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# Evaluation of the effect of vacuum assisted closure in the surgical management of Fournier's gangrene: A single center experience

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**Abstract**

Fournier's gangrene is a surgical emergency arising in the perineum and genital area and is characterized as necrotizing fasciitis of the perineum and genital area. It quickly spreads between the fascial planes and causes soft tissue necrosis. Diabetes mellitus is the most prevalent predisposing factor. Early diagnosis and management are critical in the progression of the disease. Surgical debridement and wide-spectrum antibiotic therapy are the first steps in treatment. Despite advancements in diagnosis and treatment procedures and changes in critical care techniques, the disease has a death rate of 16-40%. This research compares patients operated on for Fournier's gangrene between January 2016 and January 2022, including those treated with vacuum-assisted closure technique, vs those who were not. We acquired and analyzed the data on the patients' demographic and clinical features from hospital records. The study involved 16 patients, six (38%) in Group 1 and 10 (62%) in Group 2, 11 men (68 %) and five women (32%). Swelling in the wound region was the most prevalent complaint. The most common gangrene site was the perianal region, and diabetes was the most common predisposing condition. Group 2 had a significantly shorter hospital stay (p=0.02). There was no statistically significant difference in mortality or other parameters between the groups. The main advantages of VAC therapy are that it requires fewer dressings, causes less pain, and reduces the risk of contamination. The advantages of the traditional wet dressing include its ease of use and low cost and the fact that VAC therapy promotes faster wound healing and shorter hospital stays.

**Keywords:** Fournier's gangrene, vacuum-assisted closure, surgical treatment, diabetes mellitus

## 1. Introduction

Necrotizing fasciitis of the perineum and genital area is known as Fournier's gangrene (FG) (1). FG is a common surgical emergency that affects the perineum and genital area, spreads quickly between the fascial planes, and leads to soft tissue necrosis (2, 3).

In a case reported by Jean-Alfred Fournier in 1883, the disease, first identified as necrotizing fasciitis of the genital area by Bauriene in 1764, became known as Fournier's gangrene (4). Meleney was the first to use surgical debridement in FG in the 1920s (5). Surgical treatment is the most effective technique for reducing mortality today.

Every disease or condition that reduces tissue circulation and suppresses the immune system has been proposed as a risk factor. Diabetes mellitus is the most prevalent predisposing factor (6). Hypertension, coronary and peripheral artery disease, obesity, smoking and drug use, poor hygiene, alcoholism, cancer, and immunosuppression are all critical risk factors (7, 8). Although males are more commonly affected, the disease can affect both sexes and people of all ages (9). The etiology includes urogenital and anorectal infections, as well as trauma. FG is a disease with a fulminant and deadly course that is difficult to diagnose before necrosis and gangrene develop (10). Early detection and treatment are critical in the progression of the disease. Surgical debridement and wide-spectrum antibiotic therapy are the first steps in treatment (11). The continuation of treatment requires frequent and effective wound dressings and recurrent wound debridement's. Vacuum-assisted wound closure techniques (VAC) have become increasingly popular in recent years (12). Despite advancements in diagnosis and treatment procedures and changes in critical care techniques, the disease's death rate remains between 16 and 40% (13).

Our research aimed to assess the etiological characteristics, comorbidities, current treatment techniques, and factors influencing mortality in patients with FG, as well as to share the impact of VAC use on treatment outcomes.

## 2. Materials and Methods

This study compared patients operated on for FG between January 2016 and January 2022 and those treated with VAC with those who were not. We defined two groups of patients: Group 1 included patients operated on for FG and treated without VAC, while Group 2 included patients treated with

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VAC. We obtained and analyzed from hospital records patient demographics, leukocyte and lactate dehydrogenase (LDH) levels at admission, symptoms, affected area, etiological factors, comorbid diseases, number of debridements, diverting ostomy status, reconstruction methods, length of hospitalization, and mortality status.

### 2.1. Statistical analysis

We analyzed the data with IBM SPSS (Statistics for Windows. Armonk, NY, USA, IBM Corp.) software. We presented numerical data with mean and standard deviation values and categorical data with numbers and percentages. We evaluated relationships between categorical data using the chi-square test. We determined the distribution characteristics of continuous data with the Kolmogorov Smirnov test and the differences in numerical variables between the groups with the Mann Whitney U test. We accepted the significance level as $p<0.05$ in all statistical analyzes.

## 3. Results

This study involved 16 patients, six (38%) in Group 1 and 10 (62%) in Group 2, 11 men (68%) and five women (32%). Patients came to the emergency room with a variety of complaints. Swelling in the wound region was the most common complaint at the diagnosis. The most common gangrene site was the perianal region, and diabetes was the most common predisposing condition. We considered many factors to be associated with the etiology.

