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REVIEW

Fournier's gangrene. A clinical review

Ariana Singh, Kamran Ahmed, Abdullatif Aydin, Muhammad Shamim Khan, Prokar Dasgupta

MRC Centre for Transplantation, King's College London;
Department of Urology, Guy's and St. Thomas' NHS Foundation Trust - King's Health Partners, London, United Kingdom.

Summary ***Introduction and Hypothesis: Fournier's gangrene is a rare, necrotising fasciitis of the external genitalia, perineal or perianal regions. The disease has a higher incidence in males and risk factors for development include diabetes, HIV, alcoholism and other immune-compromised states. The aggressive disease process is associated with a high mortality rate of 20-30%. In addition, the increasing age and prevalence of diabetes in the population, begs the need for increased clinical awareness of Fournier's gangrene with emphasis on early diagnosis and management. This review aims to highlight the relevant research surrounding Fournier's gangrene, in particular the various prognostic indicators and management strategies.***
Methods: A search was conducted on the MEDLINE database for all applicable research; clinical reviews, retrospective studies and case reports. In addition to which a search of the European Association of Urology, the British Association for Urological Surgeons and the British Medical Journal was conducted for the most recent recommendations.
Results: Immediate broad-spectrum antibiotic therapy and urgent surgical debridement are the core managerial principles of Fournier's gangrene. The use of adjunctive therapies such as hyperbaric oxygen and vacuum assisted closure are supported in some aspects of the literature and disputed in others. The lack of randomized controlled studies limits the use of these potential additional therapies to patients unresponsive to conventional management. The value of unprocessed honey as a topical antimicrobial agent has been highlighted in the literature for small lesions in uncomplicated patients.
Conclusion: Fournier's gangrene is a urological emergency with a high mortality rate despite advances in the medical and surgical fields. The aggressive nature of the infection advocates the need for early recognition allowing immediate surgical intervention. The opposing results of available research as well as the lack of high quality evidence surrounding emergent therapies prevents their routine use in the management of Fournier's gangrene. The absence of a specific care pathway may hinder efficient management of Fournier's gangrene, thus based on current guidelines a management pathway is suggested.

KEY WORDS: *Fournier's gangrene; Necrotizing fasciitis; Fournier's gangrene severity index (FGSI); Surgical debridement.*

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INTRODUCTION

In 1764 *Baurienne* described an idiopathic, fatal, necrotizing process with resultant gangrene of the male genitalia. However, the Parisian venereologist, *Jean Alfred Fournier* is more commonly associated with the eponymous condition. In his 1883 manuscript, he described a fulminant gangrene of idiopathic nature and abrupt onset, of the scrotum and penis, in a series of 5 young males (1). Since then our understanding of the aetiology and pathophysiology of this condition has grown to reveal a more indolent nature and identifiable cause in the majority of cases. Contrary to the earlier descriptions, the disease is not restricted to young males, but has been reported to occur in women and children, although at a lower incidence. Basic management of Fournier's gangrene employs a multi-disciplinary team approach and the three fundamental principles of urgent haemodynamic stabilization and crucial surgical debridement with or without plastic reconstruction, under the cover of antibiotic therapy.

DEFINITION

Fournier's gangrene is a type I necrotizing fasciitis of the perineal, perianal or genital areas. Over the years, Fournier's gangrene has been referred to by several names, such as "*streptococcus gangrene*", "*synergistic necrotizing cellulitis*" and "*peri-urethral phlegmon*", all of which describe a soft tissue disease that is infective, destructive and fatal (2).

EPIDEMIOLOGY

Fournier's gangrene is a relatively uncommon condition, representing a mere 0.02% of hospital admissions according to a recent epidemiological study, although its incidence is increasing with the ageing population and higher prevalence of diabetes. *Sorensen et al*. highlighted an overall incidence rate of 1.6 cases per 100,000 males/year and showed a peak in incidence past the age of 50 at 3.3 cases per 100,000 males/year (3). A retrospective case review of 1726 cases, revealed a mean of 97 cases per year during the period of 1989-1998 (4).

