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A review on Fournier's Gangrene

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ABSTRACT

Fournier's gangrene is an uncommon form of necrotizing fasciitis that affects the perineum, external genitalia, or intimate areas. Males are more likely to contract the illness and conditions such as HIV, diabetes, alcoholism, and other immune-compromised states are risk factors for its development. A significant death rate of 20-30% is related to the disease's aggressive course. A greater clinical understanding of Fournier's gangrene is also required, with an emphasis on early diagnosis and control, as a result of the population's aging trend and incidence of diabetes. This review intends to highlight the pertinent studies on Fournier's gangrene, especially the many prognostic markers and treatment options.

Despite advancements in medicine and surgery, Fournier's gangrene is a urological emergency with a high death rate. Because of the infection's aggressiveness, early detection is essential for prompt surgical management. Emergent therapies are not frequently used in the treatment of Fournier's gangrene due to the conflicting findings of the available research and the dearth of high-quality evidence surrounding them. Based on current recommendations, a management pathway is suggested since the absence of a defined care pathway may impede the effective management of Fournier's gangrene.The main management strategies for Fournier's gangrene are prompt surgical debridement and immediate broad-spectrum antibiotic therapy. Some parts of the literature support the use of additional therapies like hyperbaric oxygen and vacuum- aided closure while disputing others. The use of these potential new medicines is restricted to individuals who are unresponsive to standard management due to the lack of randomized controlled research.

KEYWORDS:Surgical debridement, Fournier's gangrene, necrotizing fasciitis, and the Fournier's gangrene severity index (FGSI).

I. INTRODUCTION

A deadly, necrotizing, idiopathic condition with gangrene of the male genitalia was described by Baurienne in 1764. The eponymous condition is most frequently linked to the venereologist from Paris, Jean Alfred Fournier. In a series of five young guys, he described idiopathic, fulminant gangrene of the scrotum and penis in his 1883 paper (1). Since then, our knowledge of the etiology and pathophysiology of this syndrome has expanded, revealing a more indolent nature and, in the vast majority of instances, a recognizable cause. In contrast to prior descriptions, it has been noted that women and children can also contract the condition, but less frequently than young males.

In order to effectively treat Fournier's gangrene, a multidisciplinary team approach is used along with the three key principles of urgent hemodynamic stabilization, critical surgical debridement, and antibiotic therapy.

DEFINITION

Type I necrotizing fasciitis of the perineal, perianal, or vaginal areas is known as Fournier's gangrene (figure 1). Over time, Fournier's gangrene has gone by a variety of names, including "streptococcus gangrene,""synergistic necrotizing cellulitis," and "peri-urethral phlegmon," all of which pertain to a

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deadly, infectious, and debilitating soft tissue illness (2).

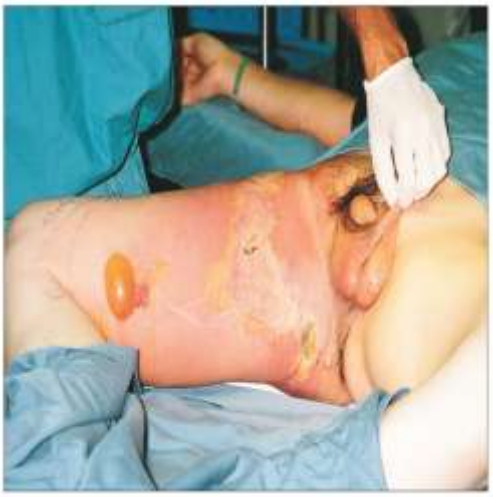

Figure1

EPIDEMIOLOGY

According to a recent epidemiological study, Fournier's gangrene is a relatively rare illness, accounting for only 0.02% of hospital admissions, but its incidence is rising as the population ages and diabetes prevalence rises. A peak in incidence occurred at the age of 50, when there were 3.3 instances per 100,000 males per year, according to Sorensen et al (3). 1726 cases were reviewed retrospectively, and it was shown that between 1989 and 1998, there were, on average, 97 cases every year (4).

