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Research Article

Fournier's Gangrene and Its Management-A Prospective Study

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Abstract

Background: Fournier's gangrene is a fatal necrotizing fasciitis of the genitalia and perineum that can lead to infection of the area with various microbes, organ failure, or even death. This study is indented to determine the presence of systemic concomitant diseases, regional risk factors, metabolic problems, early diagnosis, barriers to treatment, and treatment outcomes in Kanyakumari district. Without an accurate diagnosis and prompt treatment, Fournier's gangrene is a surgical emergency with a high mortality rate. A mortality rate of 15% to 50% has been reported for this polymicrobial necrotizing fasciitis of the vaginal, perianal and perineal regions

Aim and Objective: The aim of this study is to determine the age and sex incidence, demographic pattern, predisposing etiologic and risk factors, signs and symptoms, and net patient outcome, and to evaluate the optimal treatment modalities for Fournier's gangrene.

Methods: This study is a prospective observational study conducted in the Department of General Surgery, Kanyakumari Government Medical College from January 2021 to December 2022. A total of 50 cases of Fournier's gangrene who met the inclusion criteria were included in the study. Demographic data such as age, sex, aetiology, risk factors, clinical features, signs and symptoms, site of infestation, microbial culture, bacterial flora, treatment method used, length of hospital stay, and mortality were examined.

Results: A total of 50 patients, 46 men and 4 women, were included in the study. Males outnumbered females in 92% of cases, with a ratio of 11.5:1. Females were found to have vulvar induration and abscess in the perineal or perianal area. In 31 patients (62%), the lesions were located in the scrotum, in 8 patients (16%) in the perineal area, in 6 patients (12%) in the penis, in 3 patients (6%) in the groin, and in 2 patients (4%) in the vulva. Eight individuals in the research group suffered complete scrotal loss. Presentation of symptoms to the hospital was late, averaging 6.8 days after onset. Patients who presented late to the hospital had much more severe morbidity and delayed recovery, requiring multiple debridement and a longer hospital stay.

Conclusion: This study suggests that if Fournier's gangrene is diagnosed early and patients are hospitalized promptly with immediate debridement, metabolic control, and appropriate antibiotics, effective management with a positive outcome is possible. Because the scrotum is a very elastic skin, primary closure and wound healing are possible even after severe necrotic debridement. In patients who have major soft tissue defects after debridement, surgical reconstruction is required, reducing morbidity and hospitalization and allowing patients to return to their normal lives early. Strict metabolic control, proper hygiene, and early treatment are important tools to prevent this devastating disease.

Keywords: Fournier's Gangrene; Debridement; Scrotum; Morbidity

Introduction

Fournier's gangrene is a variant of necrotizing fasciitis that commonly affects the external genitalia or perineum. Epidemiologically, Fournier's gangrene affects adult men much more frequently than women and children. Diabetics,

immunocompromised individuals, alcoholics, and people with decompensated conditions are more susceptible to the disease. It reportedly affects one in 62,500 males, and men are 40 times more likely to be affected than women [1].

Fournier's gangrene was first described by Baurienne in 1764 and rediscovered in 1883 by French venereologist Jean Alfred Fournier, who published a series in which five previously healthy young men suffered from rapidly progressive gangrene of the penis and scrotum for no apparent cause, termed Fournier's gangrene.

Fournier's gangrene is defined as polymicrobial necrotizing fasciitis of the perineal, perianal, or genital area [2]. The manuscript of Fournier's first series of fulminant perineal gangrene provides a fascinating insight into the social customs and state of the practice of modern medicine at that time. In the form of anecdotes, Fournier described the recognized causes of perineal gangrene, with various practices such as putting a lover's ring around the phallus, ligature of the foreskin used to control enuresis or birth control by an adulterous man to avoid pregnancy, insertion of foreign objects such as beans into the urethra, and excessive sexual intercourse by diabetics and alcoholics. He implores and exhorts physicians to be persistent in obtaining confessions from patients about their "obscene practices".

Fournier's gangrene presents with initial symptoms such as swelling or sudden pain in the scrotum, fever with or without chills, pallor, fatigue, and general weakness [3]. Gangrene is characterized by a characteristic foul odor and a purulent discharge from the infected region.

