Fournier's Gangrene: validation of the severity index
Gangrène de Fournier : validation de l'indice de sévérité

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Abstract

Introduction: Fournier's gangrene is a serious infection and is considered a major emergency. A complete assessment of the severity factors using a severity score is essential and makes it possible to adapt the therapeutic management.

Aim: Validate Fournier's Gangrene Severity Index and evaluate its benefits in the initial assessment of disease severity.

Methods: This is a retrospective, monocentric study which gathered all the cases of perineal gangrene that were managed in General Surgery Department of Habib Bougatfa Hospital in Bizerte over a period of 8 years. The primary endpoint in our study was mortality.

Results: Thirty-five cases of Fournier's gangrene were collected. The average age of our patients was 46 years. Mortality rate was 23%. We calculated the Fournier's Gangrene Severity Index for 22 patients. There was a significant difference in the average Fournier's Gangrene Severity Index score between the group of surviving patients (3.75) and the group of deceased patients (12.63) (p <0.0001). Using an Fournier's Gangrene Severity Index cut-off value> 9.5 (sensitivity 87.5%, specificity 100%), we noted that the mortality rate was significantly higher in the group with a score> 10 (100%) than in the group with a score ≤ 9 (6%) (p <0.0001). A score greater than 10 was associated with 100% mortality in our series.

Conclusions: The Fournier's Gangrene Severity Index, calculated from clinical and biological data, offers a simple, reliable and valid tool to assess the initial severity of the disease.

Keys Word: Cellulitis ; Necrotizing fasciitis ; Fournier's gangrene ; Septic shock ; Antibiotic therapy ; Hyperbaric oxygen therapy.

Résumé

Introduction: La gangrène de Fournier est une infection grave et est considérée comme une urgence majeure. Une évaluation complète des facteurs de gravité à l'aide d'un score de sévérité est essentielle et permet d'adapter la prise en charge thérapeutique.

Objectif : Valider l'Indice de Sévérité de la Gangrène de Fournier (FGSI) et évaluer ses avantages dans l'évaluation de la gravité de la maladie.

Méthodes : C'est une étude rétrospective mono centrique colligeant les cas de gangrène périnéale pris en charge au service de chirurgie générale de l'hôpital Habib Bougatfa de Bizerte sur une période de 8 ans.

Résultats : Trente-trois cas de gangrène de Fournier ont été colligés. L'âge moyen de nos patients était de 46,57 ans. Le taux de mortalité était de 22,9 %. Nous avons calculé le FGSI pour 22 patients. Il y avait une différence significative dans le score FGSI moyen entre le groupe de patients survivants (3,75) et le groupe de patients décédés (12,63) (p<0,0001). En utilisant une valeur seuil FGSI > 9,5 (sensibilité 87,5 %, spécificité 100 %), nous avons noté que le taux de mortalité était significativement plus élevé dans le groupe avec un score > 10 (100 %) que dans le groupe avec un score ≤ 9 (6,6 %) (p<0,0001). Un score supérieur à 10 était associé à une mortalité de 100 % dans notre série.

Conclusions : Le FGSI, calculé à partir de données cliniques et biologiques, offre un outil simple, fiable et valable pour évaluer la gravité initiale de la maladie.

Mots clés : Cellulite; Fasciite nécrosante; Gangrène de Fournier; Choc septique; Antibiothérapie; Oxygénothérapie hyperbare.

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INTRODUCTION

Fournier's Gangrene is a necrotizing cellulitis of the perineum and the external genital organs. It is caused by a severe, poly-microbial infection, which encompasses synergistic aerobic and anaerobic germs. The disease is unpredictable and rapidly extensive, with a fatal outcome in 20 to 80% of cases (1). The disease was first described by the end of the 19th century by Alfred de Fournier who described a terrible gangrene of the penis with no evident cause. It is secondary to a regional infection in 95% of cases. When no cause is found (5% of cases), it is called idiopathic or primitive, the classical Fournier disease. Fournier's Gangrene Severity Index (FGSI) is a numerical score calculated by a combination of clinical and laboratory assessments including temperature, cardiac rate, respiratory rate, blood electrolytes, creatinine level, and hematocrit. The authors established that a score superior to 9 was a sensitive and specific mortality predictor in patients with a perineal gangrene.

The objective of this study was to validate the FGSI and determine its benefits in evaluating the severity of the disease in order to optimize patient management.

