



Evaluation of factors affecting mortality in Fournier's Gangrene: Retrospective clinical study of sixteen cases

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ABSTRACT

Objective: Fournier's gangrene is a progressive, necrotizing fasciitis due to synergistic infection of the perineum and external genitalia that is associated with high mortality and morbidity. The purpose of this study is to review the diagnostic and treatment methods that effect mortality in Fournier's gangrene.

Material and Methods: Sixteen patients who were diagnosed and treated at our clinic between 2011 and 2013 due to Fournier's gangrene were retrospectively analyzed. The surviving and non-surviving patient groups were compared in terms of age, sex, onset time of symptoms, isolated microorganisms, concomitant diseases, Fournier's gangrene severity index (FGSI), and length of hospital stay.

Results: Ten of our cases (62.5%) were male and six (37.5%) were female, with a mean age of 61.2±12.3 (42-73) years. The mortality rate was 18.8% (3 cases). The mean duration of symptoms before admission was 4.31±1.81 (2-8) days. This period was 6.67±1.52 days in patients who succumbed to death, and 3.77±1.42 days in patients who survived (p=0.007). Ten cases (62.5%) had concomitant diabetes mellitus. The most common organism isolated in wound cultures was *Escherichia coli* (68.7%), and *Acinetobacter baumannii*, *Proteus mirabilis*, *methicillin-resistant Staphylococcus aureus* and *Enterococcus* spp. in the remaining patients. The mean FGSI of surviving patients was 3.84±1.77, and 7.66±0.57 in fatal cases (p=0.003). The mean length of hospital stay was 25.5 days (2-57) and duration of hospitalization was significantly longer in survivors (p<0.05).

Conclusion: The delay in diagnosis and higher FGSI may be responsible for worsening of prognosis and mortality in Fournier's gangrene. Early diagnosis and determination of the severity of the disease, aggressive surgical debridement and appropriate antimicrobial therapy may improve prognosis.

Key Words: Fournier's gangrene, necrotizing fasciitis, soft tissue infection, treatment

INTRODUCTION

Baurinn first described Fournier's gangrene as necrotizing fasciitis of the genital area in 1764. Fournier reported a case in 1883, and the disease began to be referred to as Fournier's. Meleney first introduced surgery in these cases in the 1920s. Today, Fournier's gangrene is defined as necrotizing fasciitis of the perineum and genital area (1). It is one of the major surgical emergencies, that is a life-threatening soft tissue necrosis of the perineum and genital area, associated with rapid-spread through fascial planes (2, 3). The most common predisposing factor is diabetes mellitus. Chemotaxis, phagocytosis and cellular digestion functions are impaired in diabetes. This leads to increased susceptibility to infections (4).

Thrombosis of small vessels, known as obliterative endarteritis, is detected in the pathophysiology of Fournier's gangrene. As a result, skin gangrene occurs at the areas vascularized by these blood vessels. The isolated bacteria in Fournier's gangrene further propagate the endarteritis, which was formed by endotoxins, through platelet aggregation and complement fixation by production of coagulase, hyaluronidase, collagenase and heparinase (5, 6).

Urogenital and anorectal infections and trauma play an important role in its etiology. Early surgical debridement of necrotic tissue and the use of antibiotics are the most important elements in the treatment of Fournier's gangrene. Despite advances in diagnosis and treatment, mortality rate of the disease still ranges from 16-40% (7).

