



Original Research

Microbiological aspects of Fournier's gangrene



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HIGHLIGHTS

- Treatment of Fournier's gangrene (FG) starts with empirical antibiotic therapy. However, empirical therapy in FG has not been updated in recent years.
- All institutes should evaluate their own culture results and then choose the best empirical antimicrobial therapy regimen.
- Future large studies are necessary to find out the most accurate empirical antibiotherapy for FG.

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ABSTRACT

Background: Fournier's gangrene (FG) is a devastating disease that is characterized by necrotizing fasciitis of the perineal, genital, or perianal region. Broad-spectrum antibiotics are the key component of its treatment. However, there is paucity of data regarding the optimal empirical antibiotherapy for FG.

Materials and methods: Data from patients who underwent surgery for FG between January 2007 and December 2012 were retrieved from a prospectively collected departmental FG database. Demographics, clinical characteristics, causative pathogens and drug susceptibility/resistance were evaluated.

Results: Fifty patients with a median age of 58.5 (22–83) years were included. The perianal origin (58%) was most commonly affected. A positive growth was found in specimen cultures of 48 (96%) patients. The median number of bacterial strains that grew in the cultures was 3 (0–10). Amikacin was the antibiotic with the highest frequency of sensitivity (74%), while the highest resistance was observed against ampicillin-sulbactam (64%). *Escherichia coli* was the most common microorganism (72%). *Acinetobacter baumannii* and *Klebsiella pneumonia* were significantly more common in patients who required mechanical ventilation. The mortality rate was 26%. An Uludag Fournier's Gangrene Severity Index (UFGSI) score of >9.5 and ventilatory support requirement were factors associated with an increased rate of mortality. *Acinetobacter baumannii* was the only microorganism which was associated with an increased mortality rate.

Conclusion: Causative pathogens in FG appeared to be shifting; thus, empirical antibiotic treatment for this disease should be modified. We recommend 3rd-generation cephalosporin, metronidazole and amikacin for empirical therapy.

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1. Introduction

Fournier's gangrene (FG) is a disease that is characterized by necrotizing fasciitis due to synergistic polymicrobial infection of the perineal, genital or perianal region [1,2]. The highly virulent, usually polymicrobial infection causes disease leading to rapid and wide-spread tissue injury [3]. Treatment of FG includes fluid resuscitation, regulation of electrolyte balance, aggressive debridement of necrotic tissues, and parenteral broad-spectrum antibiotic therapy

[4,5]. The accepted and recommended empirical antibiotic therapy consists of gentamicin, clindamycin and ampicillin-sulbactam/3rd-generation cephalosporin [6]. However, some studies have recommended metronidazole instead of clindamycin, and other aminoglycosides as well as fluoroquinolone-group antibiotics instead of gentamicin (which is also an aminoglycoside) [6,7].

Studies examining the pathogens associated with FG and their susceptibility/resistance to antibiotics have been scarce despite ongoing changes in human bacterial flora due to increasing and inappropriate use of antibiotics, particularly in recent years, and effects of environmental factors.

The present study aimed to identify pathogens whose growth was associated with FG and their antibiotic susceptibility/resistance

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based on bacterial culture; in additional, this study investigated the relationship between causative pathogens and prognostic factors and mortality.

2. Materials and methods

Prospectively collected data on patients who were treated in our department for FG between January 2007 and December 2012 were retrospectively evaluated. Patients with a solitary abscess of the perineal-perianal region were not included in the study. Fluid resuscitation began in all these patients at the time of hospital admission, and empirical 3rd-generation cephalosporin, metronidazole and amikacin were administered. The patients then underwent radical debridement of devitalized necrotic tissues within the first 12 h. The patients were treated with VAC (vacuum assisted closure; Kinetic Concepts, Inc., San Antonio, TX) dressing, and they underwent re-exploration once every 48–72 h. The debridement was continued whenever necessary. Tissue cultures were obtained from the patients during each debridement. Appropriate antibiotic therapy was started based on tissue culture results. Patients with negative results for tissue culture and patients without clinical evidence of infection were discharged home after the defects had healed via gradual tertiary wound closure or skin grafts. Anaerobic cultures could not be carried out due to technical reasons. Colonizing or contaminating pathogens which were observed in the cultures were not considered to be among the pathogens associated with FG.

Demographic data on the cases, co-morbid diseases, time to symptom onset, etiology, ventilator requirement, UFGSI (Uludag Fournier's Gangrene Severity Index) score and mortality were evaluated, and their relationship with causative pathogens, as well as their impact on antibiotic susceptibility and resistance patterns, were investigated.

