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Title: Fournier's gangrene in a single-center experience: a retrospective analysis of 23 cases.

Short title: Fournier's gangrene in a single-center experience.

Abstract

Purpose: This study aims to retrospectively evaluate the outcomes of patients diagnosed with Fournier's gangrene (FG) treated and followed up in our clinic and to contribute to the literature.

Materials and methods: We retrospectively analyzed the data of 23 patients diagnosed with Fournier's gangrene and treated in our clinic between October 2015 and October 2024. Parameters such as age, gender, localization of gangrene, mortality status, comorbidities, laboratory findings, treatment methods, and microbiological results were evaluated.

Results: Of the 23 patients, 18 (78.3%) were male, and 5 (21.7%) were female, with a mean age of 56.1 years (range: 26-78). The average hospital stay was 16.2 days (range: 2-35), and 11 (47%) patients required intensive care. Mortality occurred in 4 (17.4%) patients. Comorbidities were present in 17 (74%) patients, while 6 (26%) had no comorbid conditions. Hypertension (HT) and diabetes mellitus (DM) were the most common comorbidities, each seen in 9 (52.9%) patients. The mean C-reactive protein (CRP) level was 203.3 mg/L. Gangrene was predominantly observed in the perianal region in 9 (39.13%) patients, the perineal region in 8 (34.79%) patients, and the scrotal region in 3 (13.04%) patients. Microbiological analysis revealed polymicrobial flora, with Escherichia coli being the most common pathogen (30.4%). All patients underwent surgical debridement and were treated with appropriate antibiotic therapy and regular wound care. Colostomy was performed in 14 (60.8%) patients, while vacuum-assisted closure (VAC) therapy was applied to 6 (26.8%).

Conclusion: Fournier's gangrene is a rapidly progressing and potentially fatal infectious disease if not diagnosed and treated promptly. A multidisciplinary approach is essential to achieving successful outcomes in its management.
Keywords: Fournier's Gangrene, colostomy, VAC.

Makale başlığı: Fournier gangreninde tek merkez deneyimi: 23 olguluk retrospektif analiz.

Kısa başlık: Fournier gangreninde tek merkez deneyimi.

Öz

Amaç: Fournier gangreni tanısı ile kliniğimizde takip ve tedavi edilen hastaların sonuçlarını retrospektif olarak irdelemeyi ve literatüre sunmayı amaçladık. **Gereç ve yöntem:** Kliniğimizde Ekim 2015-Ekim 2024 tarihleri arasında tedavi görmüş olan Fournier gangreni tanılı 23 hastanın bilgileri retrospektif olarak incelendi. Hastaların yaş, cinsiyet, gangrenin yerleşim lokalizasyonu, mortalite durumu, ek hastalıkları, laboratuvar değerleri, tedavi yöntemleri ve mikrobiyolojik sonuçları analiz edildi. **Bulgular:** Yirmi üç hastanın 18 (%78,3)'i erkek 5 (%21,7)'i kadın olmak üzere ortalama yaşları 56,1 (26-78) olarak saptandı. Hastaların şikayeti başladıktan itibaren hastaneye başvuru süreleri ortalama 7,95±4,67 gündü. Hastaların ortalama hastanede kalış süreleri 16,2 (2-35) gün olup, 11 (%47) hastanın yoğun bakım ihtiyacı oldu. Serimizde 4 (%17,4) hasta hayatını kaybetti. 23 hastanın 17 (%74) sinde ek hastalık mevcuttu 6 (%26) sında ise hiçbir ek hastalık yoktu. Hastaların 9 (%52,9)'unda hipertansiyon (HT), 9 (%52,9)'unda diabetes mellitus mevcuttu. Hastaların C-reaktif protein seviyeleri ortalama 203,3 mg/L olarak saptandı. Fournier gangreninin ağırlıklı olarak görüldüğü yerler ise 9 (%39,13) hastada perianal, 8 (%34,79) hastada perineal ve 3 (%13,04) hastada skrotal bölgelerdi. Hastalar mikrobiyolojik açıdan incelendiğinde polimikrobiyal flora dikkati çekmiştir ve Eschericia coli %30,4 ile en sık görülen etken olmuştur. Hastaların tamamına cerrahi debridman yapıldı ve antibiyoterapileri düzenlenerek takip edildi. Hastalara düzenli olarak lokal yara bakımı uygulandı. Hastaların 14 (%60,8)'ine kolostomi açıldı, 6 (%26,8)'sına ise vakum yardımlı kapama (VAK) tedavisi uygulandı. **Sonuç:** Fournier gangreni sinsi bir şekilde hızla ilerleyen erken tanı konulup tedavi edilmediğinde mortal seyredebilen enfeksiyöz bir hastalıktır. Tedavi programında başrı elde edebimek için multidisipliner bir yaklaşım şarttır.