MATERIAL AND METHODS

Sixteen patients who were diagnosed and treated at Bozyaka Izmir Training and Research Hospital, General Surgery Clinic between 2011 and 2013 due to Fournier's gangrene were retrospectively analyzed. Gender, age, etiology and risk factors, time of application to the clinic, physical examination and laboratory findings, Fournier's Gangrene Severity Index (FGSI), number of subsequent debridements, requirement for diversion, the treatment protocol, mortality and hospital length of stay were evaluated. The diagnosis were made by clinical examination findings; patients with perineal, inguinal and gluteal skin tenderness, erythema, induration, swelling in the scrotum and external genital organs, gangrene, cyanosis, skin necrosis and subcutaneous crepitus on physical examination were considered as Fournier's gangrene (Figure 1). After obtaining informed consent from patients, study data were recorded in pre-

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prepared forms and were evaluated retrospectively. The FGSI were calculated based on body temperature, heart rate, respiratory rate, hematocrit and leukocyte counts, serum sodium, potassium, creatinine and bicarbonate values (Table 1). Oral feeding was stopped and antibiotics and intravenous fluid treatments were started. A Foley catheter was inserted and urinary output was monitored and intestinal diversion (diverting colostomy or ileostomy) was applied if required. Surgery was performed immediately after stabilization of the patient, and cultures were taken from the infected necrotic tissue. During surgery, aggressive debridement of infected and necrotic tissue was applied until reaching viable, bleeding tissue and in suitable cases Vacuum Aspirated Closure (VAC) therapy was used. After VAC therapy, skin defects were either treated with primary suture closure or with the application of grafts. The patients were followed-up for 2 years at intervals of 2 to 6-months.

Statistical Analysis

Data were analyzed using "Statistical Package for the Social Sciences (SPSS) for Windows 21.0" package program. Descriptive statistics were presented as mean±standard deviation for continuous variables, and as frequencies and percentages for categorical variables. The 16 patients who were operated on were compared in terms of demographic characteristics and risk factors that are thought to affect mortality. Continuous variables were compared by the t-test and the Mann-Whitney U test, and categorical variables were compared by the chi-square one sample test, Pearson's chi-square test and Fisher's exact chi-square tests. Statistical significance was considered as $p < 0.05$.

RESULTS

Ten of our patients (62.5%) were male and 6 (37.5%) were female, and the mean age was 61.2 ± 12.3 years. The mean age of the women was 63.5, and that of the men was found to be 59.9 years. The mean age of surviving patients was 61.7, whereas the mean age of non-surviving patients was 59.0 years. There was no statistically significant difference between the two groups ($p > 0.05$). The mean duration of symptoms on admission was 4.31 ± 1.81 (2-8) days. This duration was 6.67 ± 1.52 days in non-surviving cases, while it was found to be 3.77 ± 1.42 days in surviving patients, a statistically significant difference was detected between these two groups ($p = 0.007$).

Ten patients in the study (62.5%) had concomitant diabetes mellitus. The effect of diabetes mellitus on mortality was not statistically significant ($p > 0.05$). In addition, 6 (37.5%) patients had hypertension, and 4 (25%) had coronary artery disease. Other co-morbidities included chronic renal failure, cerebrovascular occlusion, rectal cancer and oesophageal cancer that were present in separate patients.

The source of infection that caused the disease was detected as perianal abscess in 12 patients (75%), Bartholin's abscess in 2 cases (12.5%), and postoperative abscess at the incision site in 2 cases (12.5%). Wound culture results showed *Escherichia coli* (68.7%) most commonly, followed by *Acinetobacter baumannii*, *Proteus mirabilis*, methicillin-resistant *Staphylococcus aureus* and *Enterococcus* spp. in the remaining patients. When compared in two groups of *E. coli* and other microorganisms, culture results were not significantly effective on mortality ($p > 0.05$).

The mean FGSI was calculated as 4.56 ± 2.22 days. The mean FGSI of surviving and non-surviving patients was 3.84 ± 1.77 , and 7.66 ± 0.57 days, respectively. The mean FGSI was significantly higher in the non-surviving patient group than the surviving group ($p = 0.003$).

Wide debridement of necrotic tissue was applied to all patients, and the treatment was continued with sequential debridements. The mean number of debridements was 4.44 ± 0.89 (3-6). The number of debridements was found to be 4.31 ± 0.85 in surviving, and as 5.00 ± 1.00 in non-surviving patients. There was no statistically significant difference between groups ($p > 0.05$). Intestinal diversion was applied in addition to surgical debridement when required. Prevention of fecal contamination was attempted by diversion colostomy or ileostomy in 12 cases (75%), and by intrarectal catheter system in 4 patients (25%).