Statistical analysis was performed using The Statistical Package for Social Sciences (SPSS®) for Windows Ver.10.0 (SPSS, Chicago, IL, USA). Data were presented as mean (\pm standard error) or median (min-max) as necessary. Comparison of the means between the groups for the various variables was performed using the Pearson chi-square test or the Kolmogorov-Smirnov test, whereas comparison of the magnitude of values between the groups was performed using the Mann-Whitney *U* test. The level of statistical significance was $p < 0.05$.

3. Results

Of the 50 patients treated for FG in our clinic between January 2007 and December 2012, the median age was 58.5 (22–83) years, and 27 patients (54%) were female. Twenty-five (50%) patients were referred from an external center, whereas 15 (30%) patients were transferred to us while they were an in-patient of another hospital, and 10 (20%) patients were hospitalized after they were seen in our emergency room. Diabetes mellitus (DM) was the most common comorbidity (64%). The median time to onset of symptoms was 7 (2–15) days, and the median duration of hospital stay was 22 (4–65) days. The perianal origin (58%) was the most commonly affected region, followed by decubitus ulcers (12%) and Bartholin's abscesses (10%). Ventilator requirement was required in 15 (30%) patients. The median UFGSI score was 9.5 (3–15). The overall mortality rate was 26%.

A positive growth was found in the tissues of 48 (96%) patients, whereas no growth was observed in 2 (4%) patients. The median number of bacteria that grew in the cultures was 3 (0–10). The culture was monomicrobial in 20% of patients and polymicrobial in 76% ($n = 38$). *Escherichia coli* was the most commonly identified microorganism (72%), followed by *Enterococcus sp.* (62%) and

Acinetobacter baumannii (30%) (Table 1).

Amikacin was the antibiotic which had the highest frequency of bacterial sensitivity (74%), followed by imipenem (58%), meropenem (56%) and vancomycin (52%). The highest bacterial resistance was observed against ampicillin-sulbactam (64%), followed by ciprofloxacin and levofloxacin (44%) and cefazolin (42%) (Table 2).

Mechanical ventilation support was required in 30% of patients, and the mortality rate was higher in patients who required ventilatory support ($p = 0.0001$). When microorganisms which were isolated from the patients with and without ventilator requirement were compared, *Acinetobacter baumannii* ($p = 0.0005$) and *Klebsiella pneumonia* ($p = 0.0240$) were significantly more commonly found in patients who required mechanical ventilation.

The mortality rate was 26% (13 patients). A UFGSI score of >9.5 ($p = 0.046$) and ventilatory support ($p = 0.0001$) were factors associated with an increased rate of mortality. When microorganisms between the patients with and without mortality were compared, *Acinetobacter baumannii* was the only microorganism which was associated with an increased mortality rate ($p = 0.0108$).

4. Discussion

The present study is the largest study aiming to identify the causative pathogens in FG and their associated patterns of antibiotic susceptibility/resistance. The prevalence of resistant pathogens increased with inappropriate treatment of FG, which was typically a polymicrobial infection related to environmental factors. A positive growth of *Klebsiella pneumonia* and *Acinetobacter baumannii* increased in patients who required mechanical ventilation for bacterial pneumonia. The mortality rate was influenced by a UFGSI score >9.5 , ventilator requirement and positive growth of *Acinetobacter baumannii*.

Although anaerobic culture was not performed in the present study, the median number of microorganisms that grew in the cultures was 3 (0–10). The most common pathogens identified included *Escherichia coli*, *Bacteroides sp.*, *Staphylococcus aureus*, *Proteus*, *Streptococcus*, *Pseudomonas* and *Enterococci* strains [8]. Although *Escherichia coli* and *Enterococci* were the most prevalent pathogens identified in the present study, a positive growth of *Acinetobacter* which has not been reported in the literature, as well

Table 1
Distribution of causative pathogens.

	n	%
Polymicrobial	38	76
Monomicrobial	10	20
None	2	4
Gram positive		
<i>Enterococcus sp.</i>	31	62
MRSE	5	10
<i>Streptococcus anginosus</i>	3	6
<i>Staphylococcus aureus</i>	2	4
<i>Corynebacterium cytriatum</i>	1	2
Gram negative		
<i>Escherichia coli</i>	36	72
<i>Acinetobacter baumannii</i>	15	30
<i>Pseudomonas aeruginosa</i>	9	18
<i>Proteus mirabilis</i>	7	14
<i>Klebsiella pneumoniae</i>	5	10
<i>Morganella morganii</i>	4	8
<i>Citrobacter youngae</i>	2	4
<i>Burkholderia gladioli</i>	2	4
<i>Serratia fonticola</i>	1	2
<i>Candida albicans</i>	6	12

sp; species, MRSE; Methicilin-resistant staphylococcus epidermidis.

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