**Table 1.** Patient demographics, clinical features, etiological and predisposing factors

| Parameters | Group 1, (n:6) | Group 2, (n:10) |
|---|---|---|
| **Age* (years)** | 65.5 (±13.4) | 65.4 (±12.1) |
| **Gender, n (%)** | | |
| Male | 4 (25) | 7 (44) |
| Female | 2 (12) | 3 (19) |
| **Initial symptoms, n(%)** | | |
| Fever | 1 (6) | 0 |
| Pain | 0 | 1 (6) |
| Swelling | 2 (12) | 6 (38) |
| Crepitus | 1 (6) | 0 |
| Necrosis | 1 (6) | 2 (12) |
| Septic shock | 1 (6) | 1 (6) |
| **Involved area, n(%)** | | |
| Perianal | 4 (25) | 4 (25) |
| Perineal | 2 (12) | 2 (12) |
| Genital | 0 | 2 (12) |
| **Predisposing factors, n(%)** | | |
| Diabetes | 4 (25) | 7 (44) |
| Hypertension | 1 (6) | 2 (12) |
| Cerebrovascular disease | 0 | 1 (6) |
| **Etiology, n(%)** | | |
| Obesity | 1 (6) | 5 (31) |
| Cigarette | 2 (12) | 3 (18) |
| Poor hygiene | 1 (6) | 0 |
| İmmunosuppression | 0 | 1 (6) |
| Anorectal diseases | 2 (12) | 1 (6) |
| **Leukocyte count (u/L)*** | 17.8 (±2.8) | 15.5 (±1.9) |
| **LDH level (u/L)*** | 841 (±231) | 720 (±305) |

*Data is presented as mean (standard deviation), LDH: Lactate Dehydrogenase.

The primary causes were smoking, anorectal disorders, and obesity. Blood tests taken at the time of admission to the emergency department revealed elevated levels of leukocytes and LDH (Table 1).

During hospitalization, we conducted debridement on an as-needed basis in the operating room. The number of debridements was not significantly different between the two groups (p=0.646). We opened ostomies in two (33%) of Group 1 and three (30%) of Group 2 patients. The difference between the groups was not statistically significant (p=0.654). We applied various reconstructive approaches to patients whose wounds no longer required debridement. We used graft repair and secondary healing more frequently in Group 1, while primary repair was used more frequently in Group 2. Some patients in both groups died before we could complete wound repair. The difference between the groups was not statistically significant (p=0.064). Group 2 had a considerably shorter hospital stay (p=0.02). In both groups, there was no statistically significant difference in mortality (p=0.489) (Table 2).

**Table 2.** Treatment outcomes for Fournier's gangrene

| Parameters | Group 1, (n:6) | Group 2, (n:10) | P |
|---|---|---|---|
| **Number of debridement**** | 4 (3-6) | 3 (1-6) | 0.646 |
| **Ostomy, n(%)** | 2 (33) | 3 (30) | 0.654 |
| **Reconstruction methods, n(%)** | | | |
| Flap | 0 | 2 (12) | |
| Graft | 2 (12) | 0 | 0.064 |
| Secondary recovery | 2 (12) | 1 (6) | |
| Primary repair | 0 | 5 (31) | |
| Not implemented | 2 (12) | 2 (12) | |
| **Length of hospital stay (day) **** | 24 (17-38) | 16 (3-41) | **0.020** |
| **Mortality, n(%)** | 2 (12) | 2 (12) | 0.489 |

*Data is presented as mean (standard deviation), **Data is presented as median (min-max value)

## 4. Discussion

FG is a serious, rare disease that can be fatal if diagnosed and treated too late. It is a fulminant disease that can affect the anal, perineal, and genital areas individually or in combination. Although FG can occur at any age, it becomes more common after the age of 50 (14). It is most commonly diagnosed between the ages of 30 and 60 (15). Some studies suggest that the prognosis worsens with age, but some show that age does not affect disease mortality (16, 17). In our study, the disease often occurred after the sixth decade, consistent with the literature. This could be related to increasing etiological factor exposure and lower immunity as people get older. Although the disease most commonly affects men, it can also affect women and children (18). The disease was more frequent in males in our sample, consistent with the literature.

FG may manifest itself as fever, chills, fatigue, and local discomfort a few days after symptoms; it may change to a

rapidly deteriorating clinical picture with severe pain, edema, erythema, post-induration necrosis, and crepitation in the later period (19). Delay in diagnosis and treatment leads to the rapid spread of the infection, especially in diabetic or severely immunosuppressed patients, and even extends to more distant organs and tissues within hours, leading to an increase in morbidity and mortality (20, 21). In our study, the most common complaint at first admission was swelling in the affected area.

