International Archives of
Urology and Complications

RESEARCH ARTICLE

Prevalence, Pattern and Early Treatment Outcomes Predictors of Patients with Fournier's Gangrene at University of Dodoma Affiliated Teaching Hospitals

Mwinyimkuu Rajabu Lesso[1], Mwashambwa MY[1,2] and Edward Ketson Msokwa[1]*

[1]Department of Surgery, The University of Dodoma, Dodoma, Tanzania

[2]Consultant Surgeon (Kidney Transplant), Department of Surgery, Benjamin Mkapa Hospital, Dodoma, Tanzania

*Corresponding author: *Mwinyimkuu Rajabu Lesso, Department of Surgery, The University of Dodoma, Dodoma, Tanzania*

Abstract

Background information: Fournier's Gangrene is a rare disease worldwide, which has a significant mortality. The incidence is progressively becoming common in general surgical wards. While this disease is uncommon in Western countries, it is more prevalent in resource limited settings, but there hasn't been sufficient information on its prevalence, pattern and early treatment outcomes predictors. This study highlights the local prevalence of the disease, pattern and predictors of mortality and hence awareness of clinicians about the disease in resource limited settings.

Objective: The aim of this study was to assess the prevalence, pattern and early treatment outcomes predictors among patients admitted with Fournier's gangrene at the University of Dodoma Affiliated Teaching Hospitals.

Methodology: This was a hospital based prospective analytical study, involving 67 patients with Fournier's gangrene. The study was conducted from January 2021 to July 2023, where a convenient sampling technique was employed to recruit study participants. Data was managed and analysed using IBM SPSS version number 25, where continuous variables were presented using mean and standard deviation, whereas, categorical variables presented using frequency and percentage. Univariate and multivariate logistic regression were employed to assess association between independent and predictors variables. P value of less than 0.05 was considered statistically significant.

Results: Out of 6655 patients admitted in surgical ward during the study period, 67 patients had Fournier's gangrene giving a prevalence of 1%. The median age were 44 years with majority having age above 45 years (49.2%). Whereby, male were predominantly by 64 (95.5%). About two-third of the patient (65.7%) had no formal education and 33.3% had comorbidities. The most common source of infection was urogenital system (44.8%), followed by anorectal infections (14.9%). The commonest pattern of wounds were scrotal 48 (67.2%), penoscrotal 32 (47.8%) and perineum 25 (37.3%). All patients underwent surgical debridement with IV fluids and IV broad spectrum antibiotics. An infection originating from anorectal region {p < 0.01, (OR 17.7 (95% CI 1.99-157)}, presence commodities {p < 0.025, (OR 9.5 (95% CI 1.32-67.74)}, less than 2 frequency of serial surgical debridement {p < 0.009, (OR 17.63 (95% CI 2.03-153.8)} and wound pattern extending to abdominal wall {p < 0.006, (OR 16.2 (95% CI 2.19-119.15)} were significant predictors of mortality.

Conclusion: The prevalence of Fournier's gangrene in this study was 1%. The pattern of wounds was scrotal 45 (67.2%), penoscrotal 32 (47.8%) and perineum 25 (37.3%). The median length of hospital stay was 24 days and mortality rate of 11 (16%). Presence of comorbidies, the infection originate from anorectal region, less than 2 surgical debridement and pattern of wound extending to anterior abdominal wall were the independence predictors of mortality with p value < 0.05.

Introduction

Globally the mortality rate of Fournier's gangrene reported to be 20% to 40% [1] with other reported up to 88% mortality among 33 patients included in the study [2]. Fournier's gangrene is the polymicrobial rapidly progressing form of necrotizing fasciitis involving the perianal, perineum, external genitalia, or abdominal wall

---

fascia plane [3]. Founded by jean alfred Fournier's hence the name. The most common isolates are *Escherichia coli*, *Staphylococcus aureus*, *Saphylococcus pyogenes*, Enterococci species and pseudomonas species with *E. coli* reported to be commonest isolated organism [4-6].

It is reported to be associated with comorbidities as a predisposing factors and the most common mentioned includes Diabetic Mellitus (DM), Human Immunodeficiency virus (HIV), Hypertension, Chronic alcoholism, Chronic renal failure and prolonged steroid use [7,8]. The most clinical symptoms includes external genitalia severe pain or discomfort, fever, generalized body malaise and systemic symptoms such as nausea, vomiting, or confusion in severe cases and signs includes scrotal swelling, hyperaemic scrotal skin and discoloration, blisters, ulcers, foul smelling discharges or pus [9].

Patients with Fournier's gangrene can present with varying patterns of infection localization, including isolated scrotal involvement, penoscrotal involvement, exclusive penile involvement, or perineal involvement. The extension of the infection to the abdominal fascia planes indicates a more advanced or delayed presentation of the patient to the hospital [8].

The diagnosis of FG is mainly clinical with addition imaging and laboratory investigation may be useful for supporting the diagnosis, the USS will show gas or thickening of the scrotal wall due to inflammation and CT of the pelvis, and perineum may also be used to evaluate the extent of the disease [10].

The mainstay of treatment modalities includes early diagnosis, aggressive fluid resuscitation, single or serial debridement, and administration of broad-spectrum antibiotics [11]. However, urine deviation through suprapubic or urethra catherization, faecal deviation via colostomy, or recently advanced flexi seal deviation has been suggested [12]. The defect left after thoroughly SD is closed by primary or using other plastic reconstructive techniques such as split thickness skin grafting or the use of local flaps [13,14].

The global incidence of the disease is 1.6 cases to 33 cases per 100,000 populations [1]. In Africa and East Africa, the incidence and prevalence have not been described. The condition is associated with high mortality of up to 40% and high morbidity reported up to 80% [1,10] in terms of prolonged hospital stay and poor quality of life. Also, in Africa, the mortality reached up to 28% [8] and the most common causes of death include sepsis, multiple organ failure, respiration complication renal impairment, and hepatic for about 76%, 66%, 19.4%, and 5% respectively [15].

