1.07±1.19 (0–4)	0.049**
Length of the hospital stay (days)	26.35±25.07 (3–107)	11.5±10.56 (1–26)	11.5±10.56 (1–107)	0.118**
FGSI score	3.48±3.3 (0–11)	9.67±2.5 (7–14)		0.002*
UFGSI score	5.35±3.76 (1–14)	13.83±4.26 (9–20)		0.001*

*Fisher's exact test. **Mann-Whitney U test, FGSI: Fournier's gangrene severity index; UFGSI: Uludag Fournier's gangrene severity index; SD: Standard deviation; Min: Minimum; Max: Maximum.

tality rate was 20.6% (six patients). Of all the patients, 11 (37.9%) were females and 18 (62.1%) were males. The mean age was 51.52±13.36 (range, 29–78) years. According to sex, the average age was 49 years for females and 53 years for males. There was no significant difference between the groups in terms of age and sex (p>0.05). Bacterial growth was observed in wound cultures of 17 patients (58.6%). Of all patients with bacterial growth, 11 (47.8%) were in Group I and six (100%) were in Group II. The most commonly encountered bacteria was Escherichia coli, which was present in 10 patients (58.8%), followed by *Acinetobacter* in two patients (11.8%) and *Streptococcus, Staphylococcus aureus, Pseudomonas, Klebsiella,* and *Citrobacter* each occurring in one patient (5.9%). The presence of bacterial growth in the cultures was significantly different between the two groups (p<0.05). Fourteen patients (48.3%) had comorbid conditions. The mean number of comorbid conditions was 0.83±1.03 in

Group I, 2.00±1.41 in Group II, and 1.07±1.19 in the whole study group. There was a significant difference between the groups in terms of the total number of comorbid conditions (p<0.05) (Table 2). The presence of DM, number of debridements, length of hospital stay, and other variables did not significantly differ between the two groups (p>0.05).

In the analysis of the FGSI and UFGSI scoring systems, FGSI and UFGSI scores were significantly higher in Group II than in Group I (p<0.05) (Table 1).

The extent of disease, body temperature, pulse rate, and HCO_3 values were significantly higher in Group II than in Group I (p<0.05). The other variables did not significantly differ between the two groups (Table 3). The FGSI and UFGSI had 100% sensitivity and 78.2% and 73.9% specificity, respectively, for predicting mortality. ROC curves that were drawn

Table 3. Parameters of between groups of mean and prognostic significance in FGSI and UFGSI scoring systems

	Group I		Group II		p*
	Mean±SD	Min–Max	Mean±SD	Min–Max	
Temperature (°C) score	0.04±0.21	0–1	0.33±0.52	0–1	0.041
Heart rate score	0.35±0.78	0–2	2.17±0.41	2–3	0.0001
Respiratory rate score	0±0	0–0	0.17±0.41	0–1	0.050
Serum K (mmol/L) score	0.13±0.34	0–1	0.67±1.21	0–3	0.204
Serum Na (mmol/L) score	0.09±0.42	0–2	0±0	0–0	0.610
Serum creatinine (mg/dL) score	0.91±1.47	0–4	1.5±1.76	0–4	0.390
Hematocrit (%x100) score	0.7±0.97	0–2	0.67±1.03	0–2	0.948
White blood cell count (total/mm³x1000) score	0.65±0.78	0–2	1.17±0.41	1–2	0.086
Serum bicarbonate (mmol/L) score	0.61±1.27	0–4	3.00±1.1	1–4	0.001
Dissemination score	1.57±1.08	1–6	3.83±2.4	1–6	0.014
Age score	0.3±0.47	0–1	0.33±0.52	0–1	0.893

*Mann-Whitney U test. SD: Standard deviation; Min: Minimum; Max: Maximum.

Table 4. FGSI and UFGSI scoring systems for predicting mortality in patients with Fournier's gangrene

	Cut-off	Sensitivity 95% CI	Specificity 95% CI	+ Likelihoodratio 95% CI	– Likelihoodratio 95% CI	+ Predictivevalue 95% CI	– Predictivevalue 95% CI
FGSI score	>6	100	78.26	4.6	0	54.5	100
		54.1–100.0	56.3–92.5	3.7–5.7	0	22.0–84.4	81.5–100.0
UFGSI score	>8	100	73.91	3.83	0	50	100
		54.1–100.0	51.6–89.8	3.0–4.9	0	21.1–78.9	80.5–100.0

FGSI: Fournier's gangrene severity index; UFGSI: Uludag Fournier's gangrene severity index.