Fournier's gangrene is also known as "streptococcal gangrene", "synergistic necrotising cellulitis" and "peri-urethral phlegmon", which are infectious, destructive and fatal. The infection is usually polymicrobial with aerobic and anaerobic bacteria. The predominant aerobe in this disease is *Escherichia coli* and the predominant anaerobe is Bacteroides. Other commonly isolated bacteria include:

- *Proteus*
- *Staphylococcus*
- *Enterococcus*
- *Streptococcus (aerobic and anaerobic)*
- *Pseudomonas*
- *Klebsiella*
- *Clostridium*

Polymicrobial involvement is necessary to create the synergy between enzyme production that promotes rapid multiplication and favours the spread of Fournier's gangrene. When a microorganism produces the enzymes necessary to trigger coagulation of the nutrient vessels, thrombosis of these nutrient vessels occurs, reducing the local blood supply and leading to a drop in oxygen tension in the tissue. As this leads to hypoxia, the growth of facultative anaerobes and microaerophilic organisms is promoted. These anaerobic microorganisms in turn produce enzymes (e.g., lecithinase, collagenase) that lead to the digestion of the fascial barriers, thus promoting the rapid spread of infection [4].

Obliterative endarteritis of the subcutaneous arteries is the characteristic feature of Fournier's gangrene, which ultimately leads to gangrene of the skin covering the affected area. Early diagnosis is important, otherwise gangrene progresses rapidly and leads to multiple organ failure and eventual death [5,6].

Infection begins with infection of the superficial perineal fascia (Colles' fascia) and spreads from there to the penis and scrotum via Buck's and Dartos' fascia or to the anterior abdominal wall via Scarpa's fascia, or vice versa. Since Colles' fascia is attached posteriorly to the perineal body and urogenital diaphragm and laterally to the pubic arches, progression in these directions is limited. Involvement of the testes in the process is rare because the testicular arteries arise directly from the aorta and thus have a blood supply separate from the affected region. Advanced or fulminant Fournier's gangrene may spread from the fascial sheath of the genitalia to the perineum, boot and occasionally to the thighs [7].

Pathognomonic findings of Fournier's gangrene noted on pathological assessment and examination of the affected tissues include [8]:
-Necrosis of the superficial and deep fascial planes
- Fibrinoid coagulation of the nutrient arterioles
- Infiltration of polymorphonuclear cells
- Biofilm in the affected tissues

Conditions that compromise cellular immunity may predispose a patient to the development of Fournier's gangrene. Examples include the following:
- Diabetes mellitus (present in up to 60% of cases)
- Morbid obesity
- Alcoholism
- Cirrhosis
- Extreme old age
- Vascular disease of the pelvis
- Malignant diseases (e.g., acute leukaemia)
- Systemic lupus erythematosus
- Crohn's disease
- HIV infection
- Malnutrition
- Iatrogenic immunosuppression (e.g., due to long-term corticosteroid therapy or chemotherapy)

Treatment of Fournier's gangrene consists of intensive and careful systematic management, empirical broad-spectrum antibiotic therapy, surgical debridement (removal of necrotic tissue in the scrotum, penis and groin), strict metabolic control and hyperbaric oxygen therapy, etc. Surgical debridement must be repeated and some patients may also need reconstructive surgery.

With the advancement of new technologies for wound care, the diagnosis, assessment and triaging to treat Fournier's gangrene with multiple options have made the treatment much more complex. This study is conducted to determine the demographic profile of individuals affected by this disease, etiological and risk factors, time delay in reporting to hospital, clinical features, different surgical procedures for Fournier's gangrene, reconstructive procedures and outcome of the disease.

Materials and Methodology
Population of the study: Patients of both sexes with Fournier's gangrene admitted to the Department of General Surgery, Kanyakuamri Government Medical College, India.
Study design: Prospective interventional study.
Study period: January 2021 to December 2021.
Study site: Surgical departments of the medical university.
Sample size: It is a hospital-based study with 50 cases fulfilling the inclusion/exclusion criteria.

