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The Evaluation of Microbiology in Patients with Fournier's Gangrene

Agnieszka Grabinska[1*], Lukasz Michalczyk[2], Anna Grabinska[3], Tomasz Syrylo[1], Tomasz Zabkowski[1]

[1]*Department of Urology, Military Institute of Medicine, Warsaw, Poland*

[2]*Department of Urology and Oncologic Urology, Praski Hospital in Warsaw, Warsaw, Poland*

[3]*Department of Gastroenterology, Military Institute of Medicine, Warsaw, Poland*

ABSTRACT

Introduction: Fournier's Gangrene (FG) is a devastating necrotising disease that affects the perineum and genitourinary regions. The aim of this study is to identify pathogens whose growth was associated with FG and their antibiotic sensitivity/resistance patterns based on bacterial culture; in addition, this study investigated the relationship between causative pathogens and prognostic factors and mortality.

Materials and methods: It was a retrospective study of 35 patients who were treated for fournier's gangrene in the period from 2017 to 2022. The study group consisted only of male persons (n=35) aged 24-85 years. Demographic data were evaluated and their relationship with causative pathogens, as well as their impact on antibiotic sensitivity and resistance patterns, were investigated.

Results: The most common microbiology involved in FG is polymicrobial infection (54%) and the most common found pathogen isolate is *Escherichia coli* (32.6%) In the cultures of the gangrene material bacteria were detected: *Escherichia coli* in 14 (32.6%) people, *Enterococcus faecalis* in 6 (14%) people and *Pseudomonas aeruginosa* in 5 (11.6%) people.

Most bacteria were sensitive to piperacillin-tazobactam, clindamycin and metronidazole and resistant to cefuroximum, ciprofloxacin and ceftriaxone.

Conclusions: Causative pathogens in FG are shifting; thus, empirical antibiotic treatment for this disease should be modified.

Keywords: Evaluation; Microbiology; Fournier's; Gangrene; Clindamycin

INTRODUCTION

Fournier's Gangrene (FG) is a devastating necrotizing disease that affects the perineal and genitourinary regions. The common causes of FG are polymicrobial infections, epididymo-orchitis, perianal abscess, scrotal abscess, orchitis with abscess, epididymitis, scrotal phlegmon, gangrene of the scrotum and penis, orchitis with necrosis, inflammation of the

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Corresponding author: Agnieszka Grabinska, Department of Urology, Military Institute of Medicine, Warsaw, Poland; E-mail: agrabinska@wim.mil.pl

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skin and subcutaneous tissue of the penis and gangrene of the scrotum, perineum and buttock. Studies have shown that males, especially those in their 60 and 70's are more often affected by FG than other populations. Other risk factors for FG include chronic alcoholism, renal failure and obesity. Most FG studies have shown that early diagnosis and aggressive management of FG are required to significantly improve patient outcomes [1].

Owing to its specific location, FG is usually accompanied by mixed bacterial infections. The infection spreads along the deep fascia and the lower abdomen or thigh can also be affected as the disease progresses. Most patients exhibit systemic infection symptoms such as high fever and chills, while some may develop septic shock or organ failure [2].

The interdisciplinary treatment of FG consists of a combination of surgical and urological interventions, antibiotic therapy, Negative-Pressure Wound Therapy (NPWT), HBOT and plastic reconstructive procedures.

Since FG is not a common disease, prospective studies are difficult to perform in patients. Therefore, in this study, data from a large number of FG cases that had occurred in the past five years were gathered by retrospective literature review and analyzed to determine the relationship between microbiology and the prognosis of FG.

This study aimed to identify pathogens whose growth was associated with FG and their antibiotic sensitivity/resistance patterns based on bacterial culture, as well as to investigate the relationship between causative pathogens and prognostic factors and mortality [3].

MATERIALS AND METHODS

This was a retrospective study of 35 patients who were treated for Fournier's gangrene at the military institute of medicine and Praski hospital in Warsaw between 2017 and 2022. The study group consisted of only male persons (n=35) aged 24-85 years [4].

FG was diagnosed on a clinical basis. Data on patient age, gender, comorbidities, laboratory results (CRP, WBC, HCT, PLT, sodium, potassium, creatinine, procalcitonin, INR and gangrene culture), the extent of resection, antibiotics used, urinary diversion (Foley or suprapubic catheter) and hospitalization time were obtained accordingly.