ETIOLOGY

Fournier's gangrene was once thought to be an idiopathic process by J.A. Fournier; however, the ailment is rarely really idiopathic, and in the majority of instances, an underlying cause may be found with careful observation and research. A common source of necrotizing fasciitis is an infection of the ano-rectum (30–50%), uro-genitalia (20–40%), or genital skin (20%). (4). It has been suggested in the literature that trauma to these areas, whether purposeful or accidental, may be a cause of infection. It has been demonstrated that a number of risk factors for Fournier's gangrene include diabetes, long-term alcohol use, the human immunodeficiency virus (HIV), lymphoproliferative disorders, chronic steroid usage, and cytotoxic medicines (5). The fundamental cause of all of these issues is weakened host defenses, which create an environment that's conducive to infection.

PREDISPOSING FACTORS

Human Immunodeficiency Virus

The Human Immunodeficiency Virus (HIV) is a retrovirus that invades CD4+ cells, the essential building blocks of the immune response, and damages the host's immune system. As a result, it is not surprising that these patients are more prone to opportunistic infections. It follows that it makes sense to suggest that these patients are more likely to acquire Fournier's gangrene than an HIV-negative group. In 4% of individuals with Fournier's gangrene, HIV has been noted as a concomitant condition (10). Numerous studies have shown that since the start of the HIV epidemic, cases of Fournier's gangrene have significantly increased in frequency (11).Fournier's gangrene has been described as the first sign of HIV infection in a small number of instances (11, 12). It should be noted that despite the possibility of Fournier's gangrene being increased by co-occurring HIV, neither the course of the disease nor the prognosis of the patient appears to be significantly impacted. Early detection and prompt treatment commencement have been emphasized as the basic principles that should be followed to achieve a positive result. In terms of the prognosis for patients who are HIV-positive, the same rules apply.

Diabetes

Patients with systemic diseases like diabetes mellitus are at an increased risk due to Fournier's gangrene's persistent nature, which threatens the immune-competent host. Through its deleterious effects on cellular adhesion, chemotaxis, and phagocyte activity, sustained hyperglycemia weakens host immunity (6). Diabetes has been identified as a risk factor for Fournier's gangrene in 32% to 66% of cases (6). An analysis of Fournier's gangrene cases in diabetics has revealed that this co-morbid condition affects the way the soft-tissue infection presents clinically.The persistent nature of Fournier's gangrene, which threatens the immune-competent host, puts patients with systemic disorders like diabetes mellitus at an increased risk. Sustained hyperglycemia reduces host immunity due to its harmful effects on cellular adhesion, chemotaxis, and phagocyte function (6). In 32% to 66% of instances of Fournier's gangrene, diabetes has been recognized as a risk factor (6). This co-morbid condition has an impact on how the soft-tissue infection manifests clinically, according to a review of Fournier's gangrene cases in diabetics.

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PATHOPHYSIOLOGY

The presence of a localized infection near the portal of entry, as shown in Table 1, allows normally commensal bacteria, such as Staphylococcus spp. and Escherichia coli, to enter the perineum. The infectious organisms, in essence, cause an inflammatory response, resulting in obliterative endarteritis of the surrounding vasculature. Following thrombosis of the nutrient vessels, there is a reduction in blood flow to this region. This causes tissue ischemia. The tissues' reduced oxygen tension promotes the growth of anaerobic bacteria, fascial necrosis, and digestion.