METHODS

We collected, in a retrospective manner, the folders of patients admitted between 2008 and 2016 with a Fournier's Gangrene. We included all the patients who presented with a perineal gangrene regardless of the primary cause. We did not include patients who presented with perineal suppuration without a true gangrene. Data collection was based upon hospital registries, patient folders and surgical reports. Patients with incomplete folders were excluded from this study. The primary outcome in our study was mortality attributed to this infection. Data was collected on investigative sheets which included epidemiological, diagnostic, therapeutic and follow up information as well as FGSI calculation for each patient. Statistical analysis was carried out by SPSS 20 software. Each variable studied was submitted to a univariate statistical analysis with comparison between the group of surviving patients and the group of deceased patients. Pearson's Chi-squared test and Fisher's exact test were used for qualitative variables, whereas Student's test was used for quantitative variables. The variables, identified by a Bivariate analysis, were introduced to a logistic regression model to determine the independent predictive factors of mortality. For all of the statistical tests used, the p-value was set to 0.05. In order to determine an FGSI threshold value associated to mortality, we transformed the score from a quantitative variable to a two-arrangement qualitative variable and we established Receiver Operating Characteristics (ROC) Curves (figure 1). After checking that the area under the curve is significantly greater than 0.500, we chose as the threshold the value of the variable which

corresponds to the best "sensitivity-specificity" pair. In order to attain our study's objective, and to elucidate the role of FGSI in the initial evaluation of disease severity, we divided the cohort in two groups according to an FGSI threshold value set at 9.5.
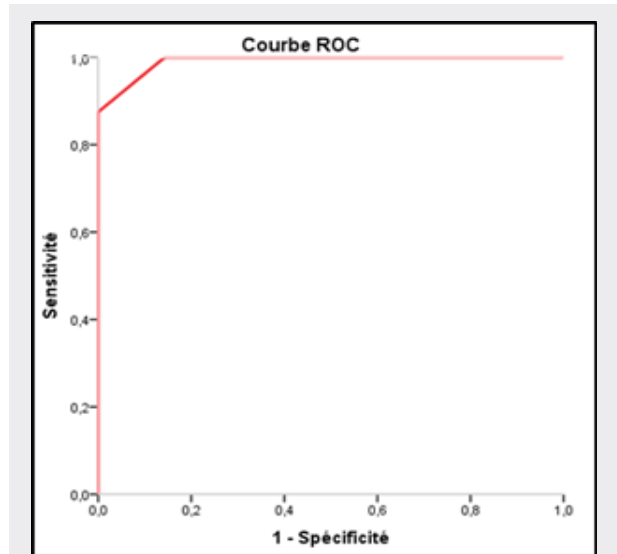

Figure 1. Receiver operating characteristic curve

RESULTS

Thirty-five patients were included in the study, the average age was 46 years with extreme values of 22 and 70 years. The study showed a male predominance with a sex ratio of 4. Patient history mainly included diabetes mellitus in 40% of cases, smoking (20%), high blood pressure (11%). As for disease etiology, we distinguished gangrenes of proctological origin (75%), urological origin (21%), and gynecological origin (4%). The average patients' admittance delay was 10 days, with extreme values of 3 and 21 days. The most frequent presenting complaints were anal pain in 21 patients and scrotal pain in 11 patients. The main clinical signs recorded on admission of our patients were fever (>38.5°C) found in 77% of patients, altered condition (29%), cardiac rhythm anomalies (22%), respiratory rate abnormalities (11%). The patients were allocated according to intervals of temperature, cardiac and respiratory rates, chosen in accordance to FGSI. Upon admission, 18 of our patients (51%) presented with sepsis, 13 patients (37%) had severe sepsis and four patients were in septic shock (11%). Anal pain and enlarged, inflammatory testicular bursae dominated the local symptoms, with a necrosis extension limited to external genital organs in 23% of patients, spread out to the perineum in 14%, to the abdomen in 9%, and two cases of extension to the inferior limbs. The anatomical lesions included skin invasion and cellulitis in all cases,

myonecrosis in 34% of cases. The necrotic surface of the skin was estimated in percentage compared to total body surface. The percentage of necrotic skin surface was distributed as following: three patients had 1%, two patients had 2%, two patients had 3%, three patients had a surface of 5% and two patients had 9%. Crepitus was present in six patients, five of whom where deceased. The studied laboratory findings were high White Blood Cell (83%), anemia (51%), electrolyte disturbances (46%) and kidney failure (43%). This data was allocated in intervals chosen according to the FGSI. Urinalysis was performed on eight of our patients, it was negative in all cases. Local pus sampling was performed on 21 patients. The results were positive for E. coli in seven patients, Pseudomonas aeroginosa in nine patients, the microbiological analysis was negative in five patients, and the sampling was not performed in 14 patients.

