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# Fournier's Gangrene: From Diagnosis to Reconstruction

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Fournier gangrene (FG) is an acute and potentially fatal infection of the scrotum, perineum, and abdominal wall. It is characterized by necrotizing fasciitis with loss of subcutaneous tissue and skin. Although originally thought to be an idiopathic process, FG has been shown to have a predilection for patients with diabetes as well as long-term alcohol misuse; however, it can also affect patients with non-obvious immune compromise. Twenty patients were admitted to our hospital with the diagnosis of Fournier gangrene, between 1 January 2011 to January 2013.
The epidemiological characteristics, evolution and treatment modalities were reviewed. Early surgical debridement of necrotic tissues and antibiotics are fundamental in the treatment of FG. Scrotal reconstruction with skin grafts or flaps is fundamental to improve the quality of life and provides social reinsertion.

*Keywords: Fournier's gangrene; defect reconstruction; perineoscrotal defect; epidemiology.*

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## 1. BACKGROUND

The Fournier's Gangrene (FG) is a genital's necrotizing fasciitis of the perineal, genital, or perianal regions. The etiology of FG is frequently polymicrobial infection, including aerobic and anaerobic pathogens. Most of the causative pathogens arise from colorectal, genitourinary, or skin and soft tissue infection [1]. It is a life-threat-ening condition, constituting a urological emergency [2]. It is secondary to locoregional cause in 95% of cases. When no cause is found, (5% of cases), The Fournier's Gangrene is called idiopathic or primitive, this is the classic disease Fournier [3,4]. Mortality of FG varies from 3 to 45%, even if it is well managed [5]. The particular gravity of this pathology requires a high index of suspicion, to undertake quickly an aggressive medical and surgical treatment.

We describe the different epidemiological aspects of périnéoscrotale gangrene and report our experience in the management of this disease from the acute phase to the stage of reconstruction, through a study of 20 patients.

## 2. MATERIELS AND METHODS

Over a period of two years (1 January 2011 to 1 January 2013), we made a retrospective study between plastic surgery department and the urology department of the CHU Ibn Rochd-Casablanca. The medical data were collected in details and analyzed, they were related to medical history, the admission exam and laboratory results: age, aetiology, existence of co-morbidities, predisposing factors, culture findings, and clinical outcome. The general conditions of patients were studied, specifically: body temperature, blood pressure, heart and respiratory rates. Biochemical, hematologic, and bacteriologic study results were also noted at admission. Presence of confusion, hypotension (systolic BP<80 mmHg), leukocytosis (>15,000), and fever (>38°C) were considered as sepsis criteria. The antibiotic therapy used and the timing of debridement were all recorded.

The parameters: temperature; serum sodium, potassium, creatinine, and bicarbonate levels; hematocrit and leukocyte count, heart rate; respiratory rate; were used to classify patients according to Fournier's gangrene severity index (FGSI) created by Laor et al in 1995 [6]. The degree of deviation from normal of each parameter was graded from 0 to 4, this values are summed to calculate the FGSI score (FGSIS).

The study protocol was approved by the local health research ethics committee and written informed consent was obtained from all the patients containing an explanation of the work and non-personal information publication permission for scientific purposes.

## 3. RESULTS

The average age of patients was 45 years (ranges 18- 83 years), all patients were male. The principal co-morbidities and toxic habits found were smoking (41%) and diabetes (35%).

No definite predisposing factor was reported in 30% of patients (n=6). Urogenital and anorectal disease were the most common causes, found successively in 36% and 29% of secondary forms. While in 14% of cases the cause was a skin infection, perianal abscess (n=2) and periurethral abscess (n=1). The Fournier's Gangrene may be secondary to a iatrogenic causes (after endoscopic urethrotomy for urethral stenosis in one patient). No etiologic factors for FG were found in 14% patients and they were classified as idiopathic.

All patients had a biological disorder, 10 were admitted with a sepsis (50%), 3 were unconscious at admission and were hospitalized in Intensive Care Units (15%). A severe metabolic acidosis was found in 2 cases (10%).

The lesions are most often located in the scrotum and penis (58%), are characterized by edema, tissue necrosis and sometimes by gas crepitus (gas gangrene). In 42% of cases, they were extended to hypogastrium: the flanks (19%), the rest of the perineum (14%) or the two legs (9%).

Samples for bacteriological examinations could not be studied because the labs do not practice these examinations in emergency.