	Uro-genital	**Ano-rectal**	**Cutaneous**	**Traumatic**
Men(26,50-58)	Prostatic massage, urethral strictures, calculi	Abscesses in the peri-anal, peri-rectal, ischio-rectal regions, anal fissures, diverticulitis, appendicitis, colonic malignancy (50), and rectal cancer	Scrotal pressure ulceration (51), suppurative hidradenitis, poor perineal hygiene, e.g. paraplegics	Prostatic biopsy (52), vasectomy (53), diathermy for genital warts, anal perforation (foreign body), a penile prosthesis (54), genital piercings (55), penile injection (56), steroid enemas (57), urethral instrumentation
Women(58)	Bartholin's abscess, vulval abscess, septic adortions		HPV lesions(58)	Episiotomy,hysterectomy
Children(59)	Strangulated congenital inguinal hernia, circumcision		Post-varicella rash(59)	Urethral instrumentation

Table 1

CAUSATIVE ORGANISMS

It was previously suggested that necrotizing fasciitis could be attributed to streptococcal species alone; however, subsequent clinical investigations have revealed that this infection is polymicrobial (13). Wound cultures from Fournier's gangrene patients reveal an average of four different microorganisms per case (14). Streptococcus, Staphylococcus, and Escherichia coli are the most commonly identified bacteria.

DISEASE SPREAD

Advanced Fournier's gangrene can spread through the fascial planes, as high as the torso and as low as the thigh. The extent of the infection is determined by the location of the portal of entry and the anatomy of the fascial planes (15). Colles' fascia, the deep layer of superficial perineal fascia, connects to Scarpa's fascia of the anterior abdominal wall and Buck and Dartos' fascia of the penis and scrotum. As a result, the infection can spread through these channels. The fascia of Colles is connected to the perineal body and urogenital diaphragm posteriorly, as well as the pubic rami laterally (15). As a result, infection progression in these directions is limited. Because of their nonperineal blood supply, testicular involvement is uncommon.

CLINICAL PRESENTATION

Scrotal pain, swelling, and erythema are the most common symptoms of Fournier's gangrene (16). Systemic symptoms such as fever, rigor, and tachycardia are frequently present. Although the condition was initially described as having a sudden onset, experience has shown that it more frequently has an indolent onset. Pruritus, pain, and general discomfort typically worsen 3-5 days before hospitalization. The onset of the disease is more insidious in up to 40% of cases, resulting in delayed diagnosis and management (17).Purulent discharge, crepitus, and patches of necrotic tissue with surrounding oedema may be discovered during an examination. As these patches progress to florid gangrene, cutaneous manifestations appear later in the disease process

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(17). Diabetes, chronic alcohol abuse, steroid abuse, HIV, malignancy, lymphoproliferative disease, and recent catherization, instrumentation, and perineal trauma should all raise the index of suspicion for a soft-tissue necrotizing infection.

INVESTIGATIONS

Although Fournier's gangrene can only be diagnosed surgically, laboratory studies and radiological evaluation are invaluable tools in risk assessment and diagnostic uncertainty.

RISK MANAGEMENT

Fournier's Gangrene Severity Index and the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) (FGSI) Necrotising fasciitis is a complex disease with a complicated patient presentation, making early detection difficult. The literature has emphasized the LRINEC as a system capable of distinguishing necrotizing fasciitis from other soft tissue infections, allowing for early intervention (18). More specifically, the (FGSI) is a numerical scoring system proposed by Laor et al. in 1995 to determine patient outcomes and risk of mortality (19).The FGSI score is calculated using nine physiological variables collected at the time of admission, including temperature, heart rate, respiratory rate, and blood pressure. These parameters, like those of the LRINEC, represent the state of equilibrium, and any deviation has been identified in the literature as a key factor in predicting outcome. These researchers discovered that a score of more than 9 was a sensitive predictor of mortality, with a 75% chance of death (19).

Renal function

Lin et al. proposed a simplified FGSI based on three parameters: serum potassium, serum creatinine, and hematocrit (20). In their patient series, this three-score index had a non-inferior predictive value for patient outcomes. It is widely accepted that abnormalities in these variables are common in renal failure. In this study, patients with renal pathology had a mortality rate of 83.3%, implying that early risk assessment and aggressive management are necessary to improve survival in this group of patients (20).Several studies of patients with Fournier's gangrene have shown that renal function is an important prognostic indicator and that dysfunction is associated with higher mortality. Dysfunction of key immune system components such as neutrophils and monocytes, as well as changes in the inflammatory cascade, all contribute to an increase in the severity of sepsis and the risk of death in these patients (20). An understanding of these risks to patients with renal pathology, which allows for early detection and aggressive management such as dialysis, may improve the patient's chances of survival.