Demographic data were evaluated and their relationship with causative pathogens, as well as their impact on antibiotic sensitivity and resistance patterns, were investigated therein [5].

Tissue cultures were obtained from patients during each debridement. Appropriate antibiotic therapy was initiated based on tissue culture results. Urological procedures and surgical debridement of the wound were performed, along with hyperbaric oxygen therapy and Negative Pressure Wound Therapy (NPWT) after initiation of antibiotic therapy in these patients. After obtaining negative cultures, skin grafts and reconstructive procedures, the patient was discharged accordingly.

Statistical analysis was performed using the IBM Statistical Package for the Social Sciences (IBM SPSS Statistics Corp.; Armonk, NY, USA) version 26 for windows. Univariate analysis was performed using the independent t-test or kruskal-wallis H test for continuous variables and the exact test for categorical variables. Statistical significance was set at a p-value of <0.05. Descriptive data are presented as parametric and non-parametric [6].

RESULTS

The most common microbiology involved in FG is polymicrobial infection (54%) and *E. coli* (32.6 %) is the most common pathogen isolate. In the cultures of gangrene bacteria, *Escherichia coli* was detected in 14 (32.6%) people, *Enterococcus faecalis* in 6 (14%) people and *Pseudomonas aeruginosa* in 5 (11.6%) people. Other contributing pathogens included *Klebsiella pneumoniae, Bacteroides fragilis, Proteus mirabilis*, *Parabacteroides distasonis, Clostridium ramosum*, *Streptococcus gallolyt cus*, *Streptococcus anginosus*, acinetobacter baumannii, *Staphylococcus aureus*, *c.dificile, Streptococcus pyogenes*, *Enterococcus avium*, *Prevotella bivia* and *Bacteroides thetaiotaomicron*. The targeted antibiotic therapy included metronidazole, vancomycin, clindamycin, carbapenems, piperacillin and tazobactam or linezolid (**Table 1**). Most bacteria were sensitive to piperacillin-tazobactam, clindamycin and metronidazole and resistant to cefuroximum, ciprofloxacin and ceftriaxone. The first empirical antibiotics were the most often used, piperacillin-tazobactam (n=8) and clindamycin (n=7) in 15 of 28 patients (53.5%) and the second empirical antibiotics were the most often used, metronidazole (n=9) and clindamycin (n=8) in 17 of 28 patients (60.7%). The number of microorganisms that grew in the cultures ranged from 1 to 3 [7].

One to six surgical procedures were performed in the study group. The duration of the antibiotic therapy was 7-33 days.

In the study group, 11/35 patients had Diabetes Mellitus (DM) and 14/35 had Hypertension (HT). Furthermore, a Foley catheter was applied in 12/35 patients and a suprapubic catheter was applied in 25/35 patients, including both urinary diversions in 9 patients a Foley catheter followed by suprapubic cystostomy after its removal. The mean length of the hospital stay was 28 days [8].

The overall Fournier gangrene mortality rate was 4 (11%). No association was noted between the type of pathogen and the length of hospital stay or mortality (**Figure 1**).

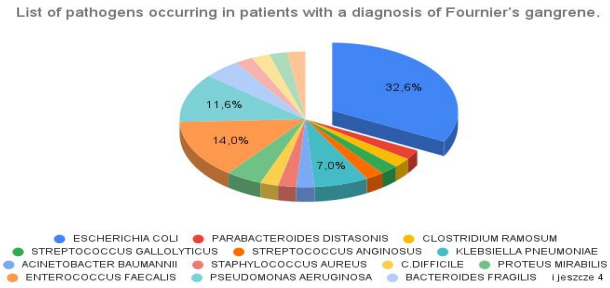

Figure 1: List of pathogens occurring in patients with a diagnosis of fournier's gangrene.

Table 1: Antibiotic sensitivity patterns.