For all patients, the initial medical management included a correction of fluid and electrolyte disorder, prevention of tetanus, and a triple antibiotic therapy with amoxicillin-clavulanic acid 50 mg / kg / day, metronidazole 20 mg / Kg / day for 10 days, gentamycin 3 mg / kg / day for 15 days. Empiric antibiotherapy was changed according to the results of the microbiological analysis of the removed tissue samples in the first debridement. 25% of patients had postoperative hyperbaric oxygen.

In the acute phase, Surgical treatment consisted of surgical drainage of subcutaneous collections of pus: by debridement with or without incision

and discharge, or surgical excision of the entire infected area. Every time there was a necrotic tissue, debridement was combined with extensive washing with hydrogen peroxide and povidone iodine diluted to 30%; and a corrugated drain can be set at the end. Urinary and colic diversions were made when there was a contamination risk of the surgical site [7]: Urinary diversion was made via suprapubic cystostomy in 16 patients (80%) and transurethral catheter in 4 patients (20%). 4 patients underwent diverting colostomy to avoid fecal contamination (20%).

Conventional wound dressings were changed 2 times a day. Wound was cleaned with hydrogen peroxide, hypertonic saline (10% sodium chloride solution) and povidone -iodine. Patients underwent repeated debridement, two or more days after the first and further necrotic tissues were debrided when needed under local or no anesthesia.

At the repair phase, we used different techniques of scrotal reconstruction: Scrotal advancement flap was used in 30% (n=6) of cases, fasciocutaneous anterolateral thigh flap in 25%(n=5), Groin flap in in 25% (n=5) and skin graft in 20% (n=4). All the morphological results were satisfactory.

Short-term complication rate was 10%; including suture dehiscence and infection (1 case) and graft lysis (1 case).Intestinal anastomosis was performed in all patients with colostomy. None of the following parameters seems to influence the patient's outcome: high glycemia (p=0.94), high creatinine (p=0.37), leukocyte count (p=0,33) and platelet count (p=0.51) , and low potassium (p=0.92), levels at the time of evaluation on admission.

The mean admission FGSIS was 7,1. We didn't find any prognostic interest of the FGSIS although with a high levels like 8 or 9 in some patients.

## 4. DISCUSSION

### 4.1 Epidemiology

The Fournier's Gangrene (FG) is a rare disease, with a ubiquitous world distribution, the larger clinical series are from the African continent [8]. In Morocco, over a period of 25 years ,more than 300 cases have been reported [9,10]. In spite of developing medical technology and experience, FG is still a fatal disease. In most reported cases, the patients' ages ranged between 30 and 60 years, the sex-ratio was 10 to 1 (Men to women) [11]. Female pelvic anatomy has been claimed to be better for drainage of secretions through the vagina. According to this theory, it has been thought that FG is more frequent in the male gender. On the other hand, Czymek et al. [12] reported that female gender was a risk factor for increased mortality. Mortality rate was 50% for female patients while it was 7.7% for male patients in their study. They suggested that female pelvic anatomy was a disadvantage related with rapid dissemination of the disease [5]. In our study, the mean age was 45 years. Contributing factors of infection and gangrene are often found, such as diabetes mellitus, alcoholism and smoking [13]. According to the literature, diabetes is found in 30% of cases [14,5]. In Morocco, diabetes is still a public health problem and may explain the frequency of this pathology. Patients with poor general health are particularly prone to develop a Fournier gangrene. This includes malnutrition or obesity, chronic renal failure, chronic liver disease, malignancies and other conditions causing immunosuppression [2].

### 4.2 Etiology

In our study, 14% of gangrenes were primitive with no founding etiology. In literature, the necrotizing soft tissue infection of the perineum and genitalia was reported with a percentage of 5 to 35% [15]. The secondary gangrene locoregional or general cause is the most common representing 65 to 95% in various series. 70% of patients in our series had secondary etiology. These data are consistent with those in the literature (Table 1). The genital Fournier's gangrene was also more often seen in patients with long-term bladder catheterization, urethral stricture, local trauma or perianal disease [2].

It is important to differentiate between limited forms to the perineum (46-87%) and extensive forms (13-54%) [16]. Palmer showed that was no relationship between the extension surface and the mortality rate [17]. In our study, 42% of gangrenes were evolving.

### 4.3 Bacteriological

Several organisms were found in most locations of these infections. The initial use of appropriate antibiotics should be based on knowledge of the epidemiology about of the causative bacteria and its drug resistance pattern. However, studies of the bacteriology and associated susceptibility patterns of Fournier gangrene were limited [1].