Inclusion criteria:
- Patients with the signs and symptoms and clinical diagnosis of Fournier's gangrene
- consent for the study
- Patients who are over 18 years of age

Exclusion criteria:
- Women with pregnancy
- Age under 18 years
- Patients who do not give consent for the study

Methodology

All patients underwent structured history taking, appropriate clinical examination, investigation of concomitant diseases and metabolic status, radiological and blood investigations, aggressive surgical debridement, wound swabbing for culture and sensitivity and empirical antibiotic therapy.

Optimisation of general conditions with blood, IV fluids, albumin and other nutrient therapy with insulin for metabolic control. Both smear and tissue culture reports were obtained and specific antibiotics were started. Treatment procedures were individualised for each patient. After admission, all patients were followed up carefully and results were recorded using the proforma.

Statistical Analysis

The collected data were entered into MS excel and SPSS 22 version software was used to analyse the data using descriptive statistics. Qualitative data was identified and expressed as frequency and proportion. Mean is used to express quantitative data and mean is used to represent continuous measurement. Categorical measurements were expressed as number (%).

Treatment

All patients admitted with Fournier's gangrene were categorized according to their clinical condition and treatment interventions were initiated either in the septic ward or ICU as required. Electrolyte imbalance and dehydration were corrected with aggressive fluid therapy and anaemia was corrected with blood components.

Patients underwent early debridement with appropriate anaesthesia and broad-spectrum antibiotics with amoxicillin with clavulanic acid or third generation cephalosporin, aminoglycosides and metronidazole were used empirically and changed according to the culture and sensitivity report once available. Moist hygroscopic dressings were applied and debridement was performed as needed.

Continuous debridement was performed at regular intervals depending on the individual case until healthy granulation tissue was formed. The general condition of the patient was improved by correcting anaemia, hypoalbuminemia and other nutritional measures. After debridement, the wounds were either primarily closed or reconstructed with local tissue, depending on the size of the affected area. Different methods used include healing by secondary intention, split skin grafting, secondary sutures and flap covering. The stage of septicaemia was classified as SIRS, MODS, ARDS and intensive care management was provided on this basis.

Results

In this prospective study conducted in the surgical department in patients with Fournier's gangrene from January 2021 to December 2022, the outcomes of several factors were considered.

The patients age were in the range of 18 to 87 years with mean age being ± SD=46.8 ± 14.87 years. Maximum cases are between 50-60 years of age group (Table 1).

Age in Years	No. of Cases	Percentage (%)
< 20	2	4
20-30	4	8
30-40	8	16
40-50	11	22
50-60	15	30
>60	10	20
TOTAL	40	100

Table 1: Age distribution.

Males are affected more 46 patients (92%) and females only 4 patients (8%).

Age in Years	Male		Female	
	No.	%	No.	%
<20	2	4	-	-
20-30	4	8	-	-
30-40	8	16	-	-
40-50	9	18	-	-
50-60	13	26	2	4
>60	8	16	2	4
TOTAL	46	92	4	8

Table 2: Incidence among males and females.

On the basis of site, 31 (62%) had lesions in the scrotum, 8 patients (16%) in the perineum, 6 patients (12%) in the penis, 3 patients (6%) in the groin, and 2 patients (4%) in the vulva (Table 3).

SITE	Number of Cases	Percentage (%)
Scrotum	31	62
Perineum	8	16
Penis	6	12
Groin	3	6
Vulva	2	4

Table 3: Site of involvement.

Pain is the most significant symptom with all the patients were having pain followed by 35 patients had fever, 31 patients had scrotal swelling and 8 patients had discoloration of the perineum, the data are tabulated in Table 4.

Symptoms	Number of cases	Percentage (%)
Pain	50	100
Erythema	50	100
Fever	37	74
Discharge from wound	20	40
Scrotal Swelling	31	62
Blisters/Skin vesicles	18	36
Discoloration of perineum	8	16

Table 4: Symptoms at presentation.

30 patients had induration in the involved region, 22 patients presented with necrosis and 16 patients with abscess, 8 patients with gangrenous skin changes. Crepitus, shock and altered Mental status were seen in 6(12%); 8(16%) and 6(12%) and values are tabulate in Table 5.

Signs	Number of Cases	Percentage (%)
Induration	30	60
Necrosis	22	44
Abscess	16	32
Gangrenous Skin Changes	8	16

Crepitus	6	12
Shock	8	16
Altered Mental Status	6	12

Table 5: Clinical signs at presentation.