AETIOLOGY

J.A. Fournier described the condition as an idiopathic process, however, Fournier's gangrene is rarely truly idiopathic and with diligent observation and investigation an underlying cause can be identified in the majority of cases. The necrotizing fasciitis frequently stems from an infection

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of the ano-rectum (30-50%), uro-genitalia (20-40%) or genital skin (20%) (4). Trauma to these regions, whether intentional or accidental has been reported in the literature as a possible source of infection. Fournier's gangrene has been shown to be strongly associated with diabetes, chronic alcoholism, human immunodeficiency virus (HIV), lympho-proliferative diseases, chronic steroid abuse and cytotoxic drugs (5). The underlying principle of all these conditions being compromised host immunity creating a favourable environment to establish infection. Malnutrition and lower socio-economic status have also been shown to be associated with the development of Fournier's gangrene. These two factors potentially associated with poor perineal hygiene and lower immunity accounting for their association with the development of Fournier's gangrene (5).

Predisposing factors

Diabetes

The insistent nature of Fournier's gangrene poses a threat to the immuno-competent host so that patients suffering from systemic disorders such as diabetes mellitus are at an additional risk. Sustained hyperglycaemia has detrimental effects on host immunity via its adverse effect on cellular adherence, chemotaxis and phagocyte activity (6). Diabetes has been indicated as a predisposing factor in 32% to 66% of cases of Fournier's gangrene (6). An evaluation of cases of Fournier's gangrene in diabetics has shown that this co-morbid condition has an impact on the clinical course of the soft-tissue infection. Primarily, the patient profile tends to be of a younger age and wound cultures reveal different bacterial colonies. Candida albicans has been identified in the cultures of diabetic patients (7). Rarely, Fournier's gangrene has been reported as the initial manifestation of diabetes in a previously undiagnosed diabetic (8, 9). The degree of diabetic control has been shown to correlate directly with the extent of the disease and therefore the patient prognosis. Hence, uncontrolled diabetics will have a poorer prognosis requiring more aggressive wound care and extensive debridement.

Human Immunodeficiency Virus

Human Immunodeficiency Virus (HIV) is a retrovirus that infects and destroys the host's immune system by invading CD4+ cells, which are at the very core of the immune response. It is therefore not surprising these patients are more susceptible to opportunistic infections. Accordingly, it is logical to propose that these patients are more prone to developing Fournier's gangrene than a HIV negative group. HIV has been reported as a comorbidity in 4% of patients with Fournier's gangrene (10). Various studies have documented a significant rise in the prevalence of cases of Fournier's gangrene since the advent of the HIV epidemic (11). A handful of cases have reported Fournier's gangrene as the initial presentation of the HIV infection (11, 12). Notably, although the presence of comorbid HIV may predispose to Fournier's gangrene, it does not seem to adversely affect the natural course of the disease or patient prognosis. The fundamental principles of early recognition and timely initiation of treatment have been highlighted in the literature repeatedly as the ideals to a successful outcome. The identical principles apply to the prognosis of patients infected with HIV.

Pathophysiology

The presence of a localized infection adjacent to the portal of entry, Table 1, allows the entry of normally commensal bacteria, such as Staphylococcus spp., and Escherichia coli, into the perineum. Essentially the infectious organisms trigger an inflammatory response resulting in an obliterative endarteritis of the surrounding vasculature. Subsequent thrombosis of the nutrient vessels and a resultant reduction in blood flow to this region leads to tissue ischaemia. The reduced oxygen tension of the tissues promotes further anaerobic bacteria proliferation and fascial necrosis and digestion.

Causative microorganisms

It was previously suggested that the necrotizing fasciitis could be attributed to infection by streptococcal species alone however; later clinical investigations have highlighted the polymicrobial nature of this infection (13). Wound cultures from patients with Fournier's gangrene show an average of 4 different microorganisms per case (14). Streptococcus, Staphylococcus and Escherichia are commonly identified species.