Studies have suggested that the disease develops from genitourinary causes in 24%, anorectal in 24%, intra-abdominal in 10%, traumatic causes in 52%, and undetected causes in 38% (22). We observed that gangrene originating from the perianal region was more common in both groups, consistent with the literature. This could stem from the perianal region being poorly ventilated and hygienic.

Diabetes mellitus is the most common predisposing factor in Fournier's gangrene. Diabetic patients have impaired chemotaxis, phagocytosis, and cellular function. This causes an increased tendency to infections (6, 21). Our study's most common comorbid disease was diabetes, consistent with the literature. This finding implies that diabetes mellitus increased sensitivity to FG once cellular activities were damaged. Other etiological risk factors include chronic alcohol consumption, obesity, cancer, poor hygiene, low socioeconomic status, trauma, immunosuppression, paraplegia, and idiopathic causes.

A high leukocyte count at the first admission increases the risk of mortality (23). In addition, increased serum creatinine kinase and lactic acid levels, high FG severity index and APACHE II score are associated with poor prognosis (20-22). In our study, leukocyte and LDH, the infection parameters, were significantly higher at first admission, but we could not evaluate the relationship between mortality and blood values due to the insufficient number of patients.

Early diagnosis, emergency debridement, and wide-spectrum antibiotics are FG's most essential treatment components (1). All necrotic tissue is debrided, and the procedure is repeated if necessary to control the infection. If the anorectal region and sphincter are involved, or if there is fecal contamination, a colostomy may be preferred to reduce contamination (24). We applied aggressive surgical debridement and wide-spectrum antibiotic therapy to all patients. There was no significant difference between the two groups regarding the number of debridements. We applied a diverting ostomy to approximately 40% of the patients, but there was no difference between the two groups. In most of the patients who underwent ostomy, the gangrene site was the perianal region. We may have opened more diverting ostomies in these patients, as we foresaw that the area would be easily contaminated and could not be taken under control. Studies have reported that patients with an ostomy prognosis are worse (16). Our study revealed diverting ostomy in all patients with a mortal course, in line with the literature. Patients are treated with wet dressing or VAC treatments, and consecutive surgical debridements are performed. Wet dressings are an effective, safe, and inexpensive method of treatment commonly used to keep the wound clean. In recent years, VAC has been widely used in treatment as an alternative to wet dressing (25). VAC therapy also has several advantages. It allows for minimizing contamination, especially in wounds with the possibility of contamination, reducing the number of dressings compared to traditional dressings, and providing less pain to the patient. In addition, negative pressure accelerates healing with the increased blood supply in the wound and provides faster clearance of inflammatory mediators (26). Studies show that the number of dressing’s decreases and the length of stay is shortened with VAC treatment (27). Our study found that patients treated with VAC were discharged in a shorter time, in line with the literature. We believe that this is due to the accelerating effect of VAC therapy on wound healing, as mentioned above.

Early closure of the defective area is an integral part of the treatment. There are various reconstruction methods to achieve this with different functional and cosmetic results. The patient's clinical characteristics and the surgeon's preference are essential in determining the reconstruction method used (28). Our study evinced that primary repair was performed significantly more in VAC patients, but there was no statistically significant difference between the two groups. We believe that the reason behind the more frequent use of primary repair in VAC patients was faster wound healing and a faster approach to wounds.

Diabetes, female gender, presence of malignant disease, and the time from the onset of the disease to the first surgical treatment were reported as independent risk factors affecting mortality (29). Pawlowski et al. reported the mortality rate in FG to be 16-40% (30). Our total mortality rate was 25%, compatible with the literature, though with no statistical significance between the two groups.

Our study had several limitations. It was retrospective and could not be randomized. Therefore, limitations such as irregularity in some case records and the inability to access all the desired data have emerged. Thus, we could not use the Fournier Gangrene Severity Index (FGSI), which is used to determine the severity and prognosis of the disease, as we could not obtain all the necessary information.

FG is an emergency surgical condition progressing rapidly and has a high mortality rate if not treated early. Early diagnosis, aggressive surgical debridement and appropriate antibiotic therapy are essential factors in the prognosis of the disease. Reconstructive procedures can be performed successfully using various dressing, and wound closure techniques in patients followed up after early surgical debridement. The important advantages of VAC therapy are

less requirement for frequent dressings and less pain and risk of contamination. According to our results, both methods have advantages over each other. The prominent features of the classical wet dressing are that it is easily accessible and cheaper and that VAC therapy provides faster wound healing and shorter hospital stays.

**Conflict of interest**

The authors declared no conflict of interest.

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**Authors' contributions**

Concept: M.U., T.A., Design: M.U., T.A., Data Collection or Processing: M.U., T.A., Analysis or Interpretation: M.U., T.A., Literature Search: M.U., T.A., Writing: M.U., T.A.

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