Anahtar kelimeler: Fournier Gangreni, kolostomi, VAK.

Introduction

Fournier's gangrene (FG) is a rare but severe surgical emergency characterized by necrotizing fasciitis of the perineal, genital, or perianal regions due to synergistic polymicrobial infections. FG was first described by Baurinne in 1764 as necrotizing fasciitis of the genital region. In 1883, Fournier reported a case, leading to the disease being named after him. The first surgical intervention for FG was proposed by Meleney in the 1920s. FG is associated with synergistic infections and vascular thrombosis in the perineal and genital regions, representing a type of necrotizing fasciitis [1]. The condition has also been referred to in the literature as 'streptococcal gangrene', 'synergistic necrotising cellulitis' and 'periurethral phlegmon' [2, 3].

FG is strongly associated with lower socioeconomic status and is more prevalent in impoverished populations [4]. The incidence is approximately 1.6 per 100,000. It can affect individuals of any gender and age but is most commonly seen in males at a 10:1 ratio, particularly between 55-65 years [5-7]. Consistent with the literature, FG in our study was more prevalent in males (78.3%). FG typically develops in patients with underlying comorbidities, though it can also occur in those without any predisposing conditions. Between 52% and 88% of cases involve at least one significant comorbidity contributing to FG development [8, 9]. Diabetes, which impairs circulation and suppresses the immune system, is the most common risk factor [10]. Similarly, comorbidities were present in 17 (74%) of our cases, with 9 (52.9%) having hypertension, 9 (52.9%) diabetes mellitus, 1 (5.8%) chronic obstructive pulmonary disease, and 4 (23.5%) malignancy.

The pathology of FG can be summarized as a synergistic necrotizing fasciitis resulting from suppurative bacterial infections in the anorectal, perineal, or genitourinary regions. This leads to thrombosis of subcutaneous vessels, causing gangrene in the overlying skin [4, 11].

Timely and effective diagnosis and treatment are life-saving in FG. This study retrospectively analyzes FG cases encountered in our clinic to present diagnostic and therapeutic strategies and outcomes to the literature.

Materials and methods

This study was approved by the Pamukkale University Non-Interventional Clinical Research Ethics Committee (approval date: 21.01.2025 and approval number: E-60116787-020-650169). As the study was retrospective, patient consent was not obtained. Data of 23 patients diagnosed with FG and treated in the Department of

General Surgery at Pamukkale University Faculty of Medicine between October 2015 and October 2024 were reviewed retrospectively.

Patient data were analyzed for age, gender, etiological and risk factors, time to hospital admission, physical examination findings, laboratory findings, Fournier's Gangrene Severity Index (FGSI), number of debridements, treatment protocols, mortality, and hospital stay durations. The anatomical locations affected by FG (perineal, scrotal, and perianal) were determined. The bacterial species isolated from wound site cultures were expressed proportionally. All patients underwent surgical debridement and regular wound care, with antibiotic therapy adjusted according to culture results. The requirement for intensive care, colostomy creation, reconstruction, and VAC therapy was also evaluated.

Statistical analysis

Statistical analyses were performed using SPSS version 27.0. Descriptive statistics were expressed as mean ± standard deviation and minimum-maximum for continuous variables. A significance level of 0.05 was considered statistically significant for all analyses.