Spread

Advanced Fournier's gangrene can extend through the fas-

	Uro-genital	Ano-rectal	Cutaneous	Traumatic
Men (26, 50-58)	Urethral strictures, calculi, prostatic massage	Peri-anal, peri-rectal, ischio-rectal abscesses, anal fissures, diverticulitis, appendicitis, colonic malignancy (50), rectal cancer	Ulceration due to scrotal pressure (51), hidradenitis suppurative, poor perineal hygiene e.g. paraplegics	Inguinal hernia repair (52), prostatic biopsy, vasectomy (53), diathermy for genital warts, anal perforation (foreign body), penile prosthesis (54), genital piercings (55), penile injection (56), steroid enemas (57), urethral instrumentation
Women (58)	Septic abortions, vulval abscess, Bartholin's abscess		HPV lesions (58)	Hysterectomy. Episiotomy
Children (59)	Circumcision, strangulated congenital inguinal hernia		Post-varicella rash (59)	Urethral instrumentation

Table 1.
Reported cases in men, women and children of various portals of entry leading to Fournier's gangrene.

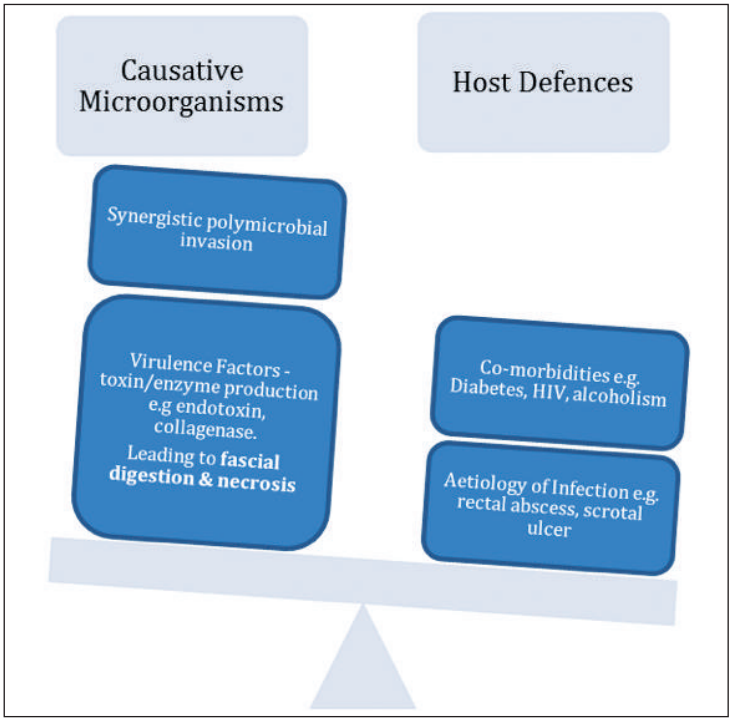

Figure 1.
The imbalance between host defenses and the virulence of microorganisms in Fournier's gangrene (12, 14).

cial planes ascending as high as the torso and descending to the thigh. The location of the portal of entry and anatomy of the fascial planes determines the extent of the infection (15). The deep layer of superficial perineal fascia, Colles' fascia, is continuous with Scarpa's fascia of the anterior abdominal wall and Buck and Dartos' fascia of the penis and scrotum. Therefore, infection can spread via these routes. Colles' fascia is attached to the perineal body and urogenital diaphragm posteriorly and the pubic rami laterally (15). Thus limiting the progression of infection in these directions. Testicular involvement is rare and this has been attributed to their non-perineal blood supply.

Clinical assessment

Patient presentation

The most common symptoms of Fournier's gangrene include scrotal pain, swelling and erythema (16). Systemic features such as fever, rigor and tachycardia are often present.

