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Is Intensive Multimodality Therapy the Best Treatment for Fournier Gangrene? Evaluation of Clinical Outcome and Survival Rate of 41 Patients

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Abstract

Background: To evaluate the effect of surgical wound debridement, antibiotics, and hyperbaric oxygen (HBO) in the treatment of Fournier gangrene (FG).

Methods: Forty-one patients with a mean age of 54.3 ± 14.6 years were referred to our department with a diagnosis of FG. To calculate a Fournier Gangrene Severity Index (FGSI), nine factors were assessed (temperature; heart rate; ventilatory rate; serum sodium, potassium, creatinine, and bicarbonate concentrations; hematocrit; and leukocyte count). After clinical stabilization, extensive debridement of the necrotic tissue was performed, and a surgical vacuum-assisted closure (V.A.C.®) device was applied. Hyperbaric oxygen was administered; medical therapy consisted of intravenous antibiotics, electrolyte replacement, and parenteral nutrition.

Results: Intraoperative cultures revealed *Escherichia coli* in 27 patients (66%), *Pseudomonas aeruginosa* in 28 (68%), gram-positive cocci in 24 (59%), and mixed flora (aerobic and anaerobic bacteria) in 39 (95%). One month after primary debridement, wound granulation was sufficient for plastic surgical reconstruction in all patients.

Conclusion: Because of the rapid worsening of FG, early diagnosis and immediate, aggressive multi-modality therapy with surgical debridement and broad-spectrum empiric antibiotics is crucial. The utility of HBO remains unproved.

FOURNIER GANGRENE (FG), defined as life-threatening necrotizing fasciitis of the (usually) male perineum, was first described in the late Nineteenth Century [1]. Many predisposing factors have been implicated, including perianal disease, urethral stricture, local trauma, diabetes mellitus, and malignant neoplasm [2–4]. Early diagnosis and immediate surgical debridement along with appropriate broad-spectrum empiric antibiotics and fluid resuscitation are the mainstays of management [5,6]. The prognosis and mortality rate can be stratified by the Fournier Gangrene Severity Index (FGSI), a numerical score obtained from a combination of admission physiological data [7]. The purpose of the present study was to evaluate the efficacy of an intensive multi-modality treatment in 41 patients to determine whether combined surgical, antibiotic, and hyperbaric oxygen (HBO) therapy could improve the survival rate of these patients.

Patients and Methods

Patient Selection, Demographics, and Data Management

From 1998 to 2009, 41 patients were referred to our department with a diagnosis of FG. Patients with a simple scrotal or perirectal abscess without necrotizing infection were excluded from this analysis. There were three women and 38 men with a mean age of 54.3 ± 14.6 years. Twenty-five patients (61%) were affected by diabetes mellitus, and all patients were from a low socioeconomic class and had poor personal hygiene. One patient tested positive for human immunodeficiency virus (HIV) (Table 1).

The diagnosis of FG was established clinically on the basis of the history and physical examination, and by radiologic imaging in some cases. The criteria for the diagnosis were

◀ T1

TABLE 1. CHARACTERISTICS OF 41 PATIENTS AND PREDISPOSING FACTORS FOR FOURNIER GANGRENE

Mean age (years)	54.3 ± 14.6
Ratio men/women (%)	12.6
Diabetes mellitus	25
Alcoholism	2
Obesity	32
Poor personal hygiene	41
Trauma of the urethra or scrotum	0
Human immunodeficiency virus positive	1

fever >38°C, scrotal erythema or swelling, purulence or wound discharge, and fluctuation or crepitus.

The patient's age, disease etiology and predisposing factors, microbiologic findings, duration of hospital stay, treatment, and outcomes were analyzed. All patients received a broad-spectrum antibiotic [8], HBO, and supportive therapy.

T2 ▶ To calculate the FGSI, nine variables were assessed (temperature; heart rate; ventilatory rate, serum sodium, potassium, creatinine, and bicarbonate; hematocrit; and leukocyte count) (Table 2). The deviation from normal was graded from 0 to 4, as described by Laor et al. [6]. The summed individual values constituted the FGSI.

The data were recorded in Microsoft Excel (Microsoft Inc., Redmond, WA). Statistical analysis was performed using SigmaPlot® software version 11.0 (SPSS Inc., Chicago, IL). Data are expressed as mean ± standard deviation (SD).