**Table 1. Etiologies of gangrene in different series**

| Causes | Our study | S. Ettalbi et al. [13] | Czymek R et al. [11] | Yilmazlar Y et al. [5] |
|---|---|---|---|---|
| Urogenital | 36% | 13% | 50% | 43.3% |
| Proctologic | 29% | - | 12% | 49.2% |
| Skin infections | 14% | - | 14% | 7.5% |
| Iatrogenic | 7% | 11% | 14% | - |

The aerobic-anaerobic association represents the best example of bacterial synergy. Bacteriological samples performed (n = 11) in our study have isolated *Escherichia coli* in 81% and anaerobes in 28%. Only two blood cultures were positive.

### 4.4 Therapeutically

The stabilization of vital functions and management toxi-infectious shock requires life-Support Measures [7]. The association of three antiobiotic was the most used proctocol: Amoxycillin+Clavulanic acid (3 g/d) + Gentamicin (15 mg / kg / d) + Metronidazole (1.5 g / d). The effectiveness of this antibiotic should be rechecked, because 55% of *Escherichia coli* isolated resistant to gentamycin and 33% of germ resistant to metronidazole [18].

The main treatment is an early surgical debridement of all necrotic tissue [19,17]. That early surgical treatment within two days after admission reduces mortality of gangrene and perineal necrotizing fasciitis. In addition, the interval time between the onset of symptoms and initial debridement has been reported to be a major predictor of mortality [20]. Some authors think that debridement should be limited to frankly necrotic tissue, other authors propose a radical excision, and these two attitudes would have no effect on mortality [11,21]. In our experience, the excision of the necrotic tissue must be supported by other interventions each time there is an extension of necrosis to prevent septic shock and preserve maximum tissue for reconstruction. The average debridement sessions required by a patient was three; this number is similar to literature [22,23].

Some authors recommend vacuum therapy after surgical debridement as an additional therapy for these patients [24]; In Morocco, we do not have this device yet, however we have the hyperbaric oxygen therapy (HBO) which is also a good alternative for the management of wound healing. However, it may not delay surgical debridement of necrotic tissue. Many institutions have initiated routine adjuvant hyperbaric oxygen therapy [25]. We believe that hyperbaric oxygen therapy inhibits the growth of anaerobic bacteria in the affected tissues.

**Fig. 1A. A 35-year-old man was referred to our department with fournier's gangrene; the management was conducted with extensive removal of necrotic tissue**

**Fig. 1B. The patient was treated by fasciocutaneous flap of thigh**

Colic derivation is important each time there is an extended perineal gangrene, and must be performed during the first intervention, preferably in the left upper quadrant abdominal to prevent possible spread of gangrene [26].

At the scrotal reconstruction, the objectives can be defined as [27]:

- An acceptable functional results with cosmetic reconstruction;
- Bridging the dead space;
- Wound healing;
- An early return to home

The success of skin graft or flaps depends on the characteristics of the defect (defect tissue topography, surface). The skin graft is for us the most simple method, when a local or regional coverage is not possible .However, there are some drawbacks; principally contractures and retractions which cause poor aesthetic results. In our study, we performed a skin graft in 4 cases with a partial lysis in one case.

Scrotal advancement flap provides the best functional and aesthetic results [28]. This technique can be used in small and medium loss of scrotal substance because of the elastic and extensible characteristics of the scrotum. In our study, we conducted a Scrotal advancement flap in 6 patients to cover a loss of substance averaged 64 $cm^2$, but this flap should be performed with caution because a long progress with live sutures may compromise the circulation and increases the risk of necrosis.

In addition, the fasciocutaneous flap and inguinal groin flap provides coverage better than skin graft [29]. In our study, we used the fasciocutaneous flap of the thigh in 5 cases, and groin flap in 5 cases (Fig. 1).

## 5. CONCLUSION

Perineal gangrene is a serious disease and its prevalence remains fortunately low. Our study confirms the complexity of this disease, both in terms of etiology as the therapeutic management. Reconstruction must be adapted to each case. Coverage of necrotic skin was done, according to its extent, by secondary epithelialization, delayed skin seal, use of skin grafts, or by the transfer of skin or muscle flaps which gives a best aesthetic and functional result.

Advances in microsurgical procedures regarding perineal reconstruction, in the design of perforator flap and tissue engineering techniques will lead to better reconstructions in the future.

## CONSENT

Written informed consent was obtained from the patient for publication of this paper.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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