Although originally described to be of sudden onset, experience has shown the condition

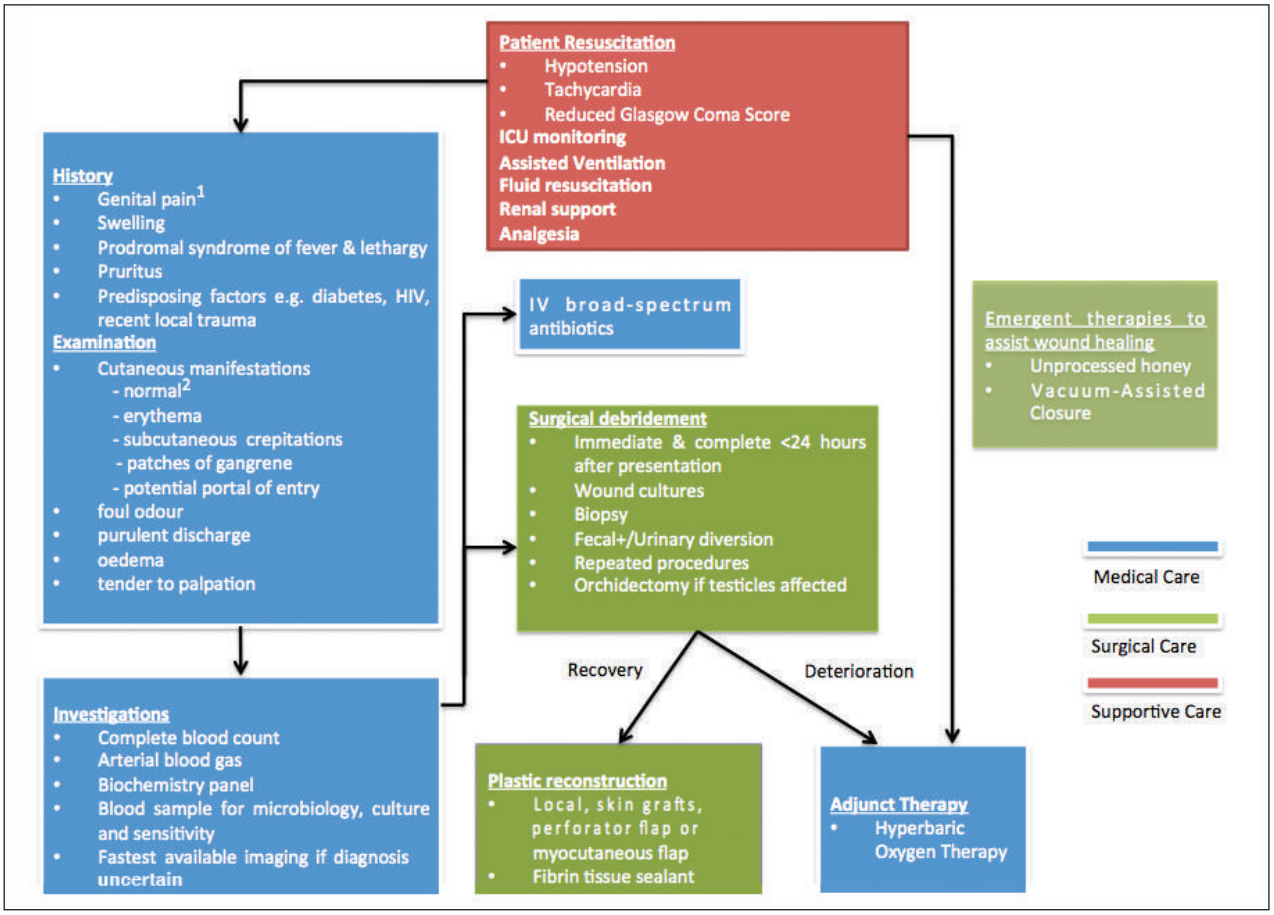

Figure 2.
Potential care pathway for Fournier's gangrene.
[1] Pain may be out of proportion to clinical findings early in disease process; [2] Early on skin changes are a poor reflection of the infectious process.

more frequently has an indolent onset. The symptoms of pruritus, pain and general discomfort tend to worsen over 3-5 days before hospital admission. In up to 40% of cases, the onset of the disease is more insidious resulting in delayed diagnosis and management (17). Examination may reveal purulent discharge, crepitus, and patches of necrotic tissue with surrounding oedema. Cutaneous manifestations tend to appear later in the disease process as these patches progress to florid gangrene (17). A thorough history, revealing diabetes, chronic alcohol abuse, steroid abuse, HIV, malignancy, lympho-proliferative disease as well as recent catherisation, instrumentation and perineal trauma, should all increase the index of suspicion for a soft-tissue necrotizing infection.