according to the optimal cutoff values for predicting mortality (sensitivity, specificity, positive LR, negative LR, positive PV, and negative PV) in the FGSI and UFGSI scoring systems are presented in Table 4 and Figure 1.
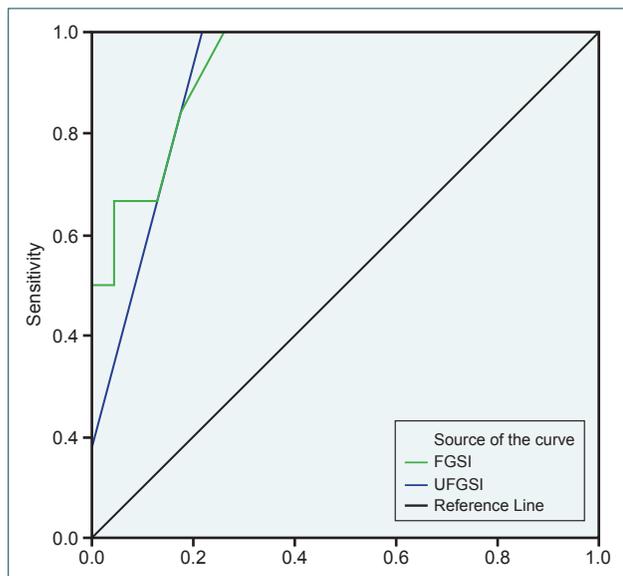

Figure 1. The predictive values of FGSI and UFGSI scoring systems were evaluated using ROC curve analysis.

DISCUSSION

FG is a rapidly progressive, infective, necrotizing fasciitis that is characterized by thrombosis and necrosis of subcutaneous tissues and superficial vessels in the perineal, genital, or perianal area.[8] The mortality rate is as high as 7.5%–40%, despite advances in medicine and technology.[8–10] The mortality rate was reported to be 7.5% by Sorensen et al.[11] and 16% by Eke et al.[3] in a review of 1726 patients. The mortality rate was 20.6% in this study, which was consistent with that reported in the literature. Many factors have been reported to influence mortality. Female sex has been advocated to be a risk factor for high mortality rates.[4,12] In this study, FG resulted in the death of 27% of females and 16.6% of males, showing higher mortality rate in females. Consistent with other studies, sex did not affect mortality.[4,13] Age is another concern that is discussed as a factor that affects mortality.[5,14,15] The present study did not report any association between age and mortality, similar to that reported by Marin et al.[14]

Many other studies have investigated the role of comorbid conditions in mortality. In this regard, very few parameters have been suggested to have a significant role.[5,14] As one of the factors discussed, DM was present in nine patients (31%) in this study. Of the patients who died, 50% had DM in Group II and 26.1% had DM in Group I. Although the prevalence of DM was high in the high mortality group, as observed in other studies, DM had no effect on mortality.[5,6,14] In the current study, although the presence of comorbid conditions did not affect mortality alone, the presence of more than one comorbid conditions significantly affected mortality. Among these comorbid conditions, malignancy was reported to be an independent risk factor for mortality.[12] However, in our patients, only one patient was diagnosed as having malignancy, and this patient case was in Group I.

FGSI was developed by Laor et al.,[7] who used vital findings and some laboratory data to determine the severity and prognosis of FG in patients. In this scoring system, the mortality rate is 75% if FGSI is >9 points and the survival rate is 78% if FGSI is <9 points. However, Yilmazlar et al.,[6] who asserted that this classification has some drawbacks, added a dissemination score and age into this system to create a modified UFGSI scoring system. Different studies have compared the two classification systems and evaluated their strengths.[5,14] The present study evaluated the roles of these scoring systems for predicting mortality. Both scoring systems were found to be correlated to mortality. Both systems yielded 100% sensitivity in the analysis of sensitivity and specificity. The specificity was 78% for FGSI and 73% for UFGSI. Yilmazlar et al.[6] described the UFGSI scoring system and reported a sensitivity of 94% and specificity of 81% for UFGSI. Roghmann et al.[5] reported these figures to be 85% and 67% for UFGSI. In the abovementioned two studies, the sensitivity and specificity for FGSI were 65%–100% and 88%–67% , respectively. Czymek et al.[4] reported a sensitivity of 87% and a specificity of 77% for FGSI, whereas Laor et al.[7] reported a sensitivity of 75% and specificity of 78%. In another study by Yılmazlar et al.,[13] no survivor was reported among patients with UFGSI scores of ≥9 in a series of 120 cases. The cutoff values for FGSI and UFGSI were 7 and 9, respectively. Six of 12 cases with a score of >7 for FGSI died, whereas six of 13 cases with a score of >9 for UFGSI died. Despite these high rates, we consider that lower mortality in these cases was associated with a prompt and effective treatment.

The present study evaluated the association with mortality using common parameters in the two scoring systems, and age and the extent of disease that are only included in UFGSI. Of the common parameters, heart rate, body temperature, and bicarbonates were significant. Serum creatinine, hematocrit, and potassium levels were related to mortality in some studies.[10,14] Roghmann et al.[5] reported an association between mortality and creatinine and hematocrit. As observed, all parameters included in FGSI and UFGSI were significant. Therefore, the authors have begun evaluating different parameters such as albumin, alkaline phosphatase, cholesterol,

lactate dehydrogenase, platelet count, calcium, and magnesium.[16–18] However, the value of these parameters for predicting mortality is only hypothetical. In the present study, the parameters of age and the extent of disease different from FGSI in UFGSI were separately analyzed. Age was not related to mortality; however, the extent of disease was higher in Group II than in Group I. One study that explored the need to establish a new scoring system suggested the use of the extent of disease for predicting prognosis.[5]