Vacuum-Assisted Surgical Therapy

All surgical sites were closed with a vacuum-assisted closure (V.A.C.®) dressing (Kinetic Concepts, Inc., San Antonio, TX). Foam-based sponges (pore size 400–600 micrometers) provided in sterile packaging were cut to fit completely inside the surgical site. Suction tubing was applied and sealed with adhesive, providing complete coverage extending over clean, dry, hairless skin 3–5 cm beyond the site. Stoma adhesive paste (Duoderm; Convatec, Princeton, NJ) was applied as a secondary sealant if necessary. A computerized vacuum pump applied sub-atmospheric pressure, initially at 50 mm Hg increasing to a maximum of 125 mm Hg over 10 min, depending on patient tolerance. Dressings were changed

under clean conditions every three days in either the in-patient or an out-patient setting; the suction was turned off for 30–60 min prior to dressing changes.

Results

Of the lesions, 44% (n = 18) were located on the penis and scrotum, and 56% (n = 23) involved the scrotum and perineum (Fig. 1A). Where were the women's lesions? The presenting symptoms included scrotal edema in 25 patients (61%), pain in 34 patients (83%), crepitus in 22 patients (53.6%), feculent odor in 41 patients (100%), and fever >38°C in 11 patients (26.8%). Thirty-five patients (85.4%) had leukocytosis on presentation (Table 3). All patients had disease localized to the genital or scrotal region and ≤7-cm lesions at presentation. ◀AU1
◀F1

Intraoperative cultures revealed *Escherichia coli* in 27 patients (65.8%), *Pseudomonas aeruginosa* in 28 patients (68.3%), gram-positive cocci in 24 patients (58.5%), and mixed flora (aerobic and anaerobic bacteria) in 39 patients (95.1%).

After clinical stabilization, extensive debridement of the necrotic tissue was performed, and a V.A.C.® dressing was applied (Fig. 1B, C). Hyperbaric oxygen was administered for 12 sessions at 2.5 atm for 120 min/session. Medical therapy consisted of intravenous antibiotics (third-generation cephalosporin, gentamicin, and metronidazole), electrolyte replacement, parenteral nutrition, and correction of any anemia. Debridement was conducted daily for 14 days and subsequently every other day for a total of 21 days. A reduction in the extent of necrotic tissue, appropriate wound granulation, and a diminution of scrotal and penile edema was observed (Fig. 1D). The mean hospital stay was 23.4 ± 9.1 days (Table 3). ◀T3

One month after primary debridement, the wound was granulated well enough to proceed with plastic surgical reconstruction using a medial circumflex femoral artery perforator flap in the 27 patients (65.8%), who lacked residual scrotal skin. The other 14 patients (34.2%) did not require plastic reconstruction, and the wound was closed using their own scrotal skin. One month after surgery, all patients had recovered completely with good aesthetic results (Fig. 1E).

The median admission FGSI score was 2.3 ± 1.6 points. At the end of treatment, all values had normalized, and the FGSI scores had decreased significantly (median 1.2 ± 0.7 points) for all patients (Table 4). The survival rate was 100%. ◀T4

TABLE 2. FOURNIER GANGRENE SEVERITY INDEX [6]

	High abnormal values					Low abnormal values			
	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (°C)	>41	39–40.9	–	38.5–35.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate (beats/min)	>180	140–179	110–139	–	70–109	–	55–69	40–54	<39
Ventilation rate (breaths/min)	>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	–	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	–	<2.5
Serum creatinine, (mg/100 mL) (× 2 for acute kidney injury)	>3.5	2–3.4	1.5–1.9	–	0.6–1.4	–	<0.6	–	–
Hematocrit (%)	>60	–	50–59.9	46–49.4	30–45.9	–	20–29.9	–	<20
White blood cell count (total/mm ³ × 1,000)	>40	–	20–39.9	15–19.9	3–14.9	–	1–2.9	–	<1
Serum bicarbonate, venous (mmol/L)	>52	41–51.9	–	32–40.9	22–31.9	–	18–21.9	15–17.9	<15

THERAPY FOR FOURNIER GANGRENE



FIG. 1. A 45-year old male smoker and alcohol abuser, who has sex with men, presented with nausea, vomiting, hyponatremia, and rapidly progressive necrotizing fasciitis of scrotum (A). (B) After clinical stabilization, extensive debridement of necrotic scrotum was performed. (C) Vacuum-assisted closure (V.A.C.®) dressing was applied. Wound debridement was conducted daily for 14 days and subsequently every other day for a total of 21 days. (D) After three weeks, good granulation is evident, with diminution of scrotal and penile edema. (E) Four weeks after plastic surgical reconstruction, patient has recovered completely, with good aesthetic results.





FIG. 1. (Continued).

