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Research Article

Our experience in the management of Fournier's gangrene – a single-center retrospective study

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Abstract

Introduction: Fournier's gangrene (FG) is a rare and potentially life-threatening infection that leads to necrosis of soft tissue. This condition constitutes a medical emergency, necessitating prompt surgical intervention to mitigate the potential consequences.

Aim: To analyze the demographic and clinical characteristics of a small cohort of patients with FG.

Patients and methods: The present retrospective study included 31 patients with Fournier's gangrene who were hospitalized in the Department of General Surgery from January 2020 to December 2023. A comprehensive examination of the patients' demographic characteristics, comorbidities, presence of diabetes mellitus, microbial agents involved, and methods used for wound management was conducted.

Results: The study found that men, particularly those over the age of 55, were more commonly affected than women. *Escherichia coli* was identified as the predominant microbial agent. The prevalence of diabetes mellitus was found to be higher among female patients. All patients received prompt surgery according to established protocols. Enzyme proteolysis was our method of choice for wound management. Ten patients underwent adjunctive surgery while seven patients had reconstructive procedures. The mortality rate registered was 25.8%. The mean length of hospital stay was 12.8 days.

Conclusion: Fournier's gangrene has a high mortality and complication rate despite the current treatment options. Wound management with enzyme proteolysis yielded promising results.

Keywords

Fournier's gangrene, necrotizing soft-tissue infections

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Introduction

Fournier's gangrene (FG) is a rare and life-threatening necrotic soft tissue infection. This type of necrotizing fasciitis initially affects the scrotum, perineum, labia majora, and the inflammation can reach the soft tissues of the abdominal and chest wall. The majority of patients are men. Major risk factors are diabetes mellitus and alcoholism. The diagnosis is primarily determined through physical examination findings. FG is an emergency, and immediate surgical treatment is essential.[1-5]

A substantial body of research has been published on FG in the scientific literature. Despite the various therapeutic strategies proposed by different authors, the morbidity and mortality of this type soft tissue infection remains significant.[6-8] The following study is one of the few similar conducted in Bulgaria to date.

Aim

The objective of this study was to analyze the demographic and clinical characteristics of a small cohort of patients with Fournier's gangrene.

Patients and methods

The present retrospective study included 31 patients with Fournier's gangrene who were hospitalized in the Department of General Surgery at St George University Hospital in Plovdiv, Bulgaria, for the period from January 2020 to December 2023. Before hospitalization, all patients gave their written informed consent for further treatment and participation in the study. The inclusion criteria were as follows: evidence of soft tissue inflammation in the scrotum, labia majora, perineum, and perianal area (including skin redness, necrosis, swelling, crepitus, increased local temperature, and localized pain). Patients whose infection originated from the torso or lower limbs and later spread to the genital and perineal regions were excluded. This study was carried out in accordance with the hospital Ethics Committee's approval protocol, the Declaration of Helsinki's ethical principles, and Good Clinical Practice guidelines. A comprehensive examination of the patients' demographic characteristics, comorbidities, presence of diabetes mellitus, microbial agents involved, and methods used for wound management was conducted. The surgical strategies employed included the following: wide incisions with debridement during the initial 12 hours of admission; and extensive surgical debridement following the stabilization of the patient's condition between the 48th and 72nd hour. For the wound management, we used proteolysis with pancreatic enzymes (trypsin, chymotrypsin) or dressings with iodinated solution (Braunol®), or with silver (Dermazin®), or Vacuum-Assisted Closure (VAC). Our treatment method of choice was surgical debridement with proteolysis. Upon hospitalization, all patients were immediately started on broad-spectrum antibiotics and appropriate resuscitation with intravenous fluids. We also reviewed cases where additional surgeries, such as orchiectomy and colostomy, were required, as well as those that needed reconstructive surgery, including skin grafting. Additionally, we assessed the average length of hospital stay, mortality rates, and the number of surgeries performed for each patient. All statistical analyses were conducted using SPSS v. 19 (SPSS, Chicago, IL, USA). Pearson's chi-squared or Fisher's exact 2-tailed tests were used for categorical data analysis, while continuous variables were analyzed using Student's *t*-test. A *p*-value of <0.05 was considered statistically significant.

Results

Demographic profile of the patients

Our study included 31 patients diagnosed with Fournier's gangrene: 27 (87.1%) were male and 4 (12.9%) were female. A Pearson's chi-square test revealed a statistically significant difference in sex distribution ($p<0.05$, $\chi^2=17.06$), with males being the predominant sex. The average age of the patients was 61.2±14.1 years. Patients were categorized into four age groups: the first group (0–35 years) included 2 males; the second group (36–55 years) consisted of 4 males; the largest group (56–75 years) included 18 males and 3 females; and the final group (over 75 years) included 3 males and 1 female. There were no statistically significant differences ($p>0.05$) in the distribution of patients by both sexes and age within the groups **(Table 1)**.