A remarkable increase in mortality was reported during the HIV era in Uganda [16]. As indicated in introductory remarks FG is third commonest at Iringa and fourth in DDRH given the ward proportion of four cases/months. One-third of these patients died; others were admitted for an average duration of sixty days. Surgical interventions such as skin graft and flaps and wound management strategies such as vacuum-assisted wound therapy (VAT) and Hyperbaric Oxygen Therapy (HBO) are underperformed and results in prolonged hospital stay in terms of morbidity according to our observation study. The prevalence, characteristics/ pattern, treatment modalities, and outcomes of these patients have not been described in our local settings.

Although the disease is rare in western countries [1] it is very common in local context settings. It is understudied and/or underreported, and the pattern, interventions, and outcomes is not well documented due to a lack of information. To fill the gap, this study aims to describe the prevalence, pattern, treatment modalities, and outcomes of this condition and to determine the most common factors that predict the outcomes in our setting.

Patients and Methods

A hospital-based cross-sectional study with prospective and retrospective approaches was done at UDOM-affiliated three Hospitals which are Iringa and Dodoma regional referral hospitals as well as Benjamin Mkapa Hospital. A population of adult patient aged 18-years and above admitted in surgical department at UDOM teaching hospital presenting with Fournier's gangrene (necrotizing fasciitis involving the perineum, penis scrotum, perianal area, and lower abdomen) were recruited from January 2021 to July 2023. The adult patient clinically diagnosed with Fournier's gangrene. A convenient sampling was used to enroll 67 patients meeting the inclusion criteria.

In this study, participants were recruited with clinical diagnosis of FG, upon recruitment were informed on the nature of the study, procedures and testing to be done. Patients who met inclusion criteria we reenrolled after informed consent diagnosis of FG made by clinical presentation where necessary imaging with USS was done to confirm the extension of the disease. Predisposing factors such as DM, HIV are obtained mainly from the patient history and examination for possible local predisposing factors and extraction of other information from patient files or ward registrars, the patient resuscitated when needed by IV fluids administration of broad spectrum antibiotics then when the patient became stable SD was done by the surgeons or registered doctor and where necessary urine or faecal deviation via urinary catheter or suprapubic cystostomy and colostomy were performed respectively.

The SD was done under emergency basis after optimization, in the operating theater the patient was given general anesthesia under endotracheal intubation and positioned in lithotomy, skin was prepared by using 10% povidone iodine solutions after proper draping

Lesso et al. Int Arch Urol Complic 2024, 10:090

• Page 2 of 12 •

the skin incision was made to all overtly necrotic skin, if there were no necrotic skin then the incision was performed over the most prominent area of the skin similar during an abscess drainage using scalpel number 21 and large curved mayor scissor starting from most severely involved area progressing outward until the health tissue encounter. For extended infection to lower abdominal wall planes, a transverse incision was made via crease, and pus drainage and all necrotic tissues were removed through the incision, for involvement of perianal and perineum the decision of colostomy was made. After thoroughly SD then Normal saline was used to irrigate to ensure maximum control of infection, wound was left open and packed with sterile gauze.

Patient who underwent diversion loop colostomy was optimized and under endotracheal intubation and general anesthesia in dorsal position a circumferential incision was made on the skin few centimeter above the left iliac fossa where the skin is redundant through subcutaneous, fascia then muscles the peritoneal was entered bluntly, colon (sigmoid) identified by presence of teniae coli and haustra then delivered in the wound about 4 cm to 6 cm above the abdominal wall using 3/0 vicryl the bowel was secured by four suture interrupted circumferential opposing the serosa and fascia.

A longitudinal incision through teniae coli was made to open lumen then four interrupted sub-cuticle and serosa of the bowel to facilitate the stoma maturation. Patients were observed in the wards in which repeated SD was performed when needed and simple primary closure or skin grafting was performed to the skin defect left after SD and duration of hospital stay was recorded after the discharge from the day of admission. All patients recruited were operated under endotracheal intubation with general anaesthesia. Preoperatively the patient placed on the lithotomy position and then shaving of lower abdomen, bilateral thigh, and genital area to reduce the risk of infection and adequate exposure, intravenous antibiotics was administered.

After aseptic skin preparation and draping, STSG was harvested from one or bilateral thighs depending on the size of the defect we harvested the graft using 0.0015-inch thickness amber knife, subsequent donor site was dressed using Vaseline gauze. The harvested graft was meshed and sutured with vicryl 3/0 around the scrotum or perineum to cover the defect, then urinary catheter was placed insitu before the dressing. For all cases involve the penile defect the penis was stretched at the graft application time and dressed to avoid wrinkles and avoid graft rejection, post-operative the patients were put on intravenous antibiotics for 72 hrs then continue with oral medications. The graft was put immobile for about 5-10 days then opened, when the take was there then the patient was discharged.

The study used a questionnaire for data collection. The tools were tested to check if they provided the intended data. Data was collected by self-administered questionnaire and three trained research assistants participated in collecting data stationed at IRRH, DRRH, and BMH. Data was checked for all technical errors before analysis and processing were commenced. Data was collected from patients and patient's files from the time of admission up to the discharge time and were exported to statistical package for social sciences (SPSS) version 26 for analysis. Frequencies and percentages were used to summarize the results. Continuous and categorical variables were summarized in mean ± standard deviation (SD) and percentages respectively. Binary logistic regression was used to determine the factors associated with treatment outcomes. All variables which were statistically significant with p value < 0.05 in Univariate analysis were put into multivariate analysis. $P < 0.05$ was regarded to be statistically significant.

Ethical Issues

The University of Dodoma's ethical research committee provided its approval and the medical officer designated for DRRH, IRRH, and BMH granted permission. (Reference number MA.84/261/60/21).

The study involved taking wound defect images before the debridement and after debridement for progression of the wound and healing after the treatment which may raise the ethical issues but the assurance of the confidentiality of the patient information was discussed with a patient and addressed. Patients had to read and understand the consent form and understand and sign it before enrolling in the study. Confidentiality was ensured by giving the patient numbers and not names during interview and management. Permission to conduct this study was obtained from three hospital administrations and the research proposal was presented to the University of Dodoma Ethical Committee for approval.