THERAPY FOR FOURNIER GANGRENE

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TABLE 3. LOCATION, SYMPTOMS, AND SIGNS OF THE LESIONS IN 41 PATIENTS

Location (%)	
Penis and scrotum	44
Scrotum and perineum	56
Symptoms (%)	
Scrotal edema	61
Scrotal pain	83
Crepitus	53.6
Feculent odor	100
Fever >38°C	26.8
Leukocytosis	85.4

Discussion

Fournier gangrene is a relatively rare, aggressive disease that affects men and, to a lesser extent, women of all ages. The most common pathogens are *Escherichia coli*, *Bacteroides* spp., streptococci, staphylococci, peptostreptococci, and clostridia, all of which are normal flora of the lower gastrointestinal tract and perineum. In FG, localized cellulitis at a portal of entry becomes diffuse inflammation of the deep fascial spaces. Obliterating endarteritis causes cutaneous and subcutaneous vascular thrombosis with tissue necrosis. Consequently, the compromised skin allows entry of commensal flora, which become pathogenic when introduced into ischemic tissues [9–14]. Despite advances in medical therapy and, especially, intensive care, FG remains a serious condition, with a high likelihood of death. Unchecked, FG can involve the abdominal wall secondarily, raising the risk of death to 7%–45% [15–

17]. Severe sepsis, coagulopathy, acute kidney injury, diabetic ketoacidosis, and multiple organ dysfunction syndrome are causes of death in patients with FG [3,18].

Since the first description of a patient with acquired immunodeficiency syndrome (AIDS) and FG in 1991, only 12 cases have been reported in the Western literature [2]. Merino et al. [13] hypothesized that HIV-induced immunosuppression can contribute to progression from minor perianal infection to FG. In the authors' experience, only one patient tested positive for HIV, without presenting any other significant clinic differences from the other patients; and this man achieved the same good therapeutic result as the patients without HIV.

Fournier gangrene is a surgical emergency. Many patients present with only minor skin lesions in the early stages of the disease. Delay in the first debridement of a necrotizing tissue infection worsens the outcome [16,19]. Therefore, early recognition, rapid diagnosis, and appropriate treatment are all crucial components of a successful outcome.

The prognosis and the risks of patients affected by FG can be evaluated by the FGSI, which was created by Laor et al. [7] to describe the acuity of the disease. The index is an objective, simple method to quantify the extent of metabolic aberration that may be used to predict outcome. This index includes nine metabolic and physiologic factors. Laor et al. found that patients with a score >9 points had a 75% probability of death, whereas an FGSI of ≤9 points was associated with a 78% probability of survival. In our study, the median admission FGSI score was only 2.3±1.6 points. After treatment, laboratory values had normalized, and the median final FGSI score was 1.2±0.7 points.

In a study by Spirnak et al. [20], a greater extent of disease was associated with a higher mortality rate for patients who had more operations. This confirms the necessity of early diagnosis, when the disease is still localized and can be treated effectively if an aggressive multi-modality surgical and medical regimen is applied. In our series, all patients presented with localized disease amenable to debridement and placement of a surgical V.A.C.® dressing. Surgical therapy was accompanied by HBO, broad-spectrum antibiotics, and supportive therapy and produced a zero mortality rate. Nevertheless, the absence of deaths likely is a consequence of the low severity of the presenting infection in our patients, which in turn could reflect early diagnosis of the disease.

The role of HBO in the therapy of FG is still controversial [3,5,21,22]. In our experience, HBO was given to all patients, but no benefit could be proved, given the design of the study. Surgical debridement still represents the mainstay of therapy.

One of the main problems associated with FG is the loss of scrotal skin consequent to infection and debridement, necessitating plastic surgical reconstruction in many patients. Reconstruction of the scrotum using a medial circumflex femoral artery perforator flap was essential for most patients, allowing restoration of social activities [10].

Conclusion

Because of the rapid progression of FG, early diagnosis and immediate aggressive, multi-modality therapy with surgical debridement and broad-spectrum empiric antibiotics is crucial. The role of HBO remains controversial, as it is as yet of unproved benefit.

TABLE 4. ADMISSION AND FINAL SERUM VALUES FOR 41 PATIENTS

Urea (mg/dL)	
Admission	47±32
Final	30±18.4
Creatinine (mg/dL)	
Admission	1.13±0.7
Final	0.7±0.2
Hematocrit (g/dL)	
Admission	34.1±5.8
Final	30.3±4.7
Leukocytes (cells × 10 ⁹)	
Admission	13.4±6.3
Final	8.5±2.4
Sodium (mmol/L)	
Admission	120±10
Final	135±6
Potassium (mmol/L)	
Admission	3.4±0.7
Final	3.5±0.3
Albumin (g/dL)	
Admission	25±4
Final	36±3
Alkaline phosphatase (U/L)	
Admission	83±56
Final	76±72
Fournier Gangrene Severity Index	
Admission	2.3±1.6
Final	1.2±0.7

Author Disclosure Statement

The authors have no commercial associations that might create a conflict of interest in connection with this manuscript.

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AU1: Where were lesions in the women?