

## New Prognostic Factors in Fournier's Gangrene: A 10-Year Experience

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### ABSTRACT

**INTRODUCTION:** Fournier's gangrene is a rapidly progressing infection of the male genitalia, including the anal and perianal region and usually extending to the abdominal wall. The objective of the present investigation was to study the epidemiologic and clinical reports of patients with Fournier's gangrene in order to evaluate the prognostic factors of the disease.

**METHODS:** The patients were referred to Ghaem hospital from 1998-2008. Their files were reviewed for: (1) laboratory parameters of urea, creatinine (Cr), hematocrit (Hct), white blood cell (WBC), albumin (Alb), sodium (Na), Calcium (Ca), and potassium (K); (2) probable risk factors (eg, diabetes); (3) ulcer microbiology; and (4) the extent of the gangrene.

**RESULTS:** There were 71 patients with a mean age of 60.9 years (SD = 17.02). The time between onset of symptoms and referral to a health care unit was 6.7 days (SD = 5.25). The source of infection was the skin in 25 patients (35%), urogenital in 34 patients (48%), and rectal in 12 patients (17%). The anorectal source was responsible for 11 out of 16 deaths. Diabetes was a predisposing factor in 39.4%.

The patients were divided in 2 groups: the survival group (n = 55) and the mortality group (n = 16). The survival group had a significantly higher socioeconomic status, shorter mean time between the onset of the illness and referral to a health clinic, lower percentage of gangrene involvement, fewer required debridements, and higher mean Alb and Ca and lower mean urea laboratory values ( $P < .05$ ). There were no other significant between-group differences for the remaining variables.

**CONCLUSIONS:** The authors compared the data in the present study with data from the *Laor Fournier's Gangrene Severity Index*. None of the conventional indices (temperature, heart rate, respiratory rate, Hct, Cr, WBC, Na, K) were found to be significantly different when the mortality and survival group were compared in the present study. The authors recommend new prognostic criteria for Fournier's gangrene: (1) time between onset of the symptoms and referral to the hospital; (2) source of infection; (3) extent of the gangrene; (4) laboratory results of Alb, urea, and Ca; and (5) the number of required debridements.

**KEYWORDS:** Fournier's gangrene; Laor Fournier's gangrene severity index; Prognosis; Risk factors

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## INTRODUCTION

Fournier's gangrene is a rapidly progressing infection of male genitalia, occurring in the anal and perianal region and usually extending to the abdominal wall. When it occurs in females, it is in the perineal region. Its characteristic features are subcutaneous vascular thrombosis and fulminant progression to an infectious gangrenous condition [1]. The patients are usually seen in advanced stages of perineal and abdominal involvement [2]. The typical rate of progression is 2-3 cm/hour [3].

The gangrene usually appears in two forms: (1) following an infection with aerobic and anaerobic organisms which are usually accompanied by diabetes mellitus or are a surgical complication, and (2) following group A streptococcus infection with a secondary infection with staphylococcus aureus, coliforms, and bacterioids [4,5]. Diabetes, cirrhosis, malignancy, malnutrition, pelvic vascular disease, and alcoholism are known to predispose Fournier's gangrene. The suspected organism seems to be of urogenital, anorectal, or dermal origin [6].

Fournier's gangrene is a life-threatening disease, so development of better prognostic criteria could be very beneficial for urologists in order to facilitate timely management. The authors of the present investigation studied the epidemiologic and clinical aspects of patients with Fournier's gangrene over a 10-year period and evaluated the prognostic factors of the disease.

## METHODS

For this retrospective study, the authors reviewed the files of patients referred to Ghaem hospital between 1998 and 2008. There were a total of 71 patients divided in 2 groups: the survival group (n = 55) and the mortality group (n = 16).

Patients were evaluated for laboratory parameters of urea mg/dL; creatinine (Cr) mg/dL; hematocrit (Hct) %; white blood cell (WBC) (cells/ $\mu$ l); albumin (Alb) g/dL; sodium (Na) mEq/L; calcium (Ca) mg/dL; potassium (K) mEq/L. The authors also gathered data on probable risk factors (eg, diabetes) and ulcer microbiology. They rated socioeconomic status (SES) on a 100-point scale, based on results of a questionnaire. The questionnaire had 5 factors (work status; economic status; personal assistance required; transportation; community service). Each factor was worth 20 points. A score of 0 was the best possible SES and a score of 100 was the worst. Finally, the authors rated the level of gangrene extension using the Lund-Browder burn index.