Results

This study recruited 67 patients with the median age of 44 years whereby the minimum and maximum age was 18 and 83 respectively. Majority of patients were in the age group of 30-49 years accounting 33 (49.2%) followed by 50 years above 26 (38.8%). 64 (95.5%) were male, 44 (65.7%) had no formal education and 23 (34.3%) with primary education (Table 1).

Clinical characteristics of patients with FG

Concerning clinical characteristics of the patients with FG, only 33.3% had comorbidities. These comorbidities included diabetes mellitus 9(13.4%), HIV/AIDS 9 (13.4%) and tuberculosis 2 (3%). Also, the patients had urogenital 30 (44.8%) as the source of infections followed by anorectal 10 (14.9%). The most common observed wound pattern was scrotum 45 (67.2%), Penoscrotal 32 (47.8%) and perineum 25 (37.3%) (Table 2).

Table 1: Socio-demographics characteristics of patients with FG (n = 67).

Variable	Frequency (n)	Percentage (%)
Age group (mean = 45.81 ± 15.746): Years		
18-29	8	11.9
30-49	33	49.3
50 and above	26	38.8
Sex		
Male	64	95.5
Female	3	4.5
Education		
Non-formal education	44	65.7
Primary education	23	34.3
Marital status		
Single	15	22.4
Married	52	77.6
Occupations		
Peasant	51	76.1
Self-employed	16	23.9
Insurance status		
Insurance	9	13.4
Cash	58	86.6

Source: Field data collected 2021/2022/2023

Table 2: Clinical characteristics of patients with FG (N = 67).

Variable	Frequency (n)	Percentages (%)
Source		
Anorectal	10	14.9
Urogenital	30	44.8
Trauma	6	9.0
Comorbidity (33.3%) (22/66)		
Diabetic mellitus	9	13.4
HIV/ AIDS	9	13.4
Tuberculosis TB	2	3.0
Wound pattern		
Scrotum	45	67.2
Penoscrotal	32	47.8
Penis	20	29.9
Perineum	25	37.3
Abdominal	19	28.4

Concerning clinical presentation of the patients with FG, the common presentations were foul smelling (85.1%), scrotal swelling (80.6%), scrotal pain (56.3%) and the least presentation being penile septic wound 7.5% and penile swelling (3%) (Figure 1).

The management modalities of patient with FG at UAH

All patients received IV fluid 67 (100%), surgical debridement was done to 61 (91.0%) mean number of surgical debridement was 1.3 ± 0.77 where the maximum number being 4 times. Cystostomy was done to 65 (97.0%) and skin grafting 5 (7.5%) (Table 3).

Early treatment outcomes of patient with FG at UAH

Concerning early treatment outcomes; longer duration of hospital stay was the most encountered outcome accounting 38 (56.7%) patients, the mean days of hospital stay was 24.12 ± 26.187 where by the minimum was one day, and the maximum was 124 days. Re operation was done to 15 (22.4%) and 11 (16.4%) death were recorded. However primary healing was observed in 3 (4.5%) and
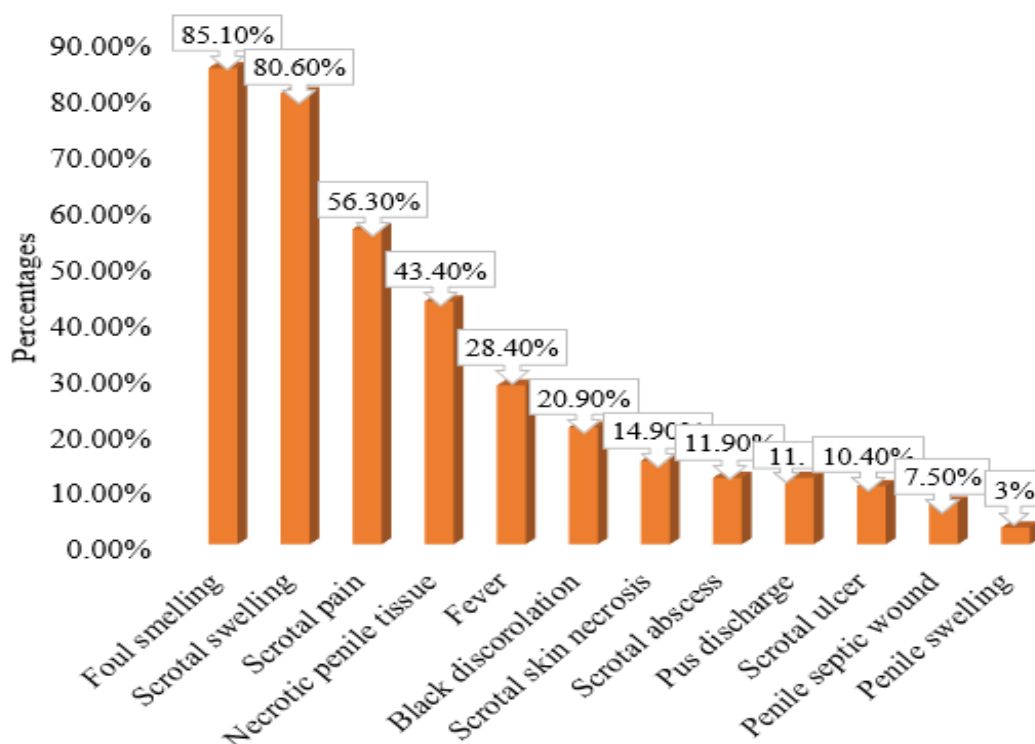
Lesso et al. Int Arch Urol Complic 2024, 10:090

• Page 4 of 12 •

Figure 1: Clinical presentations of the patients with FG.

Table 3: Treatment modalities of patients with FG (n = 67).