Investigations

Although the diagnosis of Fournier's gangrene is only certain after surgical exploration, laboratory studies and radiological evaluation are invaluable tools in risk assessment and in cases of diagnostic uncertainty.

Risk stratification

Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) & Fournier's Gangrene Severity Index (FGSI)
Necrotising fasciitis is a complicated disease with a complex patient presentation, making early recognition a difficult task. The LRINEC has been highlighted in the literature as a system capable of differentiating necrotizing fasciitis from other soft tissue infections enabling early intervention (18). More specific to Fournier's gangrene, the (FGSI) is a numerical scoring system, put forward by *Laor et al.* in 1995, to determine patient outcome and risk of mortality (19). The FGSI score is based on 9 physiological variables, Table 3, taken on admission including, temperature, heart rate, respiratory rate, These parameters similar to those of the LRINEC, represent the state of equilibrium and any deviation has been highlighted in the literature as the key factor predictive of outcome. These researchers determined that a score of greater than 9 was a sensitive indicator of mortality, with a 75% probability of death (19).

Complete blood count
· Leucocytosis; WBC count > 15.4 x 109 L
· Haemoglobin < 11 g/dL
· Haematocrit < 20/> 60%
Biochemistry panel
· Serum Na < 135 mmol/L
· Glucose level >10 mmol/L
· Serum creatinine > 141 µmol/L
· Serum K < 2.5/> 7 mmol/L
· Bicarbonate < 15/> 52 mmol/L
· Reduced serum Mg
Raised inflammatory markers
· CRP > 150 mg/L
Raised serum lactate
Urea > 18 mg/dL
DIC panel
· Sepsis induced coagulopathy
Arterial blood gas
· Acidosis (possibly due to hypo/hyperglycaemia or septic disturbance)
* LRINEC -Laboratory Risk Indicator for Necrotising Fasciitis. WBC count, Haemoglobin, CRP, Serum Na, Glucose, Creatinine.
FGSI

Table 2.
Common investigation findings and prognostic factors in Fournier's gangrene (14, 18).

Renal function

Lin et al. proposed a simplified FGSI with a focus on 3 parameters; serum potassium, serum creatinine and haematocrit (20). Their study showed a non-inferior predictive value for patient outcome utilizing this 3 score index in their patient series. It is acknowledged that abnormalities in these variables are commonly found in renal failure. A mortality rate of 83.3% in patients with renal pathology, in this study, implores the concept of early risk assessment and aggressive management to improve survival in this group of patients (20). A number of studies of patients with Fournier's gangrene have highlighted that renal function is an important prognostic indicator and that dysfunction is associated with a higher mortality. Dysfunction of the key elements of the immune system such as neutrophils, monocytes and alterations to the elements of the inflammatory cascade, accumulate to increase the severity of sepsis and risk of death in these patients (20). An appreciation of these risks to patients with renal pathology, allowing early recognition and aggressive management such as dialysis, may improve the patient's chance of survival.

Imaging

If a soft-tissue necrotizing infection is suspected urgent surgical exploration is required nevertheless, there is a place for imaging in the investigation and management of these patients. Plain radiographs, ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) may demonstrate air in the soft tissue planes as well as help determine the extent of the disease. The use of imaging modalities must not delay surgical intervention.

Conventional radiography

Radiography may reveal subcutaneous emphysema extending from the perineum and external genitalia to the inguinal regions, thigh and anterior abdominal wall (12). The presence of subcutaneous air is not pathognomic but should increase the index of suspicion of a soft-tissue necrotizing infection. 90% of patients with Fournier's gangrene have been reported to have subcutaneous emphysema (12). Radiography may also reveal significant swelling of the scrotal tissue.

