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Original Research

Comparison of Vacuum-assisted Closure and Conventional Dressing Treatment Modalities for Fournier's Gangrene

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ABSTRACT

Objective: The aims of this study were to evaluate the etiology and predisposing factors of patients with Fournier's gangrene (FG) and to compare the results and efficacy of vacuum-assisted closure (VAC) treatment with conventional dressings and debridement method.

Methods: The data of 52 patients diagnosed with FG and treated at our clinic between January 2013 and October 2018 were analyzed. Patients diagnosed with FG based on physical examination findings and anamnesis were analyzed. Patients with VAC applied (Group I) and not applied (Group II) were analyzed for demographics, etiology, wound culture results, predisposing factors, FG severity index, visual analog scale (VAS) for pain, number of debridements, requirement for analgesia, colostomy, length of hospital stay, and complications.

Results: Group I included 37 patients treated with conventional daily dressings, and Group II included 15 patients who were treated with VAC. No significant difference was determined between the groups with respect to etiology, microorganism type, or predisposing factors. Length of hospital stay was similar in both groups. Statistically significant differences were observed between the groups with respect to the number of debridements, VAS values, mean number of daily dressings, and use of analgesia ($P<0.001$).

Conclusion: VAC treatment does not decrease treatment duration, but less pain is felt during dressing changes as fewer dressings are used. Patient tolerance to treatment is also improved. It may be considered that the use of VAC treatment in wound care for patients with FG could increase patients' tolerance to treatment and quality of life.

Keywords: Fournier's gangrene, vacuum-assisted closure, debridement

INTRODUCTION

Fournier's gangrene (FG) was first defined by Jean Alfred Fournier in 1883 and continues to be known by his name (1). Fournier described this as a sudden-onset idiopathic disease in a series of 5 healthy young men, which develops in the penis and scrotum and leads to fulminating gangrene. Although Fournier defined the disease as idiopathic, there is current high incidence in men older than 50 years and, in the majority of cases, the etiological reason is known to be anorectal (30%–50%), urogenital (20%–40%), or skin (20%) infections originating from aerobic and anaerobic microorganisms (2, 3).

Early diagnosis and treatment of the disease, which is also known as necrotizing fasciitis, is of vital importance, with mortality rates varying between 7% and 75% (3). Aggressive surgical debridement must be applied to patients immediately and effective empirical parenteral antibiotic treatment must be started for all possible microorganisms (4–6). Repeated debridements are often applied to patients (7). After the first radical debridement, daily conventional dressings or vacuum-assisted closure (VAC) can be used for open wound treatment (4). However, the inability to tolerate daily dressings can create a need for analgesia or general anesthetic, which has a negative effect on quality of life for the patient.

The aims of this study were to evaluate the etiology and predisposing factors of patients with Fournier's gangrene and to compare the results and efficacy of VAC use with the conventional dressings and debridement method.