Microbial agents

The microbial agents isolated from the patients' wounds included the following: of the total, 16 (51.6%) were found to have *Escherichia coli*, 5 (16.1%) had *Acinetobacter baumanii*, 3 (9.7%) had *Proteus mirabilis*, 2 (6.5%) had *Proteus vulgaris*, and 2 (6.5%) had *Pseudomonas aeruginosa*. Polymicrobial isolates were observed in two patients, accordingly 1 (3.2 %) with *Acinetobacter baumanii* and *Enterococcus faecalis* and 1 (3.2 %) with *Escherichia coli* and *Proteus mirabilis*. Cultures remained sterile in one patient (3.2%). Pearson's chi-square test revealed a statistically significant difference in the distribution of microbial agents ($p<0.05$, $\chi^2=46.67$). *Escherichia coli* were the most commonly isolated bacterium.

Diabetes mellitus and other comorbidities

Among patients diagnosed with Fournier's gangrene, more than half (16 patients, 51.6%) had diabetes mellitus, while 15 patients (48.4%) did not have this comorbidity. Of those with diabetes, 13 were male and 3 were female. Although statistical analysis showed no significant differences in the

Table 1. Demographic and clinical characteristics of the patients with Fournier's gangrene

Sex	Total (n=31)		
Male	27		
Female	4		
Age group			
0-35 years	2		
36-55 years	4		
56-75 years	21		
>75 years	4		
Microbial agent			
Escherichia coli	16		
Acinetobacter baumanii	5		
Proteus vulgaris	2		
A. baumannii + Enterococcus faecalis	1		
E. coli + Proteus mirabilis	1		
Proteus mirabilis	3		
Pseudomonas aeruginosa	2		
Sterile	1		
Comorbidities			
Arterial hypertension	20		
Chronic kidney disease	2		
Crohn's disease	2		
Gout	1		
Rectal cancer	4		
Obesitas	1		
Liver cirrhosis	1		
Diabetes mellitus		**Males**	**Females**
Yes	16	13	3
No	15	14	1
Therapeutic method			
Surgical debridement + proteolysis	19		
Surgical debridement + iodinated sol. (Braunol®)	10		
Surgical debridement + silver agent (Dermazin®)	1		
Surgical debridement +VAC	1		
Reconstructive surgery			
Yes	7		
No	24		
Adjunctive surgery			
Orchiectomy	6		
Colostomy	4		
No	21		
Outcome			
De-hospitalized	23 (74.2%)		
Death	8 (25.8%)		
Average number of operations per patient	4.4		
Mean hospital stay (days)	12.8		

presence of diabetes or in its distribution by sex ($p>0.05$), our findings indicated that diabetes was relatively more common among female patients compared to males.

In terms of comorbidities, 20 patients (64.5%) had arterial hypertension, 4 (12.9%) had rectal cancer, 2 (6.9%) had chronic kidney disease, 2 (6.9%) had Crohn's disease, and one patient each (3.2%) had liver cirrhosis, gout, or class 3 obesity. Pearson's chi-square test demonstrated a statistically significant difference in the distribution of comorbidities ($p<0.05$, $\chi^2=65.41$), with arterial hypertension being the most prevalent. The age group most affected by comorbidities was 56–75 years, followed by those over 75 years.

Management and outcome

In terms of therapeutic approaches for patients with Fournier's gangrene, the treatment distribution was as follows: surgical debridement combined with wound care using proteolytic agents was performed in 19 patients (94.4%); 10 patients (32.3%) received surgical debridement with iodinated solution; 1 patient (3.2%) underwent debridement with a silver-based dressing; and another (3.2%) received surgical debridement with vacuum-assisted closure (VAC). Pearson's chi-square test revealed a statistically significant difference in the distribution of treatment methods ($p<0.05$, $\chi^2=28.74$), with surgical debridement with proteolysis being the most frequently employed method. On average, each patient underwent 4.4 surgical procedures **(Fig. 1)**.

Adjunctive surgical procedures were performed in 10 patients (32.3%), all of whom were male. Among them, 6 (19.4%) underwent orchiectomy and 4 (12.9%) required colostomy. Additionally, 7 male patients (22.6%) underwent reconstructive surgery **(Fig. 2)**.

A total of 8 patients (25.8%) had a fatal outcome (7 males and 1 female), while 23 patients (74.2%) were discharged. The highest mortality was observed in the age groups 56–75 years (5 cases) and over 75 years (2 cases). According to Pearson's chi-square test, there were no statistically significant differences in sex, age, comorbidities, or treatment methods in relation to disease outcome ($p>0.05$). Mortality rates were equal between patients with and without diabetes (4 cases each). The lowest mortality was observed among those treated with surgical debridement and proteolysis (2 cases). The mean length of hospital stay was 12.8 days.