SPSS (Statistical Package for the Social Sciences, Chicago, IL, USA) version 22 program was used for the analysis of the data obtained in the study. Descriptive statistical data were presented as mean, median and standard deviation. The Kolmogorov-Smirnov test was used to check the compliance of continuous variables with normal distribution. VeyselStudent t test was used to compare the means of variables with normal distribution, and Mann-Whitney U test was used to compare continuous variables that did not fit the normal distribution. Chi-square test was used to compare qualitative data. S. $p<0.05$ was considered statistically significant.

Results

Among the 23 patients included in the study, 18 (78.2%) were male and 5 (21.7%) were female. The average age of the patients was 56.1±13.3 years. In the study, 4 patients (17.4%) died in the postoperative period. Seventeen patients (74%) had comorbidities, while 6 (26%) had no comorbidities. Hypertension was present in 9 patients (52.9%), diabetes mellitus in 9 (52.9%), chronic obstructive pulmonary disease in 1 (5.8%), and malignancy in 4 (23.5%).

When examining the imaging tests performed at the time of Fournier's gangrene diagnosis, it was noted that no imaging was done for 2 patients, 10 underwent computed tomography, 8 had magnetic resonance imaging, and 3 had abdominal ultrasonography. Upon examining the localizations of Fournier's gangrene, 3 patients (13.04%) had scrotal

involvement, 9 (39.13%) had perianal, 8 (34.79%) had perineal, and 3 (13.04%) had gluteal regions affected. In the deceased patients, the locations of Fournier's gangrene were 3 in the perianal region and 1 in the perineal region. The average CRP levels of the patients were measured at 137.49 mg/L ±107.9, and WBC values were found to be 19.6±8.3 mg/dL. The results of the wound cultures in patients revealed a polymicrobial flora, with Escherichia coli being the most common agent at 30.4%.

The average length of hospital stay for all patients was 16.21 (2-35) days; for surviving patients, it was 14.37 (2-35) days, while for those who died, it was 25 (17-32) days. 11 patients (47.8%) required intensive care. Among those hospitalized in intensive care, 9 were discharged, while 2 patients died. The average duration of stay for patients admitted to intensive care was 20 (12-35) days. In contrast, the average hospital stay for patients who were not admitted to intensive care was 12.92 (2-30) days.

Colostomy was performed in 14 patients (60.8%). Patients with colostomy had an average hospital stay of 19.85 (6-35) days, while those without colostomy stayed an average of 10.55 (2-32) days. Four colostomies (28.5%) were able to be closed after complete wound healing. The average time to close colostomies was 10.5 (5-13) months. Among patients with colostomies, 3 (21.4%) experienced mortality. In contrast, among the 9 patients without colostomy, 1 (11.1%) experienced mortality. Overall, 4 patients (17.4%) experienced a fatal course of Fournier's gangrene. The average survival time for patients with fatal outcomes after diagnosis was 3 (2-4) months. Patients' demographic and clinical findings are shown in Tables 1, 2, and 3.

An average of 3.43 (1-11) wound debridements were performed on the patients. For the 4 patients who died, an average of 2.5 (1-4) debridements were performed. For the 19 patients who survives, the average number of debridements performed was 3.63 (1-11). The average Fournier's Gangrene Severity Index (FGSI) score for patients was calculated as 2.56±2.04 points. In patients with a fatal course, the FGSI score was 3.5 (1-6), while in those without mortality, it was 2.37 (0-5).

Six patients (26.8%) underwent vacuum-assisted closure (VAC) therapy. Of those who received VAC, 1 patient died and 5 were discharged. The average hospital stay for patients receiving VAC therapy was 21 (8-32) days, while for those who did not receive VAC, the average length of stay was 14.52 (2-35) days. Four patients who received VAC also had colostomies performed. Reconstruction with flap was performed in 2 patients (8.7%).