Patients were treated with broad-spectrum antibiotics and debridements. Some patients had a cystostomy or colostomy.

Daily dressing, examination of the ulcer, and further debridements were done as needed.

The authors compared the risks in the survival and mortality groups to look for both new and conventional prognostic factors. The Student *t* test was used to compare quantitative variables among patients. In all cases, *P* < .05 was considered statistically significant. A test for normal distribution of the dependent variables was not conducted. Therefore, the basic assumption of the *t* test may not have been met, particularly given the large difference in the size of the 2 groups. Additionally, without a power analysis, multiple *t* tests have a risk of false positive results.

## RESULTS

### Patient Characteristics

There were 71 patients with a mean age of 60.9 years (SD = 17; range, 11-95 years). The mean age of the patients in the survival group was 59 years (SD = 15.3); the mean age of the mortality group was 62 years (SD = 18.2 years). There was only one female patient and she was in the survival group.

Out of the total 71 patients, 45 patients (63.4%) were in good general condition and good consciousness at the time of admission; 18 patients (25.4%) were confused and lethargic; 8 patients (11.2%) were in a coma. The patients' symptoms and signs were: swelling (95%), redness (69%), tenderness (21%),

Figure 1. Patient With Signs of Fournier's Gangrene.

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Table 1. Means, Standard Deviations, and Probability of Significant Differences Between Groups for Some Patient Characteristics (N = 71).

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Characteristic	Survival Group		Mortality Group		P
	Mean	SD	Mean	SD	
Socioeconomic status, 100 point scale	45.2	12.2	60.7	17.5	< .05
Time between symptom onset and referral to health care unit, days	2.1	1.3	8.1	2.5	< .05
Degree of involvement, points on burn index	1.7	1.2	8.2	2.5	< .05
Number of required debridements, n	1.2	2.5	5.6	3.3	< .05
Body temperature at admission, °C	37.7	.9	37.5	1.2	ns
Pulse rate, beats/minute	92	23	85	18	ns
Respiratory rate, breaths/minute	18	9.3	20	7.1	ns

Abbreviation: ns, not statistically significant ( $P \geq .05$ )

warmth (9.5%), foul smelling (40%), crepitation (20%), and pain (52%). Figure 1 is a photograph of a patient with many of the Fournier's gangrene characteristics. Urologic symptoms (dysuria, frequency, urgency, hematuria, urethral discharge, and obstructive symptoms) were seen in 41% of the patients. Gastrointestinal symptoms were present in 19 patients (perianal abscess in 12 patients; melena in 2; constipation in 3; thrombosed hemorrhoid in 2). Dermatologic symptoms were seen in 20 patients either as an ulcer (15 patients), or blister and nodule (5 patients). Diabetes was present in 28 patients (39.4%) and considered a predisposing factor. The source of infection was identified using history and physical examination. The source was the skin in 25 patients (35%), urogenital in 34 patients (48%), and rectal in 12 patients (17%). The anorectal source was responsible for 11 out of 16 deaths.

The percentages of patients with positive microbiologic evaluations were: pyocyanic bacillus (30%), coli bacillus (35%), staphylococcus epidermidis (11%), Klebsiella pneumonia (17%), Corine bacterium (3%) and enterobacters (4%). The antibiotic regimens used in these patients consisted of penicillin, chloramphenicol, and metronidazole or ceftriaxone, metronidazole, and gentamicin.

Of the total 71 patients, 42 patients underwent cystostomy and 10 patients had cholestomy. The mean length of the hospital stay was 28.5 days (SD = 15.2; range, 14-95 days). There were 16 deaths (22.5%) within 10 years. There were 3 deaths (12%) within the last 4 years out of 25 patients referred during this time period, compared with 13 deaths (28%) out of 46 patients referred in the first 6 years. This reduction in the death rate may be attributed to improved surgical and nursing techniques.