The source of infection was traced and found to be from the anorectal area in 10 patients, from the genitourinary area in 17 patients, combination of both was present in 10 patients and 12 patients had idiopathic disease. The results are shown in Table 6.

Source	No. of Patients	Percentage
Anorectal	10	20
Genitourinary	17	34
Combination of above	10	20
Idiopathic	12	24
Skin	6	12
Total	50	100

Table 6: Source of infection for patients with Fournier's Gangrene (n=50).

Two patients presented within 24 hours of an RTA with degloving injuries to the scrotum, penis and perineum. In 74% of patients, the presentation with symptoms to hospital was delayed with a mean presentation of 6.8 days after onset. Patients who presented late to hospital had much more severe morbidity, recovered late and required multiple debridement and a prolonged hospital stay [11]. Patients presented to hospital only after one week and the results are shown in Table 7.

Time Interval	No. of Patients	Percentage
<48 hours	2	4
48hours-1week	37	74
≥1week	11	22

Table 7: Time interval between onset of symptoms and presentation at the hospital.

Diabetes mellitus was the most common risk factor in majority of patients (72%). Uncontrolled blood sugars were associated with significant mortality and morbidity, late recovery and surgical site infections. Various associated symptoms noted were tabulated in Table 8.

Predisposing Risk Factors	Number of Cases	Percentage (%)
Diabetes mellitus	38	72
Extremes of ages	4	8
Perianal abscess	10	20
Trauma	2	4
Alcohol	15	30
Steroids	4	8
Renal disease	12	24
Cirrhosis of liver	6	12

Table 8: Risk factors and aetiology.

The swab culture shows predominantly 66% Multi bacteria status. *Klebsiella* and *E.coli* are the most common organism isolated from wound swab cultures. The Bacteria isolated details are tabulated in Table 9.

Bacteria	Number of cases	Percentages (%)
Klebsiella	21	42
E. coli	20	40
Pseudomonas	13	26
Staph aureus	14	28
Proteus	10	20
Streptococcus pyogenes	6	12
Acinetobacter	2	4
Citrobacter	3	6

Table 9: Microbiology-Type of bacteria isolated from the wound.

Patients were having the concomitant diseases and the associated biochemical findings are tabulated in Table 10.

Investigation	No. of Patients	Percentage
Anemia	32	64
Leucocytosis	23	46
Hyponatremia	15	30
Increased Serum Creatinine	21	42
Hyperglycaemia	44	88
Glycosuria	46	92
Decreased Serum Albumin	12	24
Increased BT and CT	3	6
Hypocalcaemia	16	32

Table 10: Biochemical abnormalities in Fournier's Gangrene (n=50).

Three patients were discharged after the first resuscitation against medical advice because they did not follow the instructions. 6 patients died due to late arrival at the hospital and advanced comorbid conditions. The data are presented in Table 11.

Outcome	Number of Cases	Percentages (%)
ALIVE	41	82
DEATH	6	12
DAMA	3	6

Table 11: Outcome of patients.

Discussion

The most important critical point in terms of successful treatment of Fournier's gangrene and a positive prognosis is early diagnosis and initiation of treatment. As Fournier's gangrene is initially a clinical diagnosis, radiological procedures such as X-ray, ultrasound, computed tomography and magnetic resonance imaging, as well as advanced laboratory findings, may be secondary to the initiation of treatment. The most common symptom is pain associated with signs of inflammation, oedema, necrosis and subcutaneous crepitation. Clinical investigations should be performed to assess the extent of the disease and the extent of debridement.

Fournier's gangrene can affect either sex, but as noted in previous studies, 92 percent of patients in our study were male. Although it can occur at any age, it predominantly affected the elderly in our study. It is less common in women because of the anatomical pattern of lymphatic drainage.

Age Distribution: Patients in our study ranged in age from 18 to 87 years, with an average age of 47.8 years at presentation. In studies conducted and reported by Kavat T, Al-Abkari, et al., Laor and Alejandro, et al., Fournier's gangrene occurs most commonly in the fifth and sixth decades of life [6,9,10]. Similarly, Sockkalingam VS., et al., have reported that low socioeconomic status contributes to the development of FG. In comparison to all these studies, the mean age of patients is 50.01 years [6,9-11].