Fluid resuscitation, and a single, double or triple antibiotic therapy was initiated according to culture and antibiotic-sensitivity results. The most commonly used antibiotics were the 3rd generation cephalosporins, carbapenems, aminoglycosides, and metronidazole. Local dressings and VAC therapy was applied in suitable cases (Figure 2). In 10 (62.5%) out of 16 patients, the defects were primarily closed after VAC therapy, 2

Table 1. Fournier's gangrene severity score

Physiologic parameters	High abnormal values			Normal values			Low abnormal values		
	+4	+3	+2	+1	0	+1	+2	+3	+4
Numeric scoring	+4	+3	+2	+1	0	+1	+2	+3	+4
Body 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	-	56-59	40-54	< 39
Respiratory rate	>50	35-49	-	25-34	12-24	10-11	6-9	-	<5
Serum Na (mmol/L)	>180	160-179	155-159	150-154	130-149	-	120-129	111-119	<110
Serum K (mmol/L)	>7	6-6.9	-	5.5-5.4	3.5-4	3-3.4	2.5-2.9	-	<2.5
Serum creatinine	>3.5	2-3.4	1.5-1.9	-	0.6-1.4	-	<0.6	-	-
Hematocrit %	>60	-	50-59.9	46-49	30-45.9	-	20-29.9	-	<20
Leukocyte	>40	-	20-39.9	15-19.9	3-14.9	-	1-2.9	-	<1
Serum bicarbonate	>52	41-51.9	-	32-40.9	22-31.9	-	18-21.9	15-17.9	<15

Table 2. Analysis of parameters according to case groups

Analysis parameter	Alive cases n=13	Deceased cases n=3	Total n=16	p
Age	61.7	59.0	61.2±12.3	>0.05
Gender (M:F)	8:5	2:1	10:6	>0.05
Duration of symptoms (day)	3.77±1.42	6.67±1.52	4.31±1.81	0.007*
Accompanying disease (%)				
Diabetes mellitus	9 (69%)	1 (33%)	10 (62.5%)	>0.05
Infection etiology				
Perianal abscess	10 (77%)	2 (67%)	12 (75%)	>0.05
Bartholin abscess	2 (15%)	-	2 (12.5%)	
Incisional abscess	1 (8%)	1 (33%)	2 (12.5%)	
Isolated pathogen				
<i>Escherichia coli</i>	9 (69%)	2 (67%)	11 (69%)	>0.05
Other (<i>Acinetobacter baumannii</i> , <i>Proteus mirabilis</i> etc.)	4 (31%)	1 (33%)	5 (31%)	
FGSI score	3.84±1.77	7.66±0.57	4.56±2.22	0.003*
Number of debridements	4.31±0.85	5.00±1.00	4.44±0.89	>0.05
Additional surgery (Colostomy-ileostomy)	9 (69%)	3 (100%)	12 (75%)	>0.05
Length of hospital stay (day)	29.8±11.4 (15-57)	10.0±11.4 (2-23)	25.8±13.7 (2-57)	<0.001*

patients (12.5%) were treated by secondary healing, and 1 patient (6%) is still being treated with VAC application (Figure 3).

Our mortality rate was 18.8% (3 patients) and these patients had concomitant diseases such as COPD, hypertension and malignancy. The mean length of hospital stay was 25.5 days (2-57) and it was significantly longer in survivors than in non-survivors ($p<0.05$).

Analyses of parametric factors according to the surviving and non-surviving groups are shown in Table 2.

DISCUSSION

Fournier's gangrene is a rapidly progressive, necrotizing fasciitis due to synergistic infection of the perineum and external genitalia that is associated with high mortality and morbidity. Advanced age, diabetes mellitus, chronic liver disease, chronic renal failure, alcoholism, smoking and immunosuppressive conditions are reported as risk factors for Fournier's gangrene (4, 7).