### Survival and Mortality Group Comparisons

The means, standard deviations, and probability of significant differences between groups for some of the patient characteristics are provided in Table 1. The majority of the patients had a low SES; more than 30% were farmers. The survival group had a significantly higher SES (represented by a lower number on the scale) than the mortality group ( $P < .05$ ). The time between onset of symptoms and referral to a health care unit was 1-20 days for all patients. The survival group had a significantly shorter mean referral time (2.1 days and 8.1 days for the survival and mortality groups, respectively) ( $P < .05$ ). The mean degree of involvement assessed with the burn index was 3% (range, 1%-25%). The survival group had a significantly lower mean percentage of involvement (1.7% and 8.2% for the survival and mortality groups, respectively) ( $P < .05$ ). The number of required debridements ranged from 1-18. The survival group had a significantly lower number of debridements (1.2 and 5.6 for the survival and mortality groups, respectively) ( $P < .05$ ).

Body temperature at the time of admission ranged from 35.5°-40°C (95.9°-104°F) for all patients. There was no significant between-group difference in mean temperature. There were no significant between-group differences for pulse rate or respiratory rate at the time of admission.

Table 2 contains the results of laboratory tests for both groups and the probability of significant between-group differences. The survival group had a significantly higher mean Alb and Ca, and a significantly lower mean urea value when compared with the mortality group ( $P < .05$ ). There were no significant differences between groups for WBC, Na, K, Hct, or Cr.

Table 2. Means, Standard Deviations, and Probability of Significant Differences Between Groups for Patient Laboratory Test Results (N = 71).

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Laboratory Test	Survival Group		Mortality Group		P
	Mean	SD	Mean	SD	
Albumin (Alb), g/dL	4.1	0.8	1.9	0.5	< .05
Calcium (Ca), mg/dL	2.5	9.5	1.2	6.2	< .05
Urea, mg/dL	60	34	141	104	< .05
White blood count (WBC), cells/ $\mu$ l	15000	1200	14500	1000	ns
Sodium (Na), mEq/L	137	7	135	8	ns
Potassium (K), mEq/L	4.2	0.7	4.6	1.1	ns
Hematocrit (Hct), %	37.5	7.2	38.1	2.5	ns
Creatinine (Cr), mg/dL	1.5	0.7	2.6	1.8	ns

Abbreviation: ns, not statistically significant ( $P \geq .05$ )

## DISCUSSION

Fournier's gangrene was first reported by Baurienne in 1764 and then by Hebler in 1848. In 1883, Jean Alfred Fournier was the first to associate this condition with a specific region of the body, namely the scrotum. The cardinal points of the description included: (1) sudden onset, (2) rapid progression to gangrene, and (3) absence of a definite cause [7].

The age range associated with Fournier's gangrene is different in various studies; the mean age was 60.85 years in the present study (SD = 17.2, range 11-95 years). The male/female ratio was 70:1, which is different from the previously reported ratio of 10:1 [8].

Low SES, poor hygiene, systemic diseases, alcohol consumption, steroids, chemotherapy, and diabetes have been reported as predisposing factors [9]. The results of the present study confirmed 2 of these factors: low SES was found in over 80% of the patients and diabetes was found in 35%.

Anorectal source of infection was associated with high mortality rate, accounting for 11 out of 16 deaths (68%) in the present study. There was a significant difference between the mortality and survival groups regarding the level of disease extension as rated on the burn index, and the present authors considered this as an important prognostic factor. The time between onset of the disease and referral to a health clinic also appears to be an important prognostic factor.

The authors compared the data in the present study with data from the conventional index, known as *Laor Fournier's Gangrene Severity Index* [10]. None of the indices in the Laor

et al study (temperature, heart rate, respiratory rate, Hct, Cr, WBC, Na, K) were found to be significantly different when the mortality and survival group were compared in the present study. Instead, the results of the present investigation showed that the most important factors were: (1) time between onset of the symptoms and referral to the hospital (the survival group sought help more quickly); (2) source of infection (there was a poor prognosis when rectal was the source); (3) extent of the

Figure 2. Patient After Aggressive Surgical Debridements.