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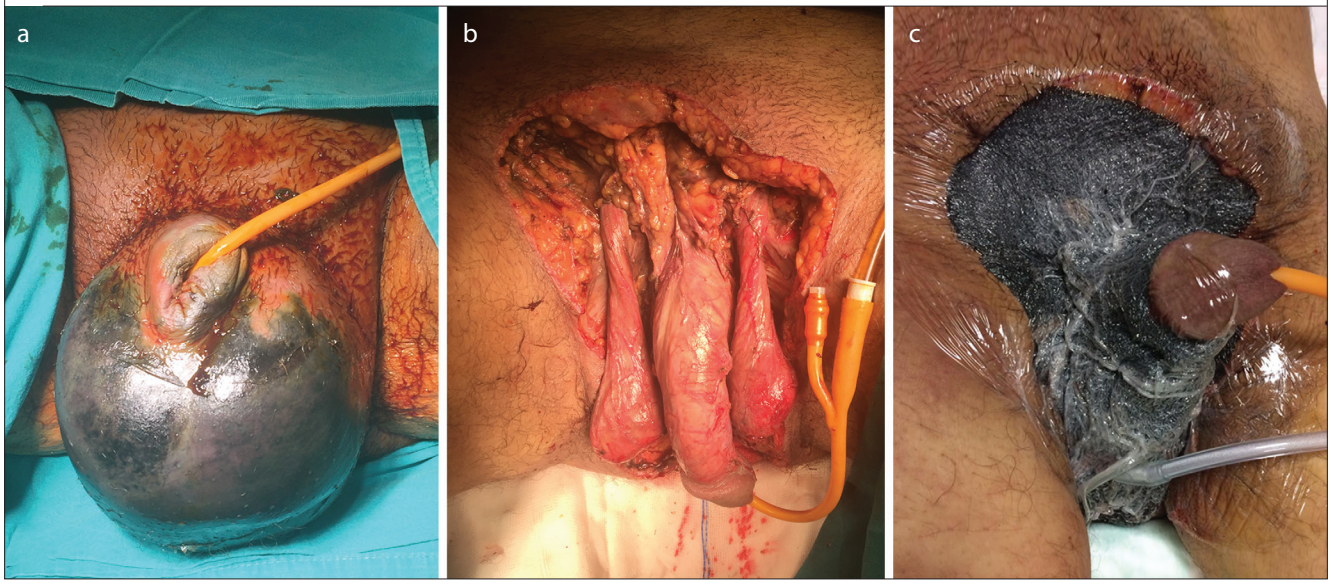
Figure 1. a-c. (a) The patient with Fournier's gangrene before treatment. (b) Same patient after the first surgical debridement procedure. (c) VAC application after surgical debridement.



METHODS

A retrospective examination was made of data for 52 patients diagnosed with Fournier's gangrene who were treated in our clinic between January 2013 and October 2018. Approval for the study was obtained from the local ethics committee of Health Sciences University, Adana City Training and Research Hospital (12.09.2018/281).

Patients diagnosed with Fournier's gangrene based on physical examination findings and anamnesis were analyzed. Diagnostic criteria for the physical examination were findings such as genital, perineal, and perianal sensitivity; induration; erythema; fluctuation; necrosis; and subcutaneous crepitation. Patients with simple abscess and inflammation of the urogenital and perianal region that had not progressed to the fascia were excluded from the study. Initially, all patients were treated with empirical broad-spectrum antibiotics (third generation cephalosporin, aminoglycoside, and metronidazole). According to the culture and antibiogram results, the antibiotics were switched if necessary. Informed consent was obtained from the patients, and they were admitted for surgery on the same day. Aggressive debridement was applied to all necrotic tissues until live and normal bleeding fascia was obtained. For patients with possible fecal contamination, a colostomy was performed. Tissues were irrigated with hydrogen peroxide and povidone iodine. Repeated debridements were applied to patients with infection and necrosis that persisted after the first debridement. Postoperatively, fluid replacement was administered to the patients, low-molecular weight heparin was started, and blood transfusion and nutritional support were administered if necessary.

Main Points:

- In the treatment of Fournier's gangrene, after the first radical debridement, daily traditional dressings or vacuum assisted closure (VAC) can be used for open wound treatment.
- In the current study, statistically significant differences were determined between the groups with respect to the number of debridements, VAS values, mean number of daily dressings, and use of analgesia.
- The number of repeated debridements was greater in the patients followed up with conventional dressings compared with those with VAC.
- The patients with VAC applied were found to have lower VAS values and require less analgesia.
- VAC treatment does not decrease treatment duration, but less pain is felt during dressing changes as fewer dressings are used. Patient tolerance to treatment is also improved.

For the patients who planned to have VAC, an Exsudex vacuum pump (Haromed bvba, Ghent, Belgium) was applied with 80 to 120 mmHg subatmospheric negative pressure within 24 to 48 hours after the acute phase. The device was set for 10 minutes of negative pressure, followed by 2 minutes of rest. The vacuum dressing was changed every 72 hours. Patients who did not use VAC were followed up with daily debridement and dressings changed twice a day (Figure 1).