Discussion

Fournier's gangrene can simply be defined as necrotizing fasciitis of the perineal and genital regions. With its rapidly spreading and life-threatening nature, it is a critical surgical emergency that all physicians should be cautious about. The management of Fournier's gangrene presents a significant burden for surgical specialties, considering that it often requires prolonged hospitalization, frequent dressing changes, serial debridements, and management of comorbidities. In the initial series published on Fournier's gangrene, the mortality was around 80%, while over the last 15 years, this rate has dropped below 40% [11]. In our study, the mortality rate was seen in 4 patients (17.4%), consistent with the literature. The causes of death in these patients included severe sepsis, coagulopathy, acute renal failure, diabetic ketoacidosis, and multiple organ failure. Sorensen et al. [12] showed that there are lower mortality rates in hospitals where surgeries are more frequently performed. Indeed, in this rare but potentially dangerous disease, the mortality rates can decrease as experience is gained. Therefore, it is crucial to remain skeptical and vigilant even in simple lesions of the ano-uro-genital area, and to demonstrate the necessary effort to raise consciousness levels in the future.d4

The clinical presentation of Fournier's gangrene is quite variable. It can present a wide spectrum, from subtle early local skin manifestations to overt skin signs and even systemic septic symptoms. Symptoms initially start with local pain, itching, and redness. Shortly thereafter, there is increased hyperemia in the genital region, leading to the emergence of ulcerative lesions and necrotic tissues. Characteristically, sensitive lesions that exhibit crepitation emerge [2, 13].

The microorganisms responsible for the infection vary for Fournier's gangrene. While the number of cases with a single isolated pathogen is low, the isolated pathogens are mostly bacteria found in the flora of the perineal and genital organs, such as E. coli, Klebsiella pneumoniae, Bacteroides fragilis, and Staphylococcus aureus. In some cases, the presence of fungal infections has also been reported [13, 14]. In our study, when examining the wound culture results of the patients, a polymicrobial flora was highlighted, with Escherichia coli being the most common pathogen at 30.4%.

The diagnosis of Fournier's gangrene is based on clinical findings. A clinician must suspect Fournier's gangrene to make the diagnosis. Often, physical examination findings and the patient's medical condition lead to the diagnosis, while laboratory tests and radiological imaging assist in early diagnosis.

Ultrasonography can show subcutaneous emphysema and dirty shadowing as reverberation artifacts in the scrotum and perineum [15]. Computed tomography (CT)

plays an important role in diagnosing Fournier's gangrene and detecting the extent of the disease. Characteristic findings of CT include thickening of soft tissue and fascia, fluid collection, abscess formation, inflammation, and subcutaneous emphysema. Since subcutaneous crepitation, the best examination finding indicating the presence of gas-producing bacteria in Fournier's gangrene, was not detected in all patients, the primary method of diagnosis remains physical examination, but usually, computed tomography is used to verify the diagnosis [5]. Magnetic resonance imaging (MRI) with gadolinium contrast is excellent for soft tissue imaging [16]. In our study, when looking at the imaging studies performed in the diagnosis of Fournier's gangrene, 2 patients had no imaging studies performed, 10 patients had computed tomography, 8 patients had magnetic resonance imaging, and 3 patients had abdominal ultrasound.

The most important point in treatment and prognosis is early diagnosis. The treatment of Fournier's gangrene often requires a multidisciplinary approach. The essence of treatment involves fluid resuscitation, broad-spectrum antibiotics, and extensive debridement involving all infected tissues [5]. Fournier's gangrene is an emergency condition that can have mortality rates of up to 90% if left untreated [2].

Hemodynamic resuscitation and optimization play a major role in the treatment of Fournier's gangrene patients. In the medical management of Fournier's gangrene, urgent empirical parenteral antibiotic therapy should be given and should be adjusted according to microbiological culture results. In treatment, combinations of 2nd and 3rd generation cephalosporins with fluoroquinolone, aminoglycosides, or nitroimidazoles are applied, or broad-spectrum carbapenem antibiotics are given in very severe cases, and based on culture and sensitivity results, either the same treatment continues or a change in antibiotics is recommended [17].

The primary treatment for Fournier's gangrene is surgical [18, 19]. There are studies showing that mortality is significantly reduced when the patient is taken to surgery within the first six hours from the time of admission [20]. The purpose of surgical debridement is to remove all devitalized tissues, stop the progression of infection, and reduce systemic toxicity. Surgical debridement should be performed extensively until well-perfused viable tissues are visible [4]. Patients with Fournier's gangrene often require repeated surgical debridements. In one study, the average number of debridements was found to be 2.3 for survivors and 5.2 for those who died, making the overall average 3.5 [21]. In our series, patients underwent an average of 3.43±2.6 wound debridements. When looking at the number of debridements in the 4 deceased patients, it was found to be an average of 2.5 (1-4) times. In the 19 patients who survived, the average number of debridements was 3.63 (1-11) times.