Conventional radiography

Subcutaneous emphysema extending from the perineum and external genitalia to the inguinal regions, thigh, and anterior abdominal wall may be seen on radiography (12). The presence of subcutaneous air is not pathognomonic, but it should raise the risk of soft-tissue necrotizing infection. Subcutaneous emphysema has been reported in 90% of patients with Fournier's gangrene (12). Radiography may also reveal significant scrotal swelling.

Computed Tomography (CT)

CT findings in Fournier's gangrene include soft-tissue thickening, inflammation, and subcutaneous emphysema. However, the primary role of CT in soft-tissue necrotizing infections is to identify the infectious source and to delineate the extent of the disease (22). On CT, the extent of fascial destruction correlates with the total affected tissue at surgery (22).

Magnetic Resonance Imaging (MRI)

Despite the fact that MRI provides more soft tissue detail than the other imaging modalities, only a few cases in the literature describe its use in Fournier's gangrene. This could be due to its limited availability in many hospitals, as well as its longer scan time, which reduces its practical usefulness. MRI has been used in the diagnosis of Fournier's gangrene in a number of cases, showing subcutaneous emphysema, scrotal wall thickening, and fluid accumulation (24, 25). MRI provides a wider field of view, allowing the spread of infection to be assessed, and is thought to be useful in advanced tumors (25).

Ultrasonography (US)

In the United States, subcutaneous emphysema may be detected as echogenic areas with reverberation artifact and 'dirty' shadowing in the scrotal or perineal regions (22). A thickened, oedematous scrotal wall could be another ultrasound finding in Fournier's gangrene. In cases of diagnostic uncertainty, prompt and efficient radiological evaluation enables timely treatment. Morrison et al. emphasized that bedside ultrasound

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can be used to diagnose Fournier's gangrene with high sensitivity (23). The US can also help distinguish a soft-tissue necrotizing infection from other scrotal pathology. In this context, the United States outperforms radiography.

DIFFERENTIAL DIAGNOSIS

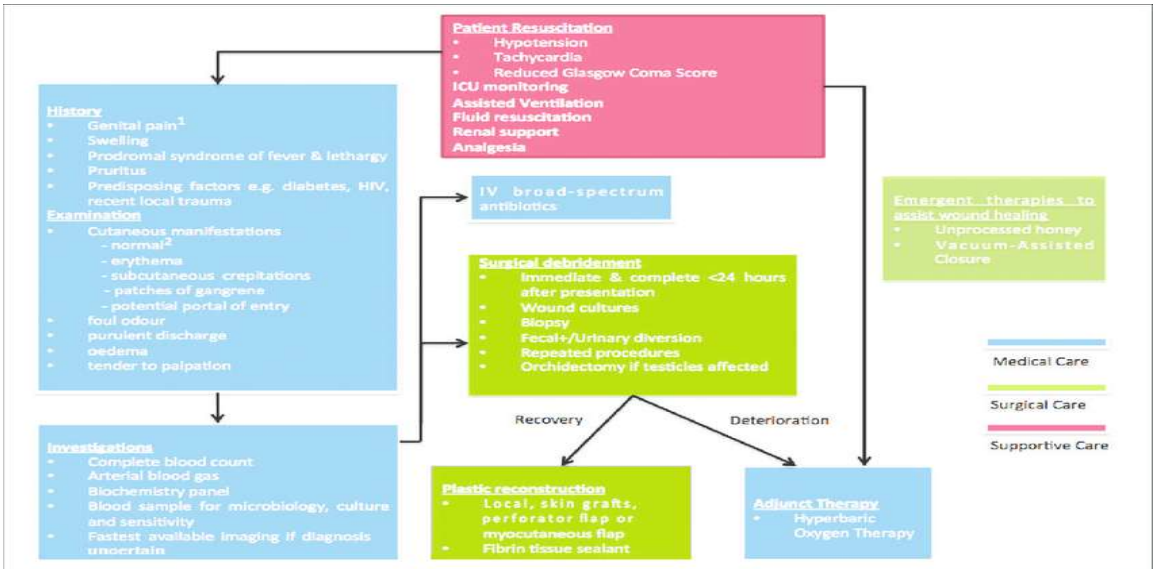
Scrotal, perineal, intra-abdominal, and systemic disorders may be present in the differential diagnosis of Fournier's gangrene (Table 2).