The patients with VAC applied and not applied were analyzed with respect to demographic data, etiology, culture results, predisposing factors, Fournier's gangrene severity index (FGSI) score, visual analog scale (VAS) for pain, number of debridements, requirement for analgesia, colostomy, length of hospital stay, and complications. The FGSI score was defined by Laor et al. (8) as the score obtained from the 9 parameters of body temperature; pulse; respiratory count; and serum sodium, potassium, creatinine, bicarbonate, hematocrit, and white cell values, indicating the severity of the disease (Table 1).

Table 1. Fournier's gangrene severity index (FGSI)

Physiological Variable/Point Assignment	High Abnormal Value				Normal	Low Abnormal Value			
	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (˚C)	>41	39–40.9	–	38.5–38.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate	>180	140–179	110–139	–	70–109	–	55–69	40–54	<39
Respiratory rate	>50	35–49	–	25–34	12–24	10–11	6–9	–	<5
Serum sodium (mmol/L)	>180	160–179	155–159	150–154	130–149	–	120–129	111–119	<110
Serum potassium (mmol/L)	>7	6–6.9	–	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	–	<2.5
Serum creatinine (mg/100 mL x2 for acute renal failure)	>3.5	2–3.4	1.5–1.9	–	0.6–1.4	–	<0.6	–	–
Hematocrite (%)	>60	–	50–59.9	46–49.9	30–45.9	–	20–29.9	–	<20
White blood count (total/mm3 x1000)	>40	–	20–39.9	15–19.9	3–14.9	–	1–2.9	–	<1
Serum bicarbonate (venous, mmol/L)	>52	41–51.9	–	32–40.9	22–31.9	–	18–21.9	15–17.9	<15

Table 2. Etiology, morbidity and predisposing factors for Fournier's gangrene

	Group I (Conventional) n (%)	Group II (VAC)	Total n (%)	P Value
Origin				
Urogenital[a]	26 (70.3)	10 (66.7)	36 (69.2)	0.523
Anorectal	8 (21.6)	4 (26.7)	12 (23.1)	0.726
Other	3 (8.1)	1 (6.7)	4 (7.7)	0.674
Mortality	4 (10.8)	2 (13.3)	6 (11.5)	0.565
Colostomy	2 (5.4)	1 (6.7)	3 (5.8)	0.648
Predisposing factors				
DM	22 (59.5)	10 (66.7)	32 (61.5)	0.628
Renal failure	4 (10.8)	2 (13.3)	6 (11.5)	0.565
Hepatic dysfunction	2 (5.4)	1 (6.7)	3 (5.8)	0.648
Malignancy	1 (2.7)	1 (6.7)	2 (3.8)	0.498
Alcoholism	1 (2.7)	1 (6.7)	2 (3.8)	0.498

DM, diabetes mellitus.
[a]Urogenital includes the urethra, prostate, urinary bladder, and genitalia.

Statistical Analysis

Data obtained in the study were analyzed statistically using Statistical Package for Social Sciences software, version 20.0 (IBM SPSS Corp.; Armonk, NY, USA). Conformity of quantitative variables to normal distribution was assessed using the Kolmogorov-Smirnov test and the Shapiro Wilk test. The Mann Whitney U test was applied to quantitative variables, and the Chi-square test and Fisher's Exact test to categorical-nominal variables. A value of P less than 0.05 was accepted as statistically significant.

RESULTS

Patients diagnosed with FG to whom surgical debridement was applied were separated into 2 groups according to the open wound treatment. Group I included 37 patients treated with conventional daily dressings, and Group II included 15 patients with VAC applied. All of the patients were men with a mean age of 57.1±10.7 years in Group I and 58.6±11.1 years in Group II (P=0.785). No significant difference was determined between the groups with respect to etiology, microorganism type, or predisposing factors. In Group I, 22 (59.5%) patients had diabetes, 1 (2.7%) had alcoholism, and 4 (10.8%) had renal failure. In Group II, 10 (66.7%) patients had diabetes, 1 (6.7%) had alcoholism, and 2 (13.3%) had renal failure (Table 2).