The vacuum-assisted closure (VAC) therapy described by Argenta et al. [22] in 1997 was first used by Weinfeld et al. [23] for the treatment of Fournier's gangrene in 2005, changing the disease from a feared condition to a manageable one. The VAC method accelerates wound healing by reducing edema, draining dirty fluid and stagnant debris, and increasing blood flow. VAC temporarily transforms an open wound into a closed and controlled environment. In our series, vacuum-assisted closure (VAC) therapy was applied in 6 of our patients (26.8%).

Fecal diversion may be considered if the anorectal area and sphincter are affected or if there is fecal contamination delaying wound healing. Although there is no general consensus about the implementation of colostomy, it is recommended if there is extensive sphincter damage or wide perineal debridements [24, 25]. In our study, colostomy was performed in 14 patients (60.8%). Of the opened colostomies, 4 (28.5%) could be closed after complete wound healing. Colostomies were closed after an average of 10.5 (5-13) months. Mortality was observed in 3 (21.4%) of the patients who had colostomies.

Another adjunct treatment method that enhances wound healing is hyperbaric oxygen (HBO) therapy. HBO therapy optimizes the immune system by increasing fibroblast proliferation and neutrophil functions, reducing edema, and accelerating the penetration of antibiotics into cells, which also speeds up wound healing [26]. Studies indicate that HBO therapy reduces systemic toxicity, limits necrosis, and decreases mortality when combined with surgical intervention and antibiotic therapy [27].

Some studies in the literature report the therapeutic effects of topical honey application in Fournier's gangrene. Raw honey has been tested in the treatment of Fournier's gangrene due to its antimicrobial properties and ability to stimulate epithelial cell growth. Honey has a low pH of about 3.6 and contains enzymes that facilitate the digestion of necrotic tissues. The antibacterial properties of honey, due to its phenolic acid content, have been observed to enhance fibroblast activity within the 7 days following its application to the wound site [5].

The last stage of treatment for patients with Fournier’s gangrene is to reconstruct the tissue defects that arise from aggressive surgical debridement as soon as granulation tissue forms. The selection of surgical reconstruction depends on the size, width, depth, location of the defect, and the availability of local tissue. For debridement defects in Fournier's gangrene, types of local tissue flaps, fasciocutaneous perforator flaps, split-thickness skin grafts, and myocutaneous/muscle flaps have been described in the literature [28]. In our series, reconstruction using flaps was applied to 2 (8.7%) of the patients with Fournier's gangrene.

In conclusion, despite advancements, FG remains a life-threatening condition Early diagnosis and aggressive treatment such as surgical debridement is important due to high mortality rates in FG. Colostomy should be opened if necessary. Wound control can be achieved with VAC in appropriate patients. Although the treatment of FG is performed with a multidisciplinary approach with general surgery, urology, gynaecology and plastic-reconstructive surgery, family physicians and emergency physicians should also be informed about this disease for early diagnosis.

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Table 1. Demographic characteristics of patients

Age, years (mean ± SD)	56.17±13.32
Gender, n (%)	
Male	18 (78.26)
Female	5 (21.74)
Mortality, n (%)	4 (17.39)
Presence of Chronic Disease, n (%)	
Present	17 (73.92)
None	7 (26.08)
Regular Medication Use, n (%)	
Present	11 (47.83)
None	12 (52.17)
Chronic Disease, n (%)	
Hypertension	9 (52.94)
Diabetes mellitus	9 (52.94)
COPD	1 (5.88)
Malignancy	4 (23.52)
Patients ' Test Values, mg/dL (mean ± SD)	
Hgb, mg/dL (mean ± SD)	11.84±2.08
WBC, mg/dL (mean ± SD)	19.61±8.30
CRP, mg/L mean ± SD	137.49±107.90

WBC: White Blood Cell, CRP: C-Reactive Protein, Hgb: Hemoglobin
SD: Standart Deviation, COPD: Chronic Obstructive Pulmonary Disease