Treatment modality	Frequency (n)	Percentage (%)
Iv fluid	67	100
Antibiotics	66	98.5
Surgical debridement (mean 1.3 ± 0.779)	61	91.0
Urine deviation	65	97.0
Colostomy	13	19.4
Grafting	5	7.5

Table 4: Treatment outcomes of patients with FG.

Management outcome	Frequency (n)	Percentage (%)
ICU admission		
Yes	6	9
No	61	91
Duration of hospital stay (mean days = 24.13 ± 26.187)		
Short	29	43.3
Longer	38	56.7
Reoperation		
Yes	15	22.4
No	52	77.6
Death		
Yes	11	16.4
No	56	83.6

secondary healing/closure in 49 (73.1%) (Table 4).

Predictors of early outcomes of Fournier's gangrene

Predictors of unfavorable outcomes of Fournier's gangrene: In Univariate regression age of 50 years and above [COR = 6.19; 95% CI (1.19-32.46); p = 0.031] clinical presentation scrotal swelling [COR = 4.083; 95% CI (1.15-14.47); p = 0.029], wound pattern Penoscrotal [COR = 5.25; 95% CI, (1.51-18/201); p = 0.005] and perineum

[COR = 18; 95% CI (2.22-145.8); p = 0.007] and patients with comorbidities [COR = 6.296; 95% CI, (1.3-30.42); p = 0.022] were statistically significant predictor of unfavorable outcomes of Fournier's gangrene (Table 5).

In multivariate regression only age above 50 years p-value of 0.035 and AOR of 4.3 (95% CI, 1.2-31.3), wound pattern- perineum [AOR = 26.9; 95% CI, (2.53-285); p = 0.006] and patients with comorbidities [AOR

Table 5: Predictors of unfavorable outcomes among patients with Fournier's gangrene.

Variables	Management outcomes		Univariate regression		Multivariate regression	
	Favorable (%)	Unfavorable (%)	P value	COR (95% CI)	P value	AOR (95% CI)
Age in years						
18-29	5 (62.5)	3 (37.5)	Ref			
30-49	7 (26.9)	19 (73.1)	0.077	4.52 (0.849-24.1)	0.151	4.36 (0.58-32.51)
50 and above	7 (21.2)	26 (78.8)	**0.031**	6.19 (1.19-32.46)	**0.035**	4.3 (1.2-31.3)
Source of infection						
Anorectal						
Yes	1 (10)	9 (90)	0.192	4.154 (0.489-35.3)		
No	18 (31.6)	39 (68.4)	Ref			
Urogenital						
Yes	12 (40)	18 (60)	0.061	2.857 (0.951-8.58)		
No	7 (18.9)	30 (81.1)	Ref			
Trauma						
Yes	1 (16.7)	5 (83.3)	0.514	2.093 (0.22-19.2)		
No	18 (29.5)	43 (70.5)	Ref			
Clinical presentation						
Scrotal swelling						
Yes	12 (22.2)	42 (77.8)	**0.029**	4.083 (1.15-14.47)	0.059	3.56 (0.95-13.29)
No	7 (53.8)	6 (46.2)	Ref			
Necrotic penile tissues						
Yes	5 (17.2)	24 (82.8)	0.084	2.8 (0.871-8.99)		
No	14 (36.8)	24 (63.2)	Ref			
Management						
Cystostomy						
Yes	17 (26.2)	48 (73.8)	0.999	undefined		
No	2 (100)	0 (0.0)	Ref			
Colostomy						
Yes	0 (0.0)	13 (100)	0.99	undefined		
No	19 (35.2)	35 (64.8)	Ref			
Grafting						
Yes	0 (0.0)	5 (100)	0.999	undefined		
No	19 (30.6)	43 (69.4)	Ref			
Pattern						
Scrotum						
Yes	11 (24.4)	34 (75.6)	0.312	1.77 (0.586-5.322)		
No	8 (36.4)	14 (63.6)	Ref			
Penoscrotal						
Yes	4 (12.5)	28 (87.5)	**0.005**	5.25 (1.51-18/201)	0.303	2.29 (0.47-11.08)
No	15 (42.9)	20 (57.1)	Ref			
Penis						
Yes	3 (15)	17 (85)	0.124	2.925 (0.75-11.48)		

Lesso et al. Int Arch Urol Complic 2024, 10:090

• Page 6 of 12 •

No	16 (34)	31 (66)	Ref			
Perineum						
Yes	1 (4)	24 (96)	**0.007**	18 (2.22-145.8)	**0.006**	26.9 (2.53-285)
No	18 (42.9)	24 (57.1)	Ref			
Abdominal						
Yes	0 (0.0)	19 (100)	0.999	Undefined		
No	19 (39.6)	29 (60.4)	Ref			
Peri anal						
Yes	0 (0.0)	19 (100)	0.998	Undefined		
No	19 (39.6)	29 (60.4)	Ref			
Days of symptoms						
1-7 days	14 (34.1)	27 (65.9)	Ref			
8 and above	5 (19.2)	21 (80.8)	0.192	2.178 (0.67-7.01)		
Comorbidities						
Yes	2 (9.1)	20 (90.9)	**0.022**	6.296 (1.3-30.42)	**0.022**	8.75 (1.37-55.9)
No	17 (38.6)	27 (61.4)	Ref			
Diabetes mellitus						
Yes	2 (22.2)	7 (77.2)	0.662	1.45 (0.27-7.71)		
No	17 (29.3)	41 (70.7)	Ref			
HIV						
Yes	0 (0.0)	9 (100)	0.999	undefined		
No	19 (32.8)	39 (67.2)	Ref			

of 8.75; 95% CI, (1.37-55.9); p = 0.022] were predictors of adverse/unfavorable outcomes among patients with Fournier's gangrene (Table 5).