A Computed Tomography Scanner was performed only on two patients who had unexplained post operative fever. This examination showed residual collections. Therapeutic management was based on two pillars: an adequate medical management adapted to the state of each patient, which included an initial correction of electrolyte imbalances, glycemic control, probabilistic, large specter antibiotic therapy by intravenous route which was later adapted to antibiogram results; associated to an urgent, aggressive surgical debridment and daily wound care. All patients had a urinary catheter inserted except for one patient who was drained by a suprapubic catheter. The average delay between the admission of the patient to the ward or to the intensive care unit and the surgical intervention was seven hours, with extreme values of 30 minutes and 25 hours. The average delay between admission and surgery was six hours in patients who had skin necrosis on initial clinical evaluation, whereas it was 15 hours in patients who had no necrosis. The surgical intervention started with visualization and palpation of the lesions. The surgical act consisted of large flattening of the collections, large longitudinal aponeurotomies, debridment and excision of the necrosis and all devitalized tissues. A drainage by Delbet rubber bands was necessary in eighteen cases. Six of our patients had a colostomy (14%). In four patients, the colostomy was done initially, in one patient it was done during the second intervention because of severe sepsis, severe peri-anal lesions, compromise of the anal sphincter or extension of the necrosis to the abdominal wall. The sixth patient had his colostomy on the thirteenth day after the operation because of a delay in scar healing. After the surgery, all patients were bandaged under general anesthesia with hypertonic saline solution and hydrogen peroxyde during the first 72 hours. Among our patients, six required a complimentary excision of necrotic tissue and two underwent flattening of purulent residual collections because of persistent fever. Post operative hyperbaric oxygen therapy was performed on five patients (14%). Seven patients underwent reconstructive surgery. A fasciocutaneous flap was done on six patients and one patient had a musculocutaneous flap. As for the other patients,

due to minimal tissue loss, controlled wound healing was adopted, which consisted in daily pro-inflammatory bandages, sometimes associated to sutures.

Only one patient underwent restoration of bowel continuity eight months after the operation. The average duration of hospital stay was 10 days with extreme values of 1 and 42 days. Patients were considered cured (27 cases) when they had shown improvement of general status and satisfactory wound healing. The cure rate was 77%. Seven patients died after the surgery. They had deteriorated to a state of multiple organ failure due to septic shock, and one case of massive pulmonary embolism. Mortality rate was 23%. Table 1 summarize the distribution of our patients according to FGSI. Patients prognosis was studied using FGSI which was calculated in 22 patients (Table 2). A score greater than 10 was associated with 100% mortality (figure 2). In order to determine an FGSI cut-off score associated with mortality, we transformed the score from a quantitative variable to a qualitative variable with two modalities and established ROC (Receiver Operating Characteristics) curves. After checking that the area under the curve is significantly> 0.5, we chose as the threshold the value of the variable which corresponds to the best "sensitivity-specificity" pair. The threshold found is 9.5 (sensitivity = 87.5% and specificity = 100%).

Table 1. Comparison of the two groups of patients according to severity score settings

	Surviving Patients	Deceased Patients	p
Temperature (°C)	38.159	38.1	0.799
Heart Rate	96.15 (±14.469)	105.75 (±20.24)	0.142
Respiratory Rate	22.59 (±4.144)	22.75 (±5.007)	0.929
Blood Sodium (mmol/l)	137.18 (±4.7)	128.25 (±1.40)	<0.0001
Blood Potassium (mmol/l)	3.8 (±0.74)	3.5 (±1.11)	0.357
Blood Creatinin (mg/100ml)	1.33 (±1.2593)	2.025 (±0.83)	0.088
Hematocrit(%)	37.82 (±4.22)	31.96 (±3.09)	0.001
WBC	17922 (±10059)	16055 (±3009)	0.611
Bicarbonate (mmol/l)	23.85 (±1.3)	14.25 (±4.6)	<0.0001

