Validation of the Fournier's Gangrene Severity Index in a Large Contemporary Series

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Purpose: In this study we identified prognostic factors for survival and validated the accuracy of the Fournier's gangrene severity index in patients with Fournier's gangrene.

Materials and Methods: We retrospectively reviewed medical records of patients diagnosed with Fournier's gangrene between 1996 and 2006. Fournier's gangrene severity index scores were assessed using a receiver operating characteristic curve. Using an outcome variable of inpatient mortality, univariate analyses were performed using the Mann-Whitney U, chi-square and Fisher exact tests.

Results: A total of 68 patients (79.4% male, mean age 55.8 ± 15.2 years) diagnosed with Fournier's gangrene met the criteria for review. The inpatient mortality rate was 10% (7 patients). The mean Fournier's gangrene severity index score for survivors was 5.4 ± 3.5 vs 10.9 ± 4.7 for nonsurvivors ($p = 0.006$). Isolated Fournier's gangrene severity index and individual laboratory parameters associated with mortality included heart rate ($p = 0.05$), respiratory rate ($p = 0.02$), serum creatinine ($p = 0.03$), serum bicarbonate ($p = 0.001$), serum lactate ($p = 0.001$) and serum calcium ($p = 0.03$). Although mean total body surface area was only suggestive of an association ($p = 0.169$), abdominal wall ($p = 0.004$) or lower extremity ($p = 0.005$) involvement was associated with increased mortality. Using a Fournier's gangrene severity index score threshold of 9 (sensitivity 71.4%, specificity 90%) there was a 96% survival rate in patients with a Fournier's gangrene severity index of less than 9 and a 46% mortality rate in those with a Fournier's gangrene severity index of 9 or greater ($p = 0.001$, OR 22, 95% CI 3.5–139.7).

Conclusions: The Fournier's gangrene severity index remains an objective and simple method to quantify the extent of metabolic aberration at presentation in patients with Fournier's gangrene. A Fournier's gangrene severity index threshold value of 9 is sensitive and specific for predicting mortality in this patient population.

Key Words: Fournier gangrene, severity of illness index, mortality

Fournier's gangrene, defined as life threatening necrotizing fasciitis of the male genitourinary tract, was first described in the late 19th century.[1] Many predisposing factors have been implicated including perianal disease, urethral strictures, local trauma, diabetes mellitus and malignancy.[2,3] Clinical presentation ranges from early localized infection amenable to local débridement to large areas of tissue necrosis causing sepsis and eventual death. Despite improvements in the diagnosis and management of this disorder the mortality rate of FG still ranges from 20% to 43% in most contemporary series.[4–10]

Laor et al developed the Fournier's gangrene severity index to stratify risk in this complex patient population.[5] The FGSI is a numerical score obtained from a combination of admission physiological parameters including temperature, heart rate, respiration rate, sodium, potassium, creatinine, white blood count, hematocrit and sodium bicarbonate. The authors established that a FGSI greater than 9 was a sensitive and specific predictor of mortality in patients with FG.[5] We reviewed our experience in treating 68 patients with Fournier's gangrene during a 10-year period (1996 to 2006) to identify prognostic factors for risk of mortality and to validate the predictive value of the FGSI in a large series.

MATERIALS AND METHODS

Subject Identification

After obtaining approval from the institutional review board at the University of Pittsburgh Medical Center we conducted a retrospective review of all patients identified with FG at a single institution from 1996 to 2006. Patients were accrued via a keyword search of the electronic medical record database for patients with a diagnosis of Fournier's gangrene. The diagnosis of FG was established clinically based on presenting history and physical examination, and supported by radiological imaging in select cases. Solitary perianal, periurethral and scrotal abscesses were excluded from analysis if there was no evidence of soft tissue extension or necrosis. Patient demographic information, presenting symptoms, vital signs, physical examination findings, laboratory values, operative records and followup data were recorded and analyzed. The extent of involvement, TBSA, was calculated per nomograms routinely used to assess the

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extent of burn injuries. The penis, scrotum and perineum each accounted for 1% surface area, and each ischiorectal fossa 2.5%, respectively.

Clinical Management

Preoperatively all patients received supportive fluid resuscitation and were treated with broad spectrum parenteral antibiotics until culture results dictated tailored therapy. All patients underwent immediate aggressive débridement, with resection of all necrotic skin, subcutaneous tissue, fascia and muscle until viable tissue was identified. Hyperbaric oxygen therapy and topical unprocessed honey have been described as alternative therapies for patients with FG.[3] However, no patient in this series received either treatment modality. Perioperatively the wound was closely monitored with frequent wet to dry or negative pressure dressing changes and enteral or parenteral nutrition was provided to support wound healing. Patients returned to the operating room at 24 to 48 hours for repeat wound exploration and débridement as the standard of care except in cases of hemodynamic instability or if the wound margins were clearly uninvolved on bedside examination. Colostomy was performed for infection of perirectal origin with anal sphincter involvement in conjunction with the general surgery team. Suprapubic cystostomy was performed in cases of periurethral origin with evidence of urinary extravasation. Wound closure and reconstruction (split thickness skin grafting, rotational flaps, negative pressure wound therapy) were performed by a plastic and reconstructive surgery team when healthy, viable tissue and clinical status allowed reapproximation.