Torsion/abscess/haematoma of the testis
Vasculitis
Polyarteritis nodosum
Gonococcal balanitis
Cellulitis of the scrotum
Inguino-scrotal strangulated
Acute epididymitis

Table 2

MANAGEMENT

Urgent patient resuscitation, broad-spectrum antibiotic therapy, and surgical debridement are the cornerstones of management in this life-threatening condition. The treatment goal is to reduce systemic toxicity, halt infection progression, and eradicate the causative microorganisms. In the management of Fournier's gangrene, a parenteral broad-spectrum antibiotic regime is required, as shown in Table 3. Subsequent culture and sensitivity results may influence antibiotic selection. There are currently no recommendations for optimal antibiotic therapy in Fournier's gangrene, and patient management is dictated by local hospital policies.



Antibiotic treatment

On presentation, a parenteral broad-spectrum antibiotic regimen is required in the treatment of Fournier's gangrene, according to Table 4. Subsequent culture and sensitivity results may alter antibiotic selection. There are currently no recommendations for optimal antibiotic therapy in Fournier's gangrene, and patient management is dependent on local hospital guidelines.

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Vancomycin/linezolid
· MRSA positive
Clindomycin
· Streptococcal spp
Fluoroquinolone
· Broad spectrum both gram negative spp and gran positive spp
Cephalosporin
· Gram positive spp
Metronidazole
· Anaerobic bacteria
* Antibiotic regime accounting for gram positive, gram negative and anaerobic bacteria

Table3

Surgical debridement

The early and radical removal of necrotic and devitalized tissue is critical in halting infection progression. The importance of prompt surgical debridement is recognized, with even a few hours of delay increases the risk of death (26). Kabay et al. found that a delay in surgical debridement was associated with significant mortality in a retrospective study of 72 patients with Fournier's gangrene (27). The deep fascia and underlying muscle are rarely involved in the disease process, so removal is rarely necessary. Nonetheless, it is critical to emphasize that the severity of the infection cannot be determined by the degree of cutaneous necrosis, and surgical exploration is required (12).

Plastic reconstruction

Fournier's gangrene is characterized by a rapid and aggressive pathological process that can result in significant scrotal, perineal, and abdominal defects. The defect's size, location, and depth, as well as the availability of local tissue, influence the choice of surgical reconstruction (29). The literature describes the use of local skin flaps, split-thickness skin grafts, fasciocutaneous perforator flaps, and myocutaneous flaps. The ideal reconstructive technique would be performed as a single procedure, resulting in optimal function, a natural-looking wound, and minimal post-operative and donor site complications. Primary wound closure comes the closest to this ideal, providing the best functional and cosmetic results, but it is only appropriate for small to medium-sized lesions.

Fasciocutaneous/perforator flap

For scrotal and perineal reconstruction, various fasciocutaneous flaps have been used. These tissue flaps cover a large surface area of the wound and are used when skin graft coverage is insufficient (34). The literature also reports superior functional and cosmetic outcomes when compared to split -thickness skin graft reconstruction, possibly due to a lower incidence of skin contracture (34). In the reconstruction of the scrotum and perineum, superomedial thigh, pudendal, inguinal, and anterolateral thigh fasciocutaneous flaps have been described. These flaps benefit from a consistent blood supply, minimal donor site morbidity, and preservation of the underlying muscle (35).