S.no	Empirical antibiotic 1	Empirical antibiotic 2	Empirical antibiotic 3
1	Piperacillin-tazobactam	Clindamycin	
2	Piperacillin-tazobactam	Clindamycin	
3	Piperacillin-tazobactam	Clindamycin	
4	N/A		
5	Clindamycin		
6	Cefuroximum	Metronidazole	Amicacin
7	Carbapenem	Metronidazole	Linezolid
8	Ciprofloxacin	Metronidazole	
9	Carbapenem	Metronidazole	
10	N/A		
11	Clindamycin	Metronidazole	
12	Piperacillin-tazobactam	Clindamycin	Vancomycin
13	N/A		
14	N/A		
15	Carbapenem	Metronidazole	
16	Carbapenem	Vancomycin	Metronidazole
17	N/A		
18	N/A		
19	N/A		
20	Clindamycin	Carbapenem	
21	Clindamycin		
22	Piperacillin-tazobactam	Clindamycin	
23	Clindamycin		
24	Clindamycin	Piperacillin-tazobactam	
25	Piperacillin-tazobactam	Clindamycin	Metronidazole
26	Clindamycin	Metronidazole	

27	Cefuroximum	Metronidazole	Ciprofloxacin
28	Piperacillin-tazobactam	Clindamycin	Ciprofloxacin
29	Vancomycin	Imipenem-cilastatin	Clindamycin
30	Ceftriaxone	Ciprofloxacin	Carbapenem
31	Cefuroximum	Metronidazole	
32	Tazobactam	Piperacillin	Clindamycin
33	Piperacillin-tazobactam	Clindamycin	
34	Metronidazole	Imipenem	
35	Carbapenem		

DISCUSSION

The present study aimed to identify pathogens whose growth was associated with FG and their antibiotic sensitivity/ resistance patterns based on bacterial culture and to investigate the relationship between causative pathogens, prognostic factors and mortality [9].

Fournier's Gangrene (FG) is a rare emergent condition that affects the perineal and urogenital regions. The clinical course of FG is fulminant [5]. When managing patients with FG, this gangrenous tissue requires extensive and repeated debridement [6]. Several studies have shown that diabetes, old age, low blood pressure, high creatine kinase, high lactate, abdominal affection, hemoglobin level <10 g/dL and platelet count of lessthan 150 × 10^9/L areassociated with poor outcomes in the perineum or genital area and gangrenous change. In our clinical study, 11/35 patients had Diabetes Mellitus (DM) and 14/35 had Hypertension (HT). Furthermore, a Foley catheter was applied in 12/35 patients and a suprapubic catheter was applied in 25/35 patients, including both urinary diversions in 9 patients a Foley catheter followed by suprapubic cystostomy after its removal [10].

It stated in their study that the culture was monomicrobial in 20% of patients and polymicrobial in 76%. *Escherichia coli* was the most commonly identified microorganism (72%), followed by *Enterococcus* sp. (62%) and *Acinetobacter baumannii* (30%). In our study, the most common microbiology involved in FG was polymicrobial infection (54%) and *E. coli* (32.6 %) was the most common pathogen isolate. In the cultures of gangrene bacteria, *Escherichia coli* was detected in 14 (32.6%) people, *Enterococcus faecalis* in 6 (14%) people and *Pseudomonas aeruginosa* in 5 (11.6%) people.

It showed that the generally accepted and recommended empirical antibiotic therapy includes gentamicin, clindamycin and ampicillin sulbactam/3rd generation cephalosporin. Some studies have recommended metronidazole instead of clindamycin, as well as other aminoglycosides or fluoroquinolone group antibiotics instead of gentamicin (which is also an aminoglycoside).

In our study, most bacteria were sensitive to piperacillin-tazobactam, clindamycin and metronidazole and resistant to cefuroximum, ciprofloxacin and ceftriaxone. The first empirical antibiotics were the most often used, piperacillin-tazobactam (n=8) and clindamycin (n=7) in 15 of 28 patients (53.5%) and the second empirical antibiotics were the most oftenused, metronidazole (n=9) and clindamycin (n=8) in 17 of 28 patients (60.7%). The number of microorganisms that grew in the cultures ranged from 1 to 3 [11].

Another study by Becerra confirmed that the majority of bacteria were sensitive to ampicillin-sulbactam, ceftriaxone, piperacillin-tazobactam, amikacin and cefepime and resistant to ampicillin, trimethoprim-sulfamethoxazole, levofloxacin and clindamycin. In addition, in their study *Enterococcus faecalis* and *Streptococcus anginosus* were resistant to vancomycin.

All studies have shown that antibiotic therapy for the treatment of FG should be modified based on culture and antibiogram results. In addition, alterations in empirical therapy should be made based on changes in the bacterial flora.

CONCLUSION

Causative pathogens in FG are shifting; thus, empirical antibiotic treatments for this disease should be modified accordingly. Analysis of the causative pathogens of Fournier's gangrene is very important since early empirical antibiotic therapy is a key element in the treatment of this disease.

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