Predictors of mortality among patients with Fournier's gangrene

In Univariate logistic regression anorectal as source of infection [OR = 8.5; 95% CI (1.89-38.1); p = 0.005], trauma as a source of infection with [OR = 6.63; (95% CI 1.135-38.7); p = 0.036], comorbidities [OR = 4.67; (95% CI 1.19-18.3); p = 0.027], HIV/AIDS [OR = 5.8; (95% CI 1.26-27) p = 0.024], less than 2 surgical debridement [OR = 6.62; (95% CI 1.14-38.7); p = 0.036], wound pattern-perineum [OR = 6.12; (95% CI 1.44-25.92); p = 0.014] and pattern of wound-abdominal [OR = 10.9; (955 CI 2.48-48); p = 0.002] were statistically significant associated with mortality (Table 6).

However, in the multivariate regression model only anorectal as source of infection [aOR = 17.7; (95% CI 1.99-157); p = 0.010], commodities [aOR = 9.5; (95% CI 1.32-67.74); p = 0.025], less than 2 surgical debridement [aOR = 17.63; (95% CI 2.03-153.8); p = 0.009] and wound pattern-abdominal [OR = 16.2; (95% CI 2.19-119.15); p = 0.006] were statistically significant associated with mortality (Table 6).

Discussion

Prevalence of Fournier's gangrene

The prevalence of FG in this study setting was 1% estimated as 1000 cases per 100,000 population contrary to another population-based study which estimated the prevalence to be around 1.6 to 3.3 cases per 100,000 population [1] A. The study recruited a significant number of patients in a limited time of the study leading to higher incidence and hence proving beyond the doubt that FG is no longer a rare disease in our local area.

Another study reported the annual incidence of FG to range from 0.6 to 3.3 cases per 100,000 males and 0.001 to 0.4 cases per 100,000 females [17] different from these findings where the estimate is 100 cases per 100,000 population reasons being this current study utilizes prospective approaches with acceptable chances of missing the patient. Based on our knowledge this is the first prospective approach with the highest reported prevalence in this local area.

Pattern of patients with Fournier's gangrene

The condition is reported to individuals of any age but there is some variation in its presentation and underlying causes based on age groups. Studies have explored the relationship between age and Fournier's gangrene to better understand the impact of age on the disease [9,18]. The older adults seem to be more affected with the disease with significant mortality in this age group and this may be attributed by age-related comorbidities, weakened immune system and decrease tissue perfusion, making older individuals more susceptible to infection. While in younger adults the disease is relatively less common, it can still occur and in this age group the disease is often associated

Table 6: Logistic regression of predictors of mortality among patients with FG.

Variable	Death		Univariate regression		Multivariate regression	
	No (%)	Yes (%)	P value	COR (95% CI)	P value	AOR (95% CI)
Age (Years)						
18-29	6 (75)	2 (25)	Ref			
30- 49	31 (93.9)	2 (6.1)	0.134	5.167 (0.6-44.2)		
50 and above	19 (73.1)	7 (26.9)	0.914	0.91 (0.15-5.58)		
Source- anorectal						
Yes	5 (50)	5 (50)	**0.005**	8.5 (1.89-38.1)	**0.010**	17.7 (1.99-157)
No	51 (89.5)	6 (10.5)	Ref			
Source-urogenital						
Yes	27 (90)	3 (10)	0.212	0.40 (0.097-1.68)		
No	29 (78.4)	8 (21.6)	Ref			
Source- trauma						
Yes	3 (50)	3 (50)	**0.036**	6.63 (1.135-38.7)	0.060	10.53 (0.90-122.9)
No	53 (86.9)	8 (13.1)	Ref			
Comorbidities						
Yes	15 (68.2)	7 (31.8)	**0.027**	4.67 (1.19-18.3)	**0.025**	9.5 (1.32-67.74)
No	40 (90.9)	4 (9.1)	Ref			
Diabetic mellitus						
Yes	6 (66.7)	3 (33.3)	0.156	3.12 (0.64-15.1)		
No	50 (86.2)	8 (13.8)	Ref			
HIV/AIDS						
Yes	5 (55.6)	4 (44.4)	**0.024**	5.8 (1.26-27)	0.780	1.48 (0.09-2365)
No	51 (87.9)	7 (12.1)	Ref			
Surgical debridement						
Yes	53 (86.9)	8 (13.1)	Ref			
No	3 (50)	3 (50)	**0.036**	6.62 (1.14-38.7)	**0.009**	17.63 (2.02-153.8)
Colostomy						
Yes	11 (84.6)	2 (15.4)	Ref			
No	45 (83.3)	9 (16.7)	0.911	0.9 (0.171-4.82)		
Grafting						
Yes	4 (80)	1 (20)	Ref			
No	52 (83.9)	10 (16.1)	0.823	0.77 (0.07-7.62)		
Pattern- Penoscrotal						
Yes	24 (75)	8 (25)	0.08	3.55 (0.85-14.83)		
No	32 (91.4)	3 (8.6)	Ref			
Pattern- perineum						
Yes	17 (68)	8 (32)	**0.014**	6.12 (1.44-25.92)	0.054	4.99 (0.97-25.5)
No	39 (92.9)	3 (7.1)	Ref			
Pattern- abdominal						
Yes	11 (57.9)	8 (42.1)	**0.002**	10.9 (2.48-48)	**0.006**	16.2 (2.19-119.15)
No	45 (93.8)	3 (6.3)	Ref			

Lesso et al. Int Arch Urol Complic 2024, 10:090

• Page 8 of 12 •

with risk factors such as immunosuppression such as diabetes and HIV and others such as trauma or recently surgical procedures.

Patients recruited in this study had mean age of 45.81 ± 15.746 years and majority of patients were in the age group of 45 years and above similar to different studies for stance Jiménez-Pacheco, et al. [19] reported the mean age among patient recruited to be 44.3 years. This could be explained by the fact that as age increases the immunity system becomes weaker predisposing an individual to infections, also with increase in age the risk for diseases such as hypertension and diabetes mellitus. This is similar to other studies which reported FG being more common among individuals with advanced age years [7,8,12,20] and other studies from Nigeria Nepal and other countries where all patients reviewed were males with mean age of 57.4 years; majority were +50-years [10,21-23].