The mean FGSI score was calculated as 4.6±3.3 in Group I and 3.9±3.3 in Group II (P=0.433). A total of 4 (10.8%) patients in Group I and 2 (13.3%) in Group II died (FGSI scores 10–12). In the first group, 3 patients with diabetes mellitus (DM) and 1 patient with hepatic dysfunction died as a result of sepsis. In the second group, 1 patient with DM and 1 patient with DM and kidney failure died as a result of sepsis. The general mortality rate of 6 patients was found to be 11.5%. Colostomy was opened in 2 patients in Group I and in 1 patient in Group II (P=0.648). The responsible microorganism was identified in 42 (80.8%) patients. The bacteriological results are shown in Table 3.

The length of hospital stay was similar in both groups (Group I: 20.3±11.1 d; Group II: 23.5±17.0 d) (P=0.754). Statistically significant differences were determined between the groups with respect to the number of debridements, VAS values, mean number of daily dressings, and use of analgesia. The mean number of daily dressings was 1.7±0.3 in Group I and 0.3±0.1 in Group II

Table 3. Bacteriological results

	Group I (Conventional) n (%)	Group II (VAC) n (%)	Total n (%)
Escherichia coli	10 (27.0)	6 (40.0)	16 (30.8)
Staphylococcus aureus	5 (13.5)	2 (13.3)	7 (13.5)
Proteus vulgaris	3 (8.1)	1 (6.7)	4 (7.7)
Enterococcus faecium	3 (8.1)	1 (6.7)	4 (7.7)
Acinetobacter baumannii	1 (2.7)	2 (13.3)	3 (5.8)
Klebsiella pneumoniae	3 (8.1)	–	3 (5.8)
Pseudomonas aeruginosa	2 (5.4)	–	2 (3.8)
Enterobacter cloacae	1 (2.7)	–	1 (1.9)
Staphylococcus haemolyticus	–	1 (6.7)	1 (1.9)
Streptococcus anginosus	–	1 (6.7)	1 (1.9)
No bacterial growth	9 (24.3)	1 (6.7)	10 (19.2)

Table 4. Characteristics of patients

	Group I (Conventional) n=37, Mean±SD	Group II (VAC) n=15, Mean±SD	P Value
Age	57.1±10.7	58.6±11.1	0.785
FGSI	4.6±3.3	3.9±3.3	0.433
LOS	20.3±11.1	23.5±17.0	0.754
Number of daily dressings (mean)	1.7±0.3	0.3±0.1	<0.001
VAS	6.9±1.4	4.9±1.5	<0.001
Number of debridements	2.5±1.0	1.9±0.7	0.034
Number of daily analgesics (mean)	2.3±0.4	1.7±0.3	<0.001

FGSI, Fournier's gangrene severity index; LOS, length of stay; SD, standard deviation; VAS, visual analog scale for pain.

(P<0.001). The number of debridements was 2.5±1.0 in Group I and 1.9±0.7 in Group II (P=0.034). VAS values were determined as a mean of 6.9 ±1.4 in Group I and 4.9±1.5 in Group II (P<0.001). The mean daily analgesia requirement was 2.3±0.4 in Group I and 1.7±0.3 in Group II (P<0.001) (Table 4).

DISCUSSION

Urogenital, colorectal, or cutaneous polymicrobial infections of aerobic and anaerobic microorganisms and local trauma are often encountered in FG etiology (3). Although perianal and rectal infections have often been reported in the literature (9), for the majority of patients in the current study, urogenital, perineal, and scrotal infections were involved in the etiology. This was attributed to FG developing secondary to perianal and rectal infections being referred more often to the General Surgery Clinic and that the Urology Clinic was consulted in cases of FG involving the penoscrotal region.