Split Thickness Skin Grafts (STSG)

Maguina et al. described four cases of meshed split- thickness skin graft (STSG) scrotal reconstruction (31). By reducing recovery time and achieving excellent functional and aesthetic results, these cases demonstrated the efficiency and effectiveness of STSG. Several studies have found similarities between the neo-scrotum and normal scrotal tissue in terms of color, shape, and thickness (32, 33). Post-operative complications of scrotal skin grafting have been reported, including bleeding, shearing, and infection. Some studies reported graft contracture and unfavorable cosmetic outcomes. Chen et al. used STSG on nine patients with positive clinical and cosmetic outcomes. This method is recommended by the authors in cases of scrotal defects involving the abdominal wall (30). Perineal skin grafts have been reported to be unsatisfactory due to continuous wound contamination.

Scrotal advancement flap

In the majority of cases, the scrotum is involved, and scrotal advancement flaps are

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appropriate for small-to-medium-sized lesions. A recent review of 43 reconstructive cases revealed that scrotal reconstruction was required in 93% of the cases (29). Scrotal advancement flaps use the "replace like with like" surgical principle to provide coverage from local scrotal tissue. Scrotal deficits of up to 96 cm2 have been repaired using advancement flaps (30). The larger the skin defect, the longer the advancement distance required, putting more strain on the tissue and increasing the risk of reconstructive complications.

Fibrin tissue sealant

Fibrin sealant has been reported as a useful adjunct in the management of complicated wounds of the perineum and external genitalia in a number of cases. It has been proposed that fibrin adhesive strengthens the wound site, aids in wound closure, and provides a pathway for the slow release of growth factors and antibiotics (38). In the case of Fournier's gangrene reconstruction, fibrin sealant has been shown to promote effective closure of thigh fasciocutaneous flaps and other large flaps, with decreased infection and clinically stable wounds without further complications (39).

SURGICAL ADJUNCTS

Urinary and fecal diversion

In some cases of perineal involvement, colostomy formation may prevent fecal contamination. Fecal diversion is required in cases of anal sphincter insufficiency, fecal incontinence, and continuous contamination of the wound affecting healing (40). Because diversion colostomy is a surgical procedure, it entails additional risks for the patient. Stoma site infection, ischaemia, and evisceration have all been documented. Korkut et al. found that patients who required colostomy had a 38% higher mortality rate than those who did not require a colostomy, who had a 7% mortality rate (41). The Flexi-Seal Fecal management system is a type of fecal diversion that can be used instead of a colostomy. The catheter directs feces away from the wound, preventing contamination and promoting healing.

A recent study compared the use of bowel catheters to colostomies, revealing a reduction in hospital stays and expenses (42). However, the catheter was only used in patients who did not have an anal sphincter or rectum involvement. Rectal neoplasms, penetrating rectal injuries, and fistulas are all clear contraindications to using this device (42). In cases of urethral inflammation or penile involvement, urinary diversion may be required (43). Urethral catherization may suffice in mild cases, but cystostomy is required in severe cases.

Vacuum Assisted Closure (VAC)

Vacuum Assisted Closure (VAC) is a technique used to speed up the healing of surgical and complicated wounds that have failed primary healing. Negative pressure is applied to the open wound, which is thought to reduce tissue oedema, increase blood flow, and thus promote healing and debridement. In some patients, there is some evidence that VAC is superior to conventional wound care. According to Assenza et al., VAC reduced hospitalization, and patient morbidity, and allowed for early reconstructive surgery (44).

II. CONCLUSION

Fournier's gangrene remains a surgical emergency, and complete debridement is essential for patient survival (49). Fournier's gangrene is treated with sepsis monitoring, broad-spectrum antibiotics, and surgical removal of nonviable tissue. The lack of high-quality evidence in surgical adjuncts prevents them from being used routinely in patient care. Patients who received an early diagnosis, complete debridement, and appropriate, concurrent antibiotic therapy had survival rates greater than 70%. Early diagnosis, complete debridement, and appropriate, concurrent antibiotic therapy resulted in a 70% success rate.

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