Ultrasonography (US)

US investigation may reveal subcutaneous emphysema, seen as echogenic areas demonstrating reverberation artifact with 'dirty' shadowing, in the scrotal or perineal regions (22). Another ultrasound finding in Fournier's gangrene may be a thickened, oedematous scrotal wall.

In cases of diagnostic doubt, quick and efficient radiological evaluation allows for timely treatment. *Morrison et al.* emphasized that the diagnosis of Fournier's gangrene can be made with bedside ultrasound, at a very high sensitivity (23). US is also useful in differentiating a soft-tissue necrotizing infection from other scrotal pathology. In this context, US is superior to radiography.

Computed Tomography (CT)

Soft-tissue thickening, inflammation and subcutaneous emphysema are the CT features found in Fournier's gangrene. The main role of CT in soft-tissue necrotizing infections however is in identifying the infectious origin and in delineating the extent of the disease (22). The extent of fascial destruction on CT has been shown to correlate with the total affected tissue at surgery (22).

Magnetic Resonance Imaging (MRI)

Only a few cases in the literature describe the use of MRI in Fournier's gangrene even though it yields greater soft tissue detail than the other imaging modalities. The reason for this may be its limited availability in many hospitals as well as a longer scan time, reducing its practical usefulness. However, a number of cases have detailed the use of MRI in the diagnosis of Fournier's gangrene showing subcutaneous emphysema, scrotal wall thickening and fluid accumulation (24, 25). MRI enables a wider field of view, allowing the spread of the infection to be assessed and is suggested to be advantageous in advanced lesions (25).

Differential diagnosis

The differential diagnosis of Fournier's gangrene may include scrotal, perineal, intra-abdominal or systemic disorders (Table 3).

Management

The cornerstones of management in this life-threatening condition are urgent patient resuscitation, broad-spectrum antibiotic therapy and surgical debridement. The goal of treatment is to reduce systemic toxicity, halt progression of the infection and eliminate the causative microorganisms.

Antibiotic coverage

A parenteral broad-spectrum antibiotic regime is required, Table 4, on presentation in the management of Fournier's gangrene. Subsequent culture and sensitivity results may modify the choice of antibiotics. Currently there are no recommendations for optimal antibiotic therapy in Fournier's gangrene and patient management depends on local hospital guidelines.

Scrotal cellulitis
Inguino-scrotal strangulated hernia
Testicular torsion/abscess/haematoma
Gonococcal balantis
Acute epididymitis
Vasculitis
Polyarteritis nodosum

Table 3.
Differential diagnosis of Fournier's gangrene.

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

Table 4.
European Association of Urology (EAU) suggested initial antibiotic options (49).*

Surgical debridement

The early and radical removal of necrotic and devitalized tissue is the crucial step in halting progression of the infection. The necessity for rapid surgical debridement is appreciated, with even a few hours delay increasing the risk of death (26). In a retrospective analysis of 72 patients with Fournier's gangrene, *Kabay et al.* highlighted that a time delay in surgical debridement was associated with significant mortality (27). Removal of the deep fascia and underlying muscle is not usually necessary and these structures are rarely involved in the disease process. Nonetheless, it is important to highlight that the magnitude of the infection cannot be judged by the degree of cutaneous necrosis and surgical exploration is imperative (12). The initial debridement, with adequate resection of the non-viable tissues, is considered the most important factor for survival (26). Extensive debridement, including a slim window of healthy adjacent tissue, has been advocated in the literature. Close observation of the wound and repeated debridement are necessary measures to control the infection. A mean of 3.5 debridement operations per patient has been suggested to be necessary for adequate infection control (28).

Plastic reconstruction

The rapid and aggressive pathological process underlying Fournier's gangrene can result in large scrotal, perineal and abdominal defects. The choice of surgical reconstruction is based on the characteristics of the defect, that is, the size, location and depth as well as the availability of local tissue (29). The use of local skin flaps, split-thickness skin grafts, fasciocutaneous perforator flaps and myocutaneous flaps have all been described in the literature. The ideal reconstructive technique would occur as a single procedure, yield optimal function, a natural appearance of the wound and minimal post-operative and donor site complications. Primary closure of the wound is the closest to this ideal, providing the best functional and cosmetic results, but is only useful in small to medium sized lesions.