The most common predisposing factor in Fournier's gangrene is diabetes mellitus. Chemotaxis, phagocytosis and cellular digestion are impaired in diabetic patients. This leads to an increase in susceptibility to infections. The most common concomitant disease in our study was also diabetes, which is thought to increase susceptibility to Fournier's gangrene. Other factors that are effective in morbidity include chronic alcohol intake, advanced age, renal failure and chemotherapy.



Figure 1. Fournier's gangrene located to the perineum and scrotum



Figure 2. VAC application in Fournier's gangrene

Another comorbidity in five of our patients was previous chemotherapy. Consistent with the literature, anorectal area was the most common primary site of infection in our patients.

A scoring system (FGSI) has been developed by Laor et al. (8) to determine the severity of the infection and prognosis of patients with Fournier's gangrene, by using vital signs and laboratory data. In this system, the mortality rate is 75% if the FGSI is over 9, and while the survival rate is 78% in scores of less than 9. Kara et al. (9) showed a significant increase in mortality in patients with FGSI value of ≥ 7 . The mean FGSI of our surviving patients was 3.84, while that of non-surviving patients was 7.66, and there was a statistically significant difference between groups ($p=0.003$). Aggressive resuscitation, the use of broad-spectrum antibiotics and early surgical drainage are essential in the treatment of Fournier's gangrene. All necrotic tissue is removed with debridement and if necessary this process is repeated to control the infection. In case of anorectal region and sphincter involvement or if there is fecal contamination, colostomy may be preferred to reduce contamination. Urinary catheterization or cystostomy is also suggested. Sroczynski et al. (10) also stressed the importance of hyperbaric oxygen therapy in addition to the aforementioned treatment methods. In our cases, treatment consistent with the literature was applied, except hyperbaric oxygen therapy. In the literature, there are studies that reported a reduction in dressing chang-



Figure 3. Debrided tissue after VAC application



Figure 4. Primary repair of the debrided wound after VAC application

es and length of hospital stay with VAC therapy (11). In our study, 10 (62.5%) patients received VAC therapy, the number of consecutive dressings was decreased and skin defects were primarily closed at earlier periods (Figure 4).

A combination of double and triple broad-spectrum antibiotics is recommended in the medical treatment of Fournier's gangrene, followed by either continuation of the same treatment or altering antibiotics according to culture and sensitivity results (12). Patients were started on double or triple antibiotic therapy in the preoperative period and changes in treatment according to the antibiogram results have been made.

Diabetes, female gender, the presence of malignancy and the time from the onset of the disease until the first surgical treatment are reported to be independent risk factors for mortality (12). The mortality rate is reported as 16-40% in the literature and is consistent with our rate (13). Canbaz et al. (7) have reported that the pre-treatment duration of fatal cases was significantly longer and that mortality increased if this period is longer than five days. They related this finding to the rapid and aggressive course of the disease. In our study, 3 of 4 patients (75%) who were admitted 6 days later than the onset of the disease died. The cause of mortality in these 3 patients was cardiac and respiratory failure due to sepsis.

The study was limited by the retrospective design, insufficiency of some data within the registry and inability to access all

the data. Especially in the calculation of FGSI, daily blood gas analyses were not present in some cases, therefore our FGSI values were less than the other studies in the literature.

CONCLUSION

Fournier's Gangrene is a rapidly progressive disease which is difficult to take under control and is associated with high mortality and morbidity. In patients with Fournier's gangrene and delayed diagnosis and high FGSI values result in poor prognosis and mortality. Especially in patients with high Fournier's Gangrene Severity Index score, the importance of prognostic factors such as early diagnosis and appropriate treatment increases. As a result, early diagnosis and determination of disease severity, treatment with aggressive surgical debridement and appropriate antimicrobial therapy might have a positive influence on the prognosis of the disease.

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Informed Consent: Written informed consent was obtained from all patients who participated in this study.

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