Gender Distribution: In our study, patients were predominantly female with a ratio of 11.5: 1. Our finding is in agreement with the findings of other studies. The lower incidence in females could be due to better drainage of the perineal region by vaginal secretions. Homosexuals have a higher risk, especially for infections caused by Methicillin-Resistant Staphylococcus Aureus (MRSA).

Predisposing Risk Factors: Diabetes mellitus was the most common predisposing risk factor in our study (72%). Alcohol abuse was 30%, compared with 9-31% in previous studies. Other risk factors were steroid use (3%) and no identifiable risk factor in 10% of patients. Compared to other studies, about 64% of patients had more than one risk factor.

According to the study by Sockkalingam, VS, et al., the most common cause of the disease was anorectal (35.3%), genitourinary (20.6%) and dermatological (14.7%) [6]. In 29.4% of cases, the cause was idiopathic. Diabetes (38.2%) was the most common concomitant disease, followed by chronic alcoholism (20.6%), HIV (17.6%), chronic renal failure (8.9%), chickenpox (2.9%) and pulmonary tuberculosis (2.9%).

Site of Involvement/Frequent Presentation: In our study, the scrotum was the most commonly affected region. In females, induration of the vulva and abscess in the perineal or perianal area were noted. The most common clinical features were fever, pain, swelling of the scrotum, redness, tenderness of the genitals and perineum, and gangrene. The corresponding studies also come to more or less similar results.

In our study, pain (100%) and erythema (100%) occurred in all patients with Fournier's gangrene, while Lamb RC and Juler GL et al., and Clayton and Flower JE Jr, et al., found pain (100%) and erythema (100%), while the occurrence of altered mental status and shock was less frequent compared to the above studies [13,14]. As reported by Lamb RC and Juler GL, et al., and Clayton and Flower JE, Jr et al., anorectal (46%) site of origin was more common than genitourinary (33%) [13,14]. According to Asci R and Sarikaya S, et al., genitourinary (35.3%) site of origin was more common than anorectal (29.4%) [15].

Microbiology - Isolated Organisms: *Klebsiella* and *E. coli* were the most commonly isolated organisms, with 66% of patients having polymicrobial culture isolates (more than one organism isolated), 30% having monomicrobial cultures and 4% not growing in culture. According to the study by Sockkalingam, VS, et al., Escherichia coli was isolated in 47.0% of patients, followed by *Streptococcus* (41.1%) and *Klebsiella* (35.3%). Bacteroides was the most frequently isolated anaerobe, found in 8.9% of patients. In 18 out of 34 cases (52.9%), the disease was confined to the genitalia.

Mode of Cure: In our study, which included 50 patients, the mean length of stay was 16.8 days. 17 subjects were cured with secondary intention, 13 patients had undergone secondary suturing, SSG in 12 patients and flap in 4 patients.

Mortality: Six patients with advanced comorbidities and late admission to hospital succumbed to the disease in our study. Early diagnosis, prompt aggressive and multiple surgical debridement, initial broad-spectrum therapy followed by precise antibiotic therapy based on culture reports, and intensive medical management with fluid and nutritional supplementation contribute to lower morbidity and mortality.

Delay in Hospital Admission and Delay in Reporting to Hospital: Stamenkovie I, and Lew PD, et al., 53% reported to hospital within 48 hours to 1 week and 47% within 48 hours, but in our study only 8% of patients reported within 48 hours, 72% of patients came within 48 hours and 1 week and 10% of patients after 1 week [16].

In a study by Miller JD, et al., leucocytosis was biochemical abnormality in 93% and hyperglycaemia in 82%. In our study, 88%

of patients had hyperglycaemia [17]. The data from the present study are compared with the other published studies and tabulated in Table 12.