Discussion

Fournier's gangrene is a rare but serious surgical emergency, accounting for less than 0.02% of all hospital admissions. While it can affect individuals of any age or sex, it is more commonly observed in males, with an average reported age of 61±12 years.[9-11] Mortality rates in the literature vary widely, ranging from 7% to 45%.[7,12] The primary risk factors associated with increased mortality include diabetes mellitus and alcohol abuse. Other contributing factors include recent trauma or surgical procedures, injection

Figure 1. A female patient with Fournier's gangrene – a treatment follow-up.

drug use (e.g., heroin, cocaine), and the use of sodium-glucose cotransporter 2 (SGLT2) inhibitors. Most patients also have at least one additional comorbidity.[13-15] Etiologically, Fournier's gangrene is classified into four types—Type I: polymicrobial (accounts for more than 80% of cases, with *Bacteroides* being the most common anaerobic organism); Type II: monomicrobial, typically caused by *Streptococcus* or *Staphylococcus* species; Type III: clostridial infections; and Type IV: fungal infections.[16-18]

Diagnosis is primarily clinical and is based on symptoms such as severe genital pain and tenderness, localized skin erythema followed by necrosis and blistering, fever, and general weakness.[19] There are no specific laboratory tests or biomarkers for Fournier's gangrene. However, lab findings are utilized in severity and prognosis scoring systems such as the Fournier's Gangrene Severity Index (FGSI) and the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC). While FGSI helps assess severity and prognosis, studies have shown it does not significantly correlate with mortality.[20-22]

Imaging techniques like computed tomography (CT) and point-of-care ultrasound (POCUS) can be valuable for evaluating the extent and depth of the infection and for surgical planning. However, imaging should not delay immediate surgical intervention, as it is not essential for diagnosis.[23-25]

The cornerstone of treatment for Fournier's gangrene includes prompt and repeated surgical debridement, broad-spectrum antibiotics, and general supportive measures. These should be initiated urgently to reduce the risk of mortality. Additional supportive care may involve daily wound management using agents such as silver dressings,

Figure 2. A male patient with Fournier's gangrene – follow-up and outcome after skin-grafting.

iodinated solutions, proteolytic enzymes, or vacuum-assisted closure (VAC), along with hyperbaric oxygen therapy (HBOT), blood and plasma transfusions, and proper nutritional support.[26-30] Many patients also require adjunctive procedures and reconstructive surgeries.[31-33]

An analysis of our study data revealed that the sex and age distribution of patients aligns with findings reported in previous research. The majority of Fournier's gangrene cases occurred in the 56–75 age group, which also tended to have multiple comorbidities. Our observed mortality rate of 25.8% was consistent with the range reported in the literature. In terms of classification, type I FG was the most prevalent in our cohort, with *Escherichia coli* being the most frequently isolated organism—again, in agreement with other studies. Diabetes mellitus was not the predominant comorbidity in our patient group.

Although FG severity scoring systems were not applied in our study, they may be considered in future research. All patients underwent surgical intervention within 12 hours of hospital admission, with extensive incision and debridement procedures performed. Our preferred method for wound management was proteolytic enzyme therapy using pancreatic enzymes (trypsin and chymotrypsin), which effectively removed necrotic tissue and promoted epithelial regeneration. The enzymes were administered as a spray, allowing easy application over large areas. This approach was not only effective but also cost-efficient. Patients who received proteolytic therapy had better survival outcomes compared to those treated with alternative methods **(Table 2)**.

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Table 2. Outcomes regarding the type of wound management

		Therapeutic method				Total
		Surgical debridement + proteolysis	Surgical debridement + iodinated sol. (Braunol)	Surgical debridement + silver agent (Dermazin)	Surgical debridement + VAC	
Outcome	Dehospitalization	17	4	1	1	23
	Death	2	6	0	0	8
Total		19	10	1	1	31

Vacuum-assisted closure (VAC) was used in only one patient due to its higher cost, although it is a proven effective option. Hyperbaric oxygen therapy (HBOT), while recognized as a supportive treatment for FG, was not utilized in this study due to its limitations—such as the need for patient stability and access to a hyperbaric chamber. Nonetheless, it may be considered in future investigations.

Adjunctive surgical procedures were reserved for more severe cases. Although the testicles are usually spared in FG, bilateral orchiectomy was performed in cases involving testicular vessel thrombosis and necrosis. Colostomy was indicated in patients with fecal incontinence to prevent wound contamination, as fecal soiling is associated with impaired healing and increased risks of sepsis and mortality.

Patients with penile and scrotal tissue loss exceeding 25% were evaluated for reconstructive surgery. Consultations with plastic surgeons were conducted, and split-thickness skin grafts were used as the reconstruction method of choice.

Conclusion

Effective management of Fournier's gangrene often requires a multidisciplinary approach, along with adjunctive and reconstructive surgical procedures. Our findings indicate that enzymatic proteolysis is an effective wound care method and may be considered a preferred option in the treatment of FG patients.

Authors contribution

V.H.: conceptualization, methodology, formal analysis, investigation, writing – original draft, visualization, project administration; G.M., A.S., and L.P.: conceptualization, and formal analysis; S.K. and K.K.: conceptualization, methodology, statistical analysis, and validation; A.T.S. and K.K.–conceptualization and formal analysis; AB: supervisor, conceptualization.

Conflict of interests

The authors have no conflicts of interest to declare. All co-authors have perused the manuscript and consent to its content, and there are no financial interests to disclose. We hereby affirm that the submitted work is an original piece and is not currently under review by any other publication.

Informed consent

Prior to hospitalization, all patients provided written informed consent for further treatment and study participation.

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