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Figure 3. Patient Ready to Graft.

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Figure 4. Patient After Secondary Closure and Skin Graft.

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gangrene (the survival group had less extensive involvement); (4) laboratory results of Alb, urea, and Ca (the survival group had a higher mean Alb and Ca, and a lower mean urea value when compared with the mortality group); and (5) the number of required debridements (the survival group required fewer debridements). Therefore, the results of the present study do not support the *Laor Fournier's Gangrene Severity Index* [10]. The authors suggest that new criteria may be needed.

Treatment of Fournier's gangrene consists of a combination of broad spectrum antibiotics, IV fluids, blood transfusion, and prompt aggressive surgical debridements with secondary closure and skin graft [11]. Photographs of a patient after debridement, after preparation for skin graft, and after secondary closure and skin graft are provided in Figure 2, Figure 3, and Figure 4, respectively. Mortality is reduced with early diagnosis and prompt surgery and is not affected by microbial agents which do not change the prognosis [12].

The wound will remain open after the primary urgent surgery and further debridements may need to be done. It has been reported that in some patients hyperbaric oxygen improved the prognosis [13]. The treatment increases tissue oxidation, leucocyte function, introduction of free radicals of oxygen, and vascular angiogenesis [14].

Diagnosis of Fournier's gangrene is based on clinical features. Imaging methods are of no value in the diagnosis. The key to successful treatment of these patients is early diagnosis and treatment with urgent debridements.

## CONCLUSION

The authors recommend new prognostic criteria for Fournier's gangrene: (1) time between onset of the symptoms and referral to the hospital; (2) source of infection; (3) extent of the gangrene; (4) laboratory results of Alb, urea, and Ca; and (5) the number of required debridements.

**Conflict of Interest:** None declared

## REFERENCES

- [1] Ayan F, Sunamak O, Paksoy SM, et al. Fournier's gangrene: a retrospective clinical study on forty-one patients. *ANZ J Surg.* 2005;75(12):1055-1058.
- [2] Vick R, Carson CC III. Fournier's disease. *Urol Clin North Am.* 1999;26(4):841-849.
- [3] Paty R, Smith AD. Gangrene and Fournier's gangrene. *Urol Clin North Am.* 1992;19(1):149-162.
- [4] Kumar P, Clarke M, eds. *Clinical Medicine.* 5th ed. Edinburgh, UK: WB Saunders; 2002:66-67.
- [5] McLatchie GR, Leaper DJ, eds. *Oxford Handbook of Clinical Surgery.* 2nd ed. Oxford, UK: Oxford University Press; 2003:53,890.

- [6] David JE, Yale SH, Goldman IL. Urology: scrotal pain. *Clin Med Res.* 2003;1(2):159-160.
- [7] Morrison D, Blaivas M, Lyon M. Emergency diagnosis of Fournier's gangrene with bedside ultrasound. *Am J Emerg Med.* 2005;23(4):544-547.
- [8] Ekelius L, Bjorkman H, Kalin M, Fohlman J. Fournier's gangrene after genital piercing. *Scand J Infect Dis.* 2004;36(8):610-612.
- [9] Miller JD. The importance of early diagnosis and surgical treatment of necrotizing fasciitis. *Surg Gynecol Obstet.* 1983;157(3):197-200.
- [10] Laor E, Palmer LS, Tolia BM, Reid RE, Winter HI. Outcome prediction in patients with Fournier's gangrene. *J Urol.* 1995;154(1):89-92.
- [11] Scheer F, Kamusella P, Stroszczyński C. Fournier gangrene -- an interdisciplinary emergency [in German]. *Rofo.* 2009;181(3):268-270.
- [12] Grzybowski A. A short history of Fournier gangrene. *Arch Dermatol.* 2009;145(2):182.
- [13] Quatan N, Kirby RS. Improving outcomes in Fournier's gangrene. *BJU Int.* 2004;93(6):691-692.
- [14] Hollabaugh RS Jr, Dmochowski RR, Hickerson WL, Cox CE. Fournier's gangrene: therapeutic impact of hyperbaric oxygen. *Plast Reconstr Surg.* 1998;101(1):94-100.