Table 2. Coordinates of the Receiver operating characteristic

Positive if greater than or equal to	Sensibility	1 - Specificity
.00	1.000	1.000
2.00	1.000	.786
3.50	1.000	.286
6.50	1.000	.143
9.5	.875	.000
11.00	.750	.000
12.50	.500	.000
13.50	.375	.000
15.50	.125	.000
18.00	.000	.000
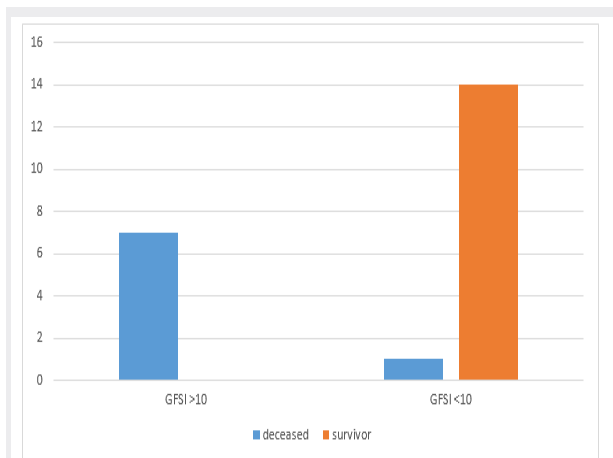
Figure 2. Distribution of patients according to Fournier's Gangrene Severity Ind**ex**

DISCUSSION

Fournier's gangrene is a rapidly progressive necrotizing fasciitis of the perineum and external genital organs. It represents the most severe complication of peri-anal suppurations regardless of the primitive infection. It is a medico-surgical emergency with a considerable mortality varying from 10 to 40% in contemporary series (1), in our series, mortality rate was 23%. In univariate analysis, the severity index was a predictive factor of mortality and in multivariate analysis, it was an independent predictive factor of mortality (p=0.015). When the FGSI was over 10, the death rate was 100%.

Management of perineal gangrene comprises two main pathways: promptly halt the sepsis and remove the necrosis; later ensure the most complete wound healing with minimum sequelae. Identifying the prognostic factors and validating the severity index will allow adequate evaluation of initial severity and personalized management of each patient. In fact, according to medical literature, FGSI represents the best tool to determine the prognosis and evaluate the initial severity of the disease. It is calculated using physiological parameters of the patient upon admission. This score was developed by Laor et al. (2) by modifying the severity index APACHEII. By comparing the average scores of the groups of surviving patients to those of the groups of deceased patients (6.9 vs 13.5), they found a statistically significant difference. They also showed that an FGSI score of more than 9 was associated with increased mortality with a death probability of 75%. The cut off value was set to 9 in most series (3,4,5). Other scores were reported in literature. The studies of Lin (6) and Tenorio (7) concluded that the difference between the parameters of blood creatinin, hematocrit and blood potassium in surviving and non-surviving patients was statistically significant. They suggested a simplified FGSI containing these 3 variables. A simplified FGSI of more than 2 provided statistically significant mortality predicting results that were not inferior when compared to FGSI in the same study, with a sensitivity and specifity of 87% and 77%, respectively. Another study (8) suggested using the Uludag FGSI score (UFGSI), which added 2 parameters (age and extension of the disease) to the classical FGSI score. The study conducted in 2019 by Arora et al. (9) found that FGSI was a valid index and a useful marker at the time of admission to identify patients with bad prognosis. Its aim was to opt for a personalized and aggressive therapeutic management for selected patients to decrease mortality rate. Each of the 9 variables had either intermediary or significant correlation with mortality, thus highlighting the validity of this index. The study of Kabay (10) showed that if the FGSI score was 10.5, the predictive value of mortality was superior to 96%. Another study lead by Moudouni and collaborators (4) joined these results by proving that an FGSI of more than 9 was associated a mortality rate of 38.4%, whereas a score of 9 or less was associated to a survival rate of 95.7% (sensitivity 71.4%, specificity 84.9%). The statistical analysis of the difference between the average FGSI in the survival series (6.23 +- 3.47) and in the mortality series (10.4 +- 2.41) was statistically significant (p=0.06). According to Yim (11) Lujan Marco (12), FGSI was not a predictor of mortality and was not useful to foretell the prognosis as high blood sodium level and low bicarbonates level were the only satistically significant laboratory elements associated with mortality in Fournier's Gangrene. Nevertheless, the variables which influenced patient prognosis in Fournier's gangrene were, for the most part, controversial in literature. The rarity of the disease, the highly heterogeneous clinical results and the absence of reliable criteria for statistical analysis were described as primary restrictions to find similar results with identical prognostic factors (13,14,15,16). The FGSI was a valid and largely accepted score by numerous studies (17,22,23).

CONCLUSION

Although Fournier's gangrene is still a deadly disease, mortality rates have improved thanks to progress in surgery and intensive care. A complete evaluation of clinical and laboratory factors, as well as predisposing conditions and the extent of the disease is essential for early diagnosis and treatment. The FGSI remains a simple method to evaluate the severity of the disease and to predict the result in this complex patient population. Our results concord with the previous conclusions according to which an FGSI threshold of 9 was considered as a sensitive, specific and predictive factor of mortality in the initial evaluation of the disease.

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