Majority of patients had no Comorbidities in other hand the common comorbidities were diabetes mellitus and HIV/AIDS. These findings with slight differences were found to be similar to the study done in northern Tanzania [7]. The difference from this study was that majority of the patients had nocomorbidity and HIV was the commonest followed by Diabetes mellitus. This might be because of the difference in mean age of the studied patients where in this study majority had younger age with the mean of 45 years this may explain the reason of little observed Commodities in current study. Another study reported similar findings concerning predisposing factors for FG, the study reported a significant percentage (29%) of the patients with unknown predisposing factors following clinical evaluation. The number of patients with an idiopathic predisposing factor is worthy of note as it varies widely in literature on Fournier's gangrene. The author cited karthikeyan and kumarasenthil who found 17% as idiopathic, Sockkalingam, et al. in Coimbatore, India (29.8%) as idiopathic. Therefore we suggest that idiopathic FG should be put in mind so as to diagnose this problem earlier for better outcomes [23-25].

The relationship between Fournier's gangrene and sex is intricate and involve multifactorial and there are several factors that has been explained to male predominant of the disease such as anatomical differences in which males have a distinct anatomy that predispose them to FG for instance the scrotum provides a warm and moist environment which can potentiate the growth of bacteria in addition the male urethral is longer which make it prone to stricture and also urinary tract infection which also is one of the independent variables for development of Fournier's gangrene.

This study found FG being almost exclusively a male disease (95.5%) similar to a retrospective study which conducted at KCMC kilimanjaro in which all patients recruited in the study were males [7]. The

specific patterns of wound presentation in relation to this condition have not been extensively studied. The identification and understanding of wound patterns associated with Fournier's gangrene are crucial for early diagnosis and timely intervention. It is worth noting that the wound patterns observed in Fournier's gangrene can differ depending on the stage of the infection and the underlying devoting factors. For instance, in the early stages, the wound may appear as a localized cellulitis or abscess. As the infection progresses, the wound may rapidly evolve into necrotic tissue with the characteristic signs of gangrene.

The most common observed wound pattern in this study was scrotum 67.2%, Penoscrotal 47.8% and perineum 37.3%. Also, concerning clinical presentation of the patients with FG, the common presentations were foul smelling (85.1%), scrotal swelling (80.6%), scrotal pain (56.3%) and the least presentation being penile septic wound 7.5% and penile swelling (3%). This findings was not far from the study done in northern Tanzania and other countries including Nigeria, Kenya Ethiopia which found that the presentations include scrotal/penile pain, fever, scrotal/penile swelling and discharge [19,21-23,26-32]. Studies reported the most common sites affected to be scrotum and or penis (89.3%), perineum and abdomen [3,17-19].

Involvement of the scrotum, penis, thigh, groin, and anterior abdominal wall in this study indicates significant delay and late presentation of the patients to hospital as reported by several scholars [11,12,19-22], the reason to this may be because majority of the patients has no health insurance , are from rural, are with advanced age and have either non formal education or primary school level which may be the reason to poor utilization of health services leading to complicated conditions. This disease seems to be linked with lower socio-economic status because majority of the patients are with advanced age, with no education or primary level, peasants and are from rural areas.

To better comprehension, the wound patterns associated with Fournier's gangrene, further research and clinical studies are needed. These studies could precisely include evaluation of wound characteristics, imaging studies, and histopathological analysis of tissue samples which was inadequate covered in this study. Such investigations would provide valuable comprehension into the pathophysiology of Fournier's gangrene and potentially assist in expanding more effective diagnostic and treatment strategies.

Treatments modalities and early outcomes of patients with Fournier's gangrene

The mainstay of treatment for Fournier's gangrene is early and thorough surgical debridement [3]. The objective is to eliminate all necrotic tissue while maintaining the borders of the wounds. Depending on

the severity of the infection, this may include a number of debridement methods, ranging from straightforward drainage to more involved surgical excision. To fix the exposed tissue flaws in severe cases, reconstructive surgery like scrotoplasty, vascularized rotation flaps, and grafting may be required.

Targeting both aerobic and anaerobic organisms known to be linked to polymicrobial conditions in the perineal area is the objective of empirical antibiotic coverage. The initial therapy frequently consists of a combination of anaerobic coverage and intravenous antibiotics, such as carbapenem or a beta-lactam/beta-lactamase inhibitor. Culture and sensitivity test findings should be taken into consideration before switching to an antibiotic regimen.

All patients in this study received IV fluid, surgical debridement was done in (91%) mean number of surgical debridement was 1.3 ± 0.77 where the maximum number being 4 times. Urine deviation was done to (97%) patients and skin grafting only to (7.5%). Regardless this intensive management, majority of patients ended up with undesired outcomes including longer duration of hospital stay with the mean days of hospital stay of 24.12 ± 26.187. 11 (16.4%) death were recorded. However, primary healing was observed in (4.5%) and secondary healing/secondary closure in (73.1%).

These study findings were not far from the study done in Northern Tanzania where all patients received a combination treatment of wound debridement, antibiotics, fluid replacement, and analgesics and wound daily dressing. However, in this study blood transfusion was given to 64% of all the patients. Skin grafting was done to seven patients where as this study was done to five patients. The average hospital stays for patients with FG admitted at KCMC was 25 days like similar to this study being 24. Also the author reported that majority of the patients stayed at hospital longer than expected [7]. This was also, similar to the experiences by Aliyu, et al. [21] and Chalya, et al. [5] who reported an average in hospital stay of 4 weeks in their experience with management.

Management and outcomes were similarly reported by different studies including that of Nigeria which reported that, after the initial immediate resuscitation with IV fluid broad-spectrum antibiotics were commenced, wound care that involved immediate debridement and dressing with povidone 10%. Of the study participants, complete wound healing by secondary closure was achieved in majority of participants. Also, skin grafting was applied in few patients with penile skin defect [6].