In a review of 1726 cases by Eke, it was emphasized that FG was observed 10-fold more in adult men (3), although pediatric (10, 11) and female (12) cases have been reported in the literature. Yucel et al. (13) reported that the increased incidence of FG in elderly patients was associated with a weak immune response secondary to chronic diseases, increased incidence of impaired circulation, and more vascular pathologies being observed at advanced ages. There is a high likelihood of diabetes and obesity in patients with FG (2). Predisposing factors for FG include diabetes, obesity, cancer, alcoholism, advanced age, poor hygiene, malnutrition, trauma, renal failure, liver disease, and other immune-suppressing conditions (2, 9, 14, 15). DM is the most frequently encountered predisposing factor (3, 9). Diabetes and alcohol consumption are known to impair the immune system, and diabetes also causes distal arterial disease. In the current study, the rate of DM was found to be 59.5% in Group I and 66.7% in Group II.

Colostomy is recommended in patients with FG with perianal sphincteric, anorectal involvement (16). In the current study, colostomy was performed in only 3 patients. The reason for this lower rate according to the previous reports in the literature is believed to be the fact that patients with FG at our clinic were generally those in whom infection had developed from the scrotum and perineal region.

The causes of death of patients with FG include severe sepsis (8), coagulopathy (17), acute renal failure (18), diabetic ketoacidosis (17), or multiple organ failure (19). When Laor et al. (8) used a cut-off value for FGSI score of 9, they reported that the probability of mortality in patients with a score greater than 9 was 75% and the survival probability for those with a score of 9 or less was 78%. In the current study, no significant difference was found between patients with conventional dressings and those with VAC applied with respect to mortality rates. The FGSI scores of the patients with mortality were greater than 9. The general mortality rate was determined to be 11.5%, which is with the findings of the current literature.

The application of negative pressure to extensive tissue defects formed after aggressive debridement aims to facilitate wound healing through the elimination of bacterial contamination, infected material, and exudates; the reduction of edema; and the acceleration of granulation tissue formation (20, 21). Assenza et al. (22). reported that VAC treatment reduced the hospitalization time of patients and allowed early reconstructive surgery. Cuccia et al. (23) also stated that VAC treatment shortened the length of stay in hospital. In a prospective evaluation of the efficacy of VAC treatment in 35 patients diagnosed with FG, Czymek et al. (9). reported that VAC treatment was not superior to conventional dressings with respect to length of hospital stay and clinical

results but that the treatment was clinically effective and successful for extensive wounds. In the current study, no significant difference was determined between the 2 groups with respect to length of stay in hospital.

Open wound care is a problematic process often requiring lengthy hospitalization. Conventional dressings generally require more than 1 intervention within 24 hours, which can be a painful procedure and vexatious for both the patient and the clinician. For wound care with VAC, the dressing is changed once every 48–72 hours (24, 25), and patients experience less pain compared with care with conventional dressings (25). In addition, patients can be mobilized with a VAC device. Reducing the number of dressing changes and mobilization increases patient comfort. An important potential advantage of the use of a VAC device in the genitourinary region is that the drape creates a barrier against fecal contamination (24). Previous studies in the literature reported that VAS scores and the requirement for daily analgesia are significantly higher in patients treated with conventional dressings compared with those treated with VAC (25, 26). Similarly, in the current study, the patients with VAC applied were found to have lower VAS values and require less analgesia.

In a review of 1641 patients with FG, it was reported that surgery was applied a mean of 2.2 ± 1.6 times and debridement a mean of 1.5 ± 1.0 times (2). Cuccia et al. stated that there were no major complications with VAC treatment. It was safe, it reduced the number of debridements, and it increased patient comfort (23). In the current study, the number of repeated debridements was greater in the patients followed up with conventional dressings compared with those with VAC.

In a study by Öztürk et al. (26) the time from first debridement to wound closure was found to be similar in both groups, but wound healing in the VAC group occurred with fewer interventions than in the conventional dressings group, which resulted in a significant increase in patient comfort. Because the VAC treatment system is portable, patients are not bed-bound, and even if only partially, mobility can be maintained, allowing independent bathroom use, unlike patients with conventional dressings. In addition, there is no bad odor originating from the