Outcomes and Statistical Analysis

Mortality was defined as disease related death during initial hospitalization. Variables analyzed included age, comorbidities, source of infection, TBSA, duration of symptoms, clinical and laboratory values, hospital length of stay, duration of antibiotic therapy, microbial organisms, urinary or fecal diversion and number of surgical resections. To calculate the FGSI 9 parameters were assessed (temperature, heart rate, respiratory rate; serum sodium, potassium, creatinine and bicarbonate; and hematocrit and leukocyte count) and the deviation from normal was graded from 0 to 4 as described by Laor et al (table 1).[5] Differences in clinical parameters were compared between survivors and nonsurvivors, and mean values were expressed as mean ± SD with $p < 0.05$ considered statistically significant. Using an outcome variable of inpatient mortality univariate analyses were performed using the Mann-Whitney U, chi-square and Fisher exact tests. The low mortality rate in this case series precluded multivariate analyses. Receiver operating characteristic curve analysis was used to identify a predictive FGSI threshold value with adequate sensitivity and specificity. Logistic regression was used to estimate the odds ratio and 95% CI for mortality using the FGSI threshold of 9.0. All analyses were performed using SPSS® 14.0 statistical software.

RESULTS

Patient Characteristics

Of the 68 patients evaluated (mean age 55.8 ± 15.2 years [range 23 to 88], 79.4% [54 of 68] male, 89% [60 of 68] white), disease related death attributed to FG during initial hospitalization was identified in 7 (10%). Mean age of nonsurvivors did not differ significantly from age of survivors (59.3 ± 11.8 vs 55.4 ± 15.6 years, $p = 0.431$). Mean time to presentation and definitive therapy was 6.6 ± 4.8 days in the entire cohort, and was not significantly associated with mortality when comparing survivors and nonsurvivors (6.6 ± 4.9 vs 6.2 ± 4.5, $p = 0.75$). Mean TBSA on admission assessment was 4.6% ± 2.5% (range 1 to 8) for the entire cohort. When comparing survivors and nonsurvivors, although mean TBSA was only suggestive of an association (4.4% ± 2.5% vs 5.9% ± 2.4%, $p = 0.169$), the presence of lower extremity involvement (16.7% vs 71.4%, $p = 0.005$) or abdominal wall involvement (26.7% vs 85.7%, $p = 0.004$) was significantly associated with inpatient mortality. Patient comorbidities included diabetes mellitus (52.9%, 36 of 68), hypertension (35.3%, 24 of 68), obesity (30.9%, 21 of 68), coronary artery disease (29.3%, 20 of 68), paraplegia (19.7%, 13 of 68), chronic obstructive pulmonary disease (11.8%, 8 of 68), peripheral vascular disease (10.3%, 7 of 68) and hepatic dysfunction (4.4%, 3 of 68). No significant differences in patient comorbidities were observed between survivors and nonsurvivors, although paraplegia (16.9% vs 42.9%, $p = 0.131$) was suggestive of an association.

TABLE 1. *Fournier's gangrene severity index*

Physiological Variable/ Point Assignment	High Abnormal Values				Normal	Low Abnormal Values			
	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (C)	More than 41	39–40.9	—	38.5–38.9	36–38.4	34–35.9	32–33.9	30–31.9	Less than 29.9
Heart rate	More than 180	140–179	110–139	—	70–109	—	56–69	40–54	Less than 39
Respiration rate	More than 50	35–49	—	25–34	12–24	10–11	6–9	—	Less than 5
Serum sodium (mmol/l)	More than 180	160–179	155–159	150–154	130–149	—	120–129	111–119	Less than 110
Serum potassium (mmol/l)	More than 7	6–6.9	—	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	—	Less than 2.5
Serum creatinine (mg/100 ml, ×2 for acute renal failure)	More than 3.5	2–3.4	1.5–1.9	—	0.6–1.4	—	Less than 0.6	—	—
Hematocrit (%)	More than 60	—	50–59.9	46–49.0	30–45.9	—	20–29.9	—	Less than 20
White blood count (total/mm^3 × 1,000)	More than 40	—	20–39.9	15–19.9	3–14.9	—	1–2.9	—	Less than 1
Serum bicarbonate (venous, mmol/l)	More than 52	41–51.9	—	32–40.9	22–31.9	—	18–21.9	15–17.9	Less than 15

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