Several authors reported that 10% povidone and hypertonic saline sitz baths as dressing is rewarding to patients with Fournier's gangrene. Authors argue that the hypertonic saline through its high osmotic gradient controls exudation and inhibits bacterial proliferation, while the povidone-iodine is bactericidal with antimicrobial activity against gram-positive and gram-negative bacteria including fungi and protozoa [1,9,11,12,14,23].

Further research in the field of Fournier's gangrene is crucial to finer understand the underlying mechanisms, refine treatment protocols, and make better patient outcomes. Future studies may explore novel treatment modalities, such as hyperbaric oxygen therapy or the use of advanced wound care procedures, which could imaginably impact mortality rates and overall prognosis.

Mortality rates linked with Fournier's gangrene differ depending on several factors, such as the underlying cause, the patient's overall health, and the promptness of diagnosis and treatment. Early identification and aggressive management are critical in revamping outcomes.

Several studies have reported the mortality rates and prognostic factors associated with Fournier's gangrene. While the specific mortality rates may vary among studies, it is generally recognized as a high-risk disease with a significant mortality rate. Mortality rates reported in the literature range from 3% to as high as 45% [1], relating with the study population and severity of the disease.

Mortality of 16.4% as obtained in this study was similar to the findings of Mabula, et al. [7] where reported to be 16% however, higher mortality rates have been reported by Oymacı, et al. (18.8%), Ersay, et al. (22.8%), and Benjelloun, et al. in Nigeria. The lower mortality rate in this study may be attributed to the population, which was more of younger age, and had no comorbidity explaining the survival of the initial septic state probable due to higher immunity in a population that have been exposed to chronic and recurrent microbial infection.

The study done in south Africa, similarly reported the mean hospital length of stay (LoS) being 26 days, overall mortality rate was 11.4% and 13.6% patients were identified as requiring ICU admission based on the need for organ support [23].

However, the review of studies reveals that there is improvement in management of Fournier's gangrene due to recorded reduced mortality from studies done in past two decades like that of turkey with mortality of 40% [24] and others done in India reported the mortality of more than 24% [4] compared to the current study with mortality of 16% and that of Northern Tanzania with mortality of 17% [6].

Patient's characteristics and mortality among patients with Fournier's gangrene

It is important to understand that the association

between these patient characteristics and mortality in Fournier's gangrene can vary among different studies, and the strength of the associations may be distinguishable. Additionally, the presence of one or more risk factors does not necessarily foresee individual patient outcomes with conclusiveness, as the disease progression and response to treatment can be highly variable. Therefore, a comprehensive and multidisciplinary approach is crucial for managing Fournier's gangrene effectively, considering the patient's overall clinical condition and personalized treatment needs.

This study found that patients with anorectal as source of infection are 17 times at risk of mortality, those with less than 2 surgical debridement and wound pattern extending to abdomen being 17 times at risk, and comorbidity being 9 times at risk of mortality compared to their counterpart. This may be because patients with comorbidities as reported in this study which are DM and HIV with lowered immunity leading to death. Also, abdominal extension of the disease may reflect the delayed treatment hence leading to mortality among these patients [6].

These findings was similar to the study done in Northwestern Tanzania in Mwanza which found that advancing age > 60 years, systemic inflammatory response syndrome on admission, diabetes mellitus, extension of infection to the abdominal wall and low CD4 count were the predictors of mortality [9]. The study done in India and other studies also reported that repeated surgical debridement and broad spectrum antibiotics were the gold standard management in reducing mortality among patients with Fournier's gangrene [4,8,19].

This study is contrary to the study done in south Africa reported no significant association between comorbidities, including HIV and Diabetes mellitus, number of surgical debridement and pattern of the wound [23]. Although in this study the mortality was reported to be higher among patients with DM and HIV. The authors cemented the findings by arguing that high mortality among referred patients may reflect a more severe form of the illness among transferred patients, lack of critical care facilities at the transferring hospitals, or delays in management and/or treatment.

Conclusion

Fournier's gangrene is not rare in the settings. The findings from this study showed that, large number of patients with Fournier's gangrene have unknown predisposing factors that they present with no comorbidities.

The most common presentation includes foul smelling, scrotal swelling, scrotal pain, and the least clinical presentation was penile swelling.

IV fluid repeated surgical debridement, aggressive wound dressing, and broad-spectrum antibiotics and Cystostomy are the good rewarding management to patients with Fournier's gangrene.

Skin grafting, rotational flaps and scrotoplasty are infrequently performed in our settings as surgical modalities to minimize morbidity in terms of prolonged hospital stays.

Mortality among patients with Fournier's gangrene is still high, also longer duration of hospital stay is among the major morbidity of Fournier's gangrene.

Presence of Comorbidity, less than 2 surgical debridement, anorectal source of infection, and extension of the wound to abdominal wall are the predictors of mortality among patients with Fournier's gangrene.

Recommendations

It is recommended that it appears FG is no longer a rare disease in settings as reported in previous literature: Development of a standard management protocol to reduce the morbidity and mortality in local area.

To emphasize the implementation of surgical interventions with the aim to reduce prolonged hospital stays as it seems procedure such as skin Grafting, rotational flaps and scrotoplasty was not routine performed in most of the patient only secondary closure/healing was the main modalities of the defect closure.

Study Limitations and Mitigations

The results may have been affected because the study only diagnoses patients who were already diagnosed with comorbidities such as DM, HTN, or CKD. We were unable to confirm new cases of these diseases through measurement.

Strengths of the Study

We believe this is the first study in our local area to follow the patients in both prospective and retrospective approaches and hence the results are more reliable compared to other in which majority utilize only retrospective approaches.

Acknowledgements

References

1. Sorensen MD, Krieger JN (2016) Fournier's gangrene: epidemiology and outcomes in the general US population. Urol Int 97: 249-259.

2. Stone H (1999) FG with 76% Mortality.pdf. Synerg necotizing fascitis.

3. Yanar H, Taviloglu K, Ertekin C, Guloglu R, Zorba U, et al. (2006) Fournier's gangrene: Risk factors and strategies for management. World J Surg 30: 1750-1754.