Table 2. Clinical characterstics of patients

FSGI, score (mean ± SD)	2.56±2.04
Hospitalization, days (mean ± SD)	16.21±9.04
Intensive care hospitalization status, n (%) (mean ± SD)	
Present	11 (47.82)
None	12 (52.17)
Length of stay in intensive care unit, days n (%) (mean ± SD)	4.45±2.33
Localization, n (%)	
Perineal	8 (34.79)
Gluteal	3 (13.04)
Scrotal	3 (13.04)
Perianal	9 (39.13)
Colostomy opening, n (%)	
Present	14 (60.87)
None	9 (39.13)
Closure of opened colostomies, n (%)	**4 (28.57)**
Mortality of patients with colostomy, n (%)	**3 (21.42)**
Debridement Number (mean ± SD)	3.43±2.60
VAC Application, n (%)	
Present	6 (26.08)
None	17 (73.91)
Flap based reconstruction, n (%)	
Present	2 (8.7)
None	22 (91.3)

FSGI: Fournier's Gangrene Severity Index, SD: Standart Deviation
VAC: Vacuum-assisted closure

Table 3. Comparison of clinical parameters in all patients, living and deceased patients in FG

	All patients	Survivng Group	Non-Surviving Group	*p*-value
Complaint/Application duration, days (mean ± SD)	7.96±4.67	7.68±4.19	9.25±7.22	0.907*
Length of stay, days (mean ± SD)	16.21±9.04	14.36±8.40	25±7.16	0.029£
Number of wound debridements, (mean ± SD)	3.43±2.60	3.63±2.79	2.50±1.29	0.611*
Colostomy application, n (%)	14 (60.9)	11 (57.9)	3 (75)	0.483&
FGSI score, (mean ± SD)	2.56±2.04	2.36±2.03	3.50±2.08	0.366*
VAC application, n (%)	6 (26.1)	5 (26.3)	1 (25)	0.73&
Closure of colostomy, n (%)	4 (17.4)	4(21.1)	0	0.438&
Necessity intensive care, n (%)	11 (47.8)	9 (47.4)	2 (50)	0.671&
ICU length of stay, days (mean ± SD)	4.45±2.33	4.44±2.50	4.50±2.12	0.727*

FSGI: Fournier's Gangrene Severity Index, VAC: Vacuum-assisted closure
SD: Standart Deviation
*Mann-Whitney U test, £ Student t test, &Chi-square test, $p<0.05$ statistically significant

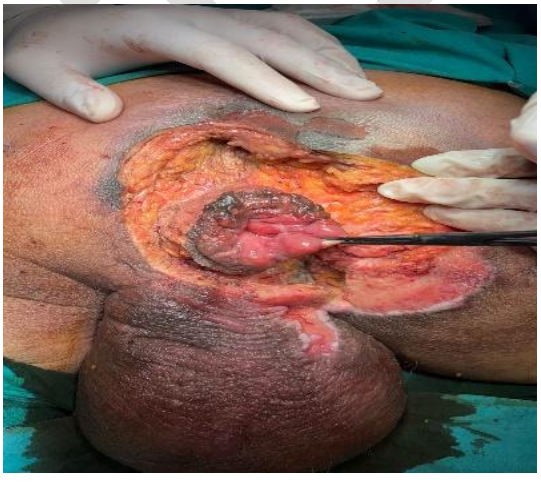

Figure 1. A case of FG with debridement

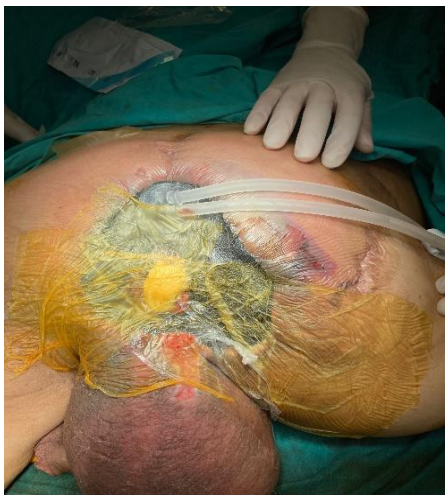

Figure 2. FG case with VAC application

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