The treatment of FG is based on large debridement of the wound and drainage after removing necrotic tissues, using broad-spectrum antibiotics, and providing hemodynamic stability.[3,8] All patients underwent large debridement under general anesthesia, and prophylactic broad-spectrum anti-biotherapy was initiated. Anti-biotherapy was revised according to the results of the cultures. In this study, bacterial growth was observed in wound cultures of 58.6% of patients. In addition, bacterial growth was observed in all fatalities. E. coli was the most prevalent agent in 58.8% of patients. The type of isolated bacteria and their rates were similar to those reported in the literature.[5,8] The presence of bacterial growth in the culture was an important factor for mortality; this was independent of the bacteria type.

The extensiveness of debridement can be life-saving; however, the association between mortality and number of debridements remains debatable,[15] and many studies[14,19,20] found no association, similar to that observed in our study. The association between the presence of colostomy and mortality remains debatable.[14,18,19] Fourteen patients (48.3%) with FG in close proximity to the anal area and resulting in fecal contamination underwent fecal diversion to prevent infections, morbidity, and mortality. The study by Li et al.[18] advocated fecal diversion to reduce mortality. However, fecal diversion had no role in reducing mortality in our series, similar to the study by Ozturk et al.[19] We consider that fecal diversion must not be routinely performed in all patients but must only be performed in selected patients with a high risk for contamination owing to close proximity to the anal area.

Our study had some limitations. The study had a retrospective design and small sample size. However, there are no large series of patients with FG in the literature, and there are continuous case reports.[21]

Conclusion

FG must be considered for abscesses that occur in the perianal, perineal, and genital area that can lead to high mortality if left untreated, although the symptoms may appear insignificant. Patients must be treated with maximum care, and an aggressive treatment approach must be adopted. FGSI and UFGSI are useful for predicting mortality associated with FG. In this study, age had no influence in the UFGSI scoring system. We assume that age is not an important prognostic fac-

tor, considering the fact that FG often occurs in advanced age groups. The extent of disease was an important prognostic parameter. Whichever scoring system is used, we suggest the use of the extent of disease score in UFGSI.

Conflict of interest: None declared.

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Fournier gangrenli hastalarda mortalite tahmininde FGSİ ve UFGSİ skorlama sistemlerinin prediktif değeri: Çok merkezli çalışma

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AMAÇ: Fournier gangreni (FG) hastalığının mortalite tayininde Fournier gangreni skorlama indeksi (FGSİ) ve Uludağ FGSİ'lerinin (UFGSİ) prediktivitesini araştırmak amaçlandı.

GEREÇ VE YÖNTEM: İki eğitim ve araştırma hastanesi genel cerrahi kliniğinde Ocak 2012 ile Aralık 2015 tarihleri arasında FG nedeniyle takip ve tedavi edilen olgular mortalite ile ilişkili faktörler yönünden değerlendirildi. Mortalite ilişkili faktörler ve hastalık prognozunun tayini için FGSİ ve UFGSİ skorlama sistemlerinin duyarlılıklarına bakıldı. Olgular yaşayan (Grup I) ve mortalite görülen (GrupII) olarak gruplandırıldı.

BULGULAR: Toplam 29 olgu çalışmaya dahil edildi. Yaş ortalaması 51.52±13.36 idi. Mortalite oranımız %20.6 (6 olgu) idi. Olguların 17'sinde (%58.6) yara kültüründe üreme saptandı. Üreme olan olguların 11'i (%47.8) Grup I, 6'sı (%100) Grup II'de idi. Bakteri üreme varlığı mortalite açısından istatistiksel olarak anlamlı bulundu (p=0.028). On dört (%48.3) olguda ek hastalık varlığı mevcuttu. Ek hastalık sayısı mortalite ile ilişkili bulundu (p=0.049). Fournier gangreni skorlama indeksi ve UFGSİ puanları Grup II olgularda istatistiksel olarak anlamlı yüksek bulundu (sırasıyla p=0.002 ve 0.001). Uludağ Fournier gangreni skorlama indeksi skorlama parametrelerinden Grup II olgularda yaralanan alan, vücut ısısı, nabız sayısı ve HCO3 puanları Grup I olguların puanlarından istatistiksel olarak anlamlı yüksek bulundu (p<0.05). Fournier gangreni skorlama indeksi ve UFGSİ'nin mortalite tahminindeki sensitivitesi %100 iken, spesitifite oranları sırasıyla %78.2 ve 73.9 idi.

TARTIŞMA: Fournier gangreni mortalitesinin öngörüsünde FGSİ ve UFGSİ oldukça etkindir. Çalışmamızda hastalığın yayılımı prognozda önemli bir parametre olarak görüldü. Hangi skorlama sistemi kullanılırsa kullanılsın UFGSİ'deki hastalığın yayılım parametresi mutlaka her olguda kullanılmalıdır.

Anahtar sözcükler: Fournier gangreni; mortalite; skorlama sistemi.