4. Elliott D, Kufera JA, Myers RAM (2000) The microbiology of necrotizing soft tissue infections. Am J Surg 179: 361-366.

5. Gedik E, Girgin S, Uluǧ M, Celen MK, Ayaz C (2009) The evaluation of microbiology and Fournier's gangrene severity index in 27 patients. Int J Infect Dis 13: e424-e430.

6. Maitra TK, Ekramullah M, Shabnam N, Roy S, Mondol SK (2017) Clinical & microbiological profile of fourniers gangrene in a tertiary care hospital in Bangladesh : A prospective observational study. Bangladesh Crit Care J 5: 28-32.

7. Mabula P, Nyongole OV, Mteta KA (2016) Pattern of presentation and outcome of patients treated for Fournier's gangrene at kilimanjaro christian medical centre in moshi, Tanzania. Tanzan J Health Res 18.

8. Chalya PL, Igenge JZ, Mabula JB, Simbila S (2015) Fournier's gangrene at a tertiary health facility in northwestern Tanzania: A single centre experiences with 84 patients. BMC Res Notes 8: 481.

9. Verma S, Kala S, Rai S, Sayana A (2012) Evaluation of the utility of the Fournier's gangrene severity index in the management of Fournier's gangrene in North India: A multicentre retrospective study. J Cutan Aesthet Surg 5: 273-276.

10. Ullah S, Khan M, Asad Ullah Jan M (2009) Fournier's gangrene: A dreadfull disease. Surgeon 7: 138-142.

11. Bruketa T, Majerovic M, Augustin G (2015) Rectal cancer and Fournier's gangrene-current knowledge and therapeutic options. World J Gastroenterol 21: 9002-9020.

12. Mallikarjuna MN, Vijayakumar A, Patil VS, Shivswamy BS (2012) Fournier's gangrene: Current practices. ISRN Surg 2012: 942437.

13. Decastro BJ, Morey AF (2002) Fibrin sealant for the reconstruction of Fournier's gangrene sequelae. J Urol 167: 1774-1776.

14. Weinfeld AB, Kelley P, Yuksel E, Tiwari P, Hsu P, et al. (2005) Circumferential negative-pressure dressing (VAC) to bolster skin grafts in the reconstruction of the penile shaft and scrotum. Ann Plast Surg 54: 178-183.

15. El Qushayri AE, Khalaf KM, Dahy A, Mahmoud AR, Benmelouka AY, et al. (2020) Fournier's gangrene mortality: A 17-year systematic review and meta-analysis. Int J Infect Dis 92: 218-225.

16. Ngugi P, Magoha G, Nyaga P (2014) Fournier's ganrene in the HIV era. Afr Health Sci 14: 1063-1068.

17. Shyam DC, Rapsang AG (2013) Fournier's gangrene. Surgeon 11: 222-232.

18. Thwaini A, Khan A, Malik A, Cherian J, Barua J, et al. (2006) Fournier's gangrene and its emergency management. Postgrad Med J 82: 516-519.

19. Jiménez Pacheco A, Arrabal Polo MÁ, Arias Santiago S, Arrabal Martín M, Nogueras Ocaña M, et al. (2012) Fournier gangrene: Description of 37 cases and analysis of associated health care costs. Actas Dermosifiliogr 103: 29-35.

20. Basukala S, Khand Y, Pahari S, Shah KB, Shah A (2022) A rare case of retroperitoneal extension in Fournier's gangrene: A case report and review of literature. Ann Med Surg 77: 103595.

21. Aliyu S, Ibrahim AG, Ali N, Waziri AM (2013) Fournier's gangrene as seen in university of maiduguri teaching hospital. ISRN Urol 2013: 673121.

22. Agwu NP, Muhammad AS, Abdullahi A, Bashir B, Legbo JN, et al. (2020) Pattern and outcome of management of Fournier's gangrene in a resource-constraint setting. Urol Ann 12: 248-253.

23. Oyelowo N, Ahmed M, Lawal AT, Sudi A, Tolani AMMA, et al. (2021) Fournier's gangrene: Presentation and predictors of mortality in Zaria, Nigeria. Ann Afr Med 20: 105-110.

24. Ugwumba FO, Nnabugwu II, Ozoemena OFN (2012) Fournier's gangrene-Analysis of management and outcome in south-eastern Nigeria. South African J Surg 50: 16-19.

25. Chia L, Cianflone NC (2018) Emergence of multi-drug-resistant organisms (MDROs) causing fournier's gangrene. J Infect 76: 38-43.

26. Zagli G, Cianchi G, Degl'Innocenti S, Parodo J, Bonetti L, et al. (2011) Treatment of fournier's gangrene with combination of vacuum-assisted closure therapy, hyperbaric oxygen therapy, and protective colostomy. Case Rep Anesthesiol 2011: 430983.

27. Parkash S, Gajendran V (1984) Surgical reconstruction of the sequelae of penile and scrotal gangrene: A plea for simplicity. Br J Plast Surg 37: 354-357.

28. Gul A, Aykan S (2017) Management of fournier's gangrene secondary to traumatic urethral catheterisation. Van Med J 24: 185-187.

29. Sockkalingam VS, Subburayan E, Velu E, Rajashekar ST, Swamy AM (2018) Fournier's gangrene: Prospective study of 34 patients in South Indian population and treatment strategies. Pan Afr Med J 31: 110.

30. Zhang N, Yu X, Zhang K, Liu T (2020) A retrospective case series of Fournier's gangrene: Necrotizing fasciitis in perineum and perianal region. BMC Surg 20: 259.

31. Nnabugwu II, Onumaegbu OO, Okolie LT (2021) Fournier's gangrene: A retrospective review of management outcomes and seasonal variations of clinical presentation. African J Urol 27.

32. Elsaket AE, Maharajh S, Urry RJ (2018) The presentation, management and outcomes of Fournier's gangrene at a Tertiary urology referral centre in South Africa. South African Med J 108: 671-676.