Scrotal advancement flap

The scrotum is involved in the majority of cases and scrotal advancement flaps are suitable in small-medium size lesions. A recent review of 43 reconstructive cases revealed the need for scrotal reconstruction in 93% of the cases (29). Scrotal advancement flaps apply the surgical principle of "replace like with like" providing coverage from local scrotal tissue. Advancement flaps have been used to repair scrotal deficits up to 96 cm^2 (30). The larger the skin defect, the longer advancement distance required and therefore the more stress on the tissue and greater risk of reconstructive complications. The higher tension in the flap may compromise the blood supply leading to wound edge necrosis and flap failure, yet it has been shown that as little as one third of healthy scrotal skin can be expanded to provide complete scrotal coverage, possibly due to the expandable and resilient nature of scrotal tissue (29). This reconstructive technique, where suitable, provides excellent clinical and aesthetic results. In more complicated cases, involving perineal and/or abdominal wall defects after debridement, local scrotal flaps may be insufficient to provide wound coverage.

Split Thickness Skin Grafts (STSG)

Maguina et al. described four cases of scrotal reconstruction by meshed split thickness skin grafts (STSG) (31). These cases illustrated both the efficiency and effectiveness of STSG by the reduction in recovery time and excellent functional and aesthetic results. Various studies have highlighted the similarities in colour, shape and thickness of the neo-scrotum to normal scrotal tissue (32, 33). Post-operative complications of scrotal skin grafting including bleeding, shearing and infection have been reported. Some studies reported cases of graft contracture and undesirable cosmetic results. *Chen et al.* applied STSG to nine patients with good clinical and cosmetic results. These authors recommend this method in scrotal defects with abdominal wall involvement (30). Skin grafts in the perineal region have been reported unsatisfactory due to continuous wound contamination.

Fasciocutaneous/perforator flap

Various fasciocutaneous flaps have been used for scrotal and perineal reconstruction. These tissue flaps provide a large surface area of wound coverage and are used in cases where skin graft coverage is insufficient (34). The literature also reports superior functional and cosmetic outcomes compared to reconstruction with split thickness skin grafts, possibly due to the reduced incidence of skin contracture (34). Superomedial thigh, pudendal, inguinal and anterolateral thigh fasciocutaneous flaps have been described in the reconstruction of the scrotum and perineum. These flaps have the advantage of having a reliable blood supply, minimal donor site morbidity and preservation of the underlying muscle (35). The tissue flaps can be harvested as sensate flaps, with preservation of the nerve supply, to allow sensation to the scrotal and perineal skin.

Myocutaneous/muscle flap

In cases of radical debridement and deep pocket formation, a muscle flap is the recommended reconstructive method of choice, to eliminate the empty space. A gracilis muscle flap has been used to provide wound coverage for large, deep perineal defects. The close proximity of the muscle to the perineal region and its highly vascularized tissue providing a greater resistance to wound contamination, make the technique ideal for this region (35). A number of cases have reported successful functional and aesthetic outcomes after gracilis myocutaneous flap reconstruction of the scrotum and perineum (36, 37). Notably, the anterolateral thigh flap can be harvested as a myocutaneous flap, with fibres of the vastus lateralis muscle within its core. This allows coverage of the deep wound, with an adjustable muscle mass, without compromising the integrity of the quadriceps femoris muscle (37).