Criteria	Study factor	Present study Jayalal, et al.,	Kavat T [6]	AL-Abkari HA. et al., [7]	Laor E, et al., [8]	Alejandro, et al., [11]
Age	Mean Age	47.8	47.4	54.7	53	47.5
Sex	Male %	92	86	82	78	96
	Female %	8	13	18	22	4
Predisposing factors	Diabetes Mellitus (%)	72	66	60	45	51
	Alcohol (%)	30	30	25	22	24
	Steroids (%)	6	3	2	1	3
Site of involvement	Scrotum (%)	65	90	70	85	52
	Perineum (%)	20	23	33	35	38
	Penis (%)	12.5	13	9	11	10
Organism Isolated	Klebsiella (%)	42	40	18	21	25
	E. coli (%)	40	33	9	13	11
	Pseudomonas (%)	26	26	38	35	30
	Staph aureus (%)	28	16	5	6	7
	Proteus (%)	20	10	2	4	3
Mode of healing	Healing by secondary intention (%)	34	43	69	60	63
	Secondary suturing (%)	26	33	20	18	19
	SSG (%)	24	16	5	4	3
	Flap (%)	8	6	2	3	4
Mortality	Mortality (%)	12	3	27	15	12

Table 12: The comparison of the results.

Various treatment modalities are shown in the Fig. 1-4.

Figure 1: Healing by secondary intention.

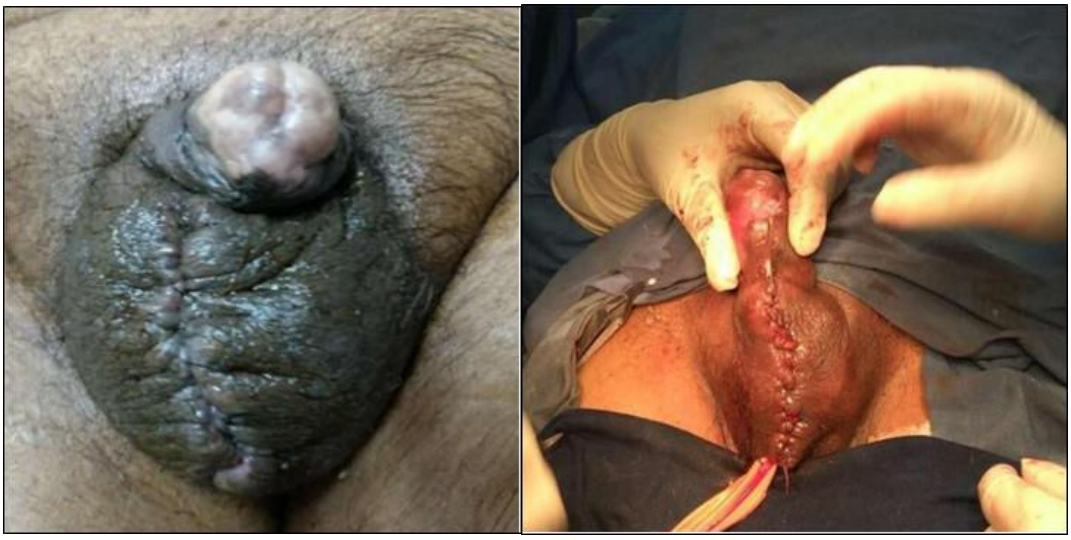

Figure 2: Healing by secondary suturing.

Figure 3: Healing by SSG.

Figure 4: Healing by tensor fascia lata flap.

Conclusion

This study suggests that if Fournier's gangrene is diagnosed early and patients are hospitalised promptly with immediate debridement, metabolic control and appropriate antibiotics, effective management with a positive outcome is possible. As the scrotum is a very elastic skin, primary closure and wound healing are possible even after severe necrotic debridement. In patients who had major soft tissue defects after debridement, surgical reconstruction was required, reducing morbidity and hospitalisation and allowing patients to return to their normal lives early. Strict metabolic control, proper hygiene and early treatment are important tools to prevent this devastating disease. Alcoholism and diabetes were the main risk factors in many of the patients. Klebsiella and Ecoli are the most common organisms. Hyperglycaemia is the most common concomitant disease and strict metabolic control in diabetics can reduce the number of incidents.

Limitation of Study

- The study must include a larger number of patients
- Associated concomitant diseases and their effects could not be investigated
- Long-term follow-up and relapses could not be investigated
- Modern, advanced treatment methods were not used

Conflict of Interest

The authors have no conflict of interest to declare.

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