Fibrin tissue sealant

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

Surgical adjuncts

Fecal & urinary diversion

In certain cases of perineal involvement, faecal contamination may be prevented by colostomy formation. Cases of anal sphincter insufficiency, fecal incontinence and continuous contamination of the wound affecting healing necessitate fecal diversion (40). Diversion colostomy is a surgical operation and therefore carries additional risks to the patient. Stoma site infection, stoma ischaemia and evisceration have been reported. *Korkut et al.* emphasized a significantly higher mortality, 38%, in patients that required colostomy compared to the mortality, 7%, of those that did not require colostomy (41). The Flexi-Seal Fecal management system is a form of fecal diversion that may serve as an alternative to colostomy. The catheter maneuvers faecal material away from the wound, preventing contamination and promoting healing. A recent study highlighted the use of bowel catheter over that of colostomy revealing a reduction in hospital stay and expenses (42). However, the use of the catheter was limited to those patients without anal sphincter and rectum involvement. Clear contraindications to the use of this device include rectal neoplasms, penetrating rectal injuries and fistulas (42). Urinary diversion may be necessary in cases of urethral inflammation or penile involvement (43). Urethral catherisation may suffice but in more severe cases, cystostomy is indicated.

Vacuum assisted closure

Vacuum Assisted Closure (VAC) is a method employed to accelerate the healing of surgical wounds and compli-

cated wounds that fail primary healing. The open wound is exposed to negative pressure, which is thought to reduce oedema of the tissues, increase blood flow and thereby promote healing and debridement. There is some evidence that suggests VAC is advantageous over conventional wound treatment in certain patients. *Assenza et al.* found that VAC reduced hospitalization, patient morbidity and allowed early reconstructive surgery (44).

Emerging therapies

Honey

Recently the antimicrobial properties of unprocessed honey and its ability to stimulate epithelial cell growth have been recognized in the management of Fournier's gangrene. A low pH of 3.6, a high osmotic pressure and enzymatic activity, are the properties, which allow honey to digest necrotic tissue and bacteria. *Tahmaz et al.* compared the classic triad of management of Fournier's gangrene to that of topical unprocessed honey and triple antibiotic therapy, without debridement, in 33 male patients (45). These researchers showed better clinical and cosmetic outcomes in the group of patients treated with unprocessed honey and antibiotic therapy. Notably, this group of patients was younger, healthier and had less severe lesions. A recent review of 25 trials analyzing the use of topical unprocessed honey and its impact on wound healing concluded that honey dressings, do not impact healing and in some cases may delay the healing process (46).

Hyperbaric oxygen therapy

Hypoxia due to arterial vessel thrombosis results in tissue ischaemia, necrosis and creates a favourable environment for anaerobic bacteria. Therefore, the creation of an environment with optimal oxygen uptake by tissues, is a sensible adjunct to surgical debridement and triple antibiotic therapy. Hyperbaric oxygen therapy is thought to hasten tissue healing by optimizing the immune system's activity through fibroblast proliferation, maximizing neutrophil function, reducing oedema and increasing intracellular transport of antibiotics (47). Indeed the use of hyperbaric oxygen has yielded promising clinical and cosmetic results. However, the most recent review examining 42 patients with Fournier's gangrene highlighted a higher morbidity and mortality with HBO. Although it was acknowledged to possibly be due to patient selection bias. HBO therapy is indicated in those patients unresponsive to conventional treatment, in Clostridial or severe anaerobic infection or deep tissue involvement (48).

Conclusions

Fournier's gangrene remains a surgical emergency and urgent, complete debridement is at the foundation of patient survival (49). The management of Fournier's gangrene focuses on patient monitoring for sepsis, broad-spectrum antibiotics and surgical removal of unviable tissue. The lack of high quality evidence in surgical adjuncts and emergent therapies prevents their routine use in patient management. Survival rates greater than 70% have been reported in those patients groups receiving early diagnosis, complete debridement and appropriate, concurrent antibiotic therapy.

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Correspondence

Ariana Singh BSc (Hons)

Kamran Ahmed MBBS, MRCS, PhD (Corresponding Author)

kamran.ahmed@kcl.ac.uk

Abdullatif Aydin BSc (Hons), MBBS

Muhammad Shamim Khan FRCS (Urol), FEBU, OBE

Prokar Dasgupta MSc, MD, FRCS (Urol), FEBU

King's College London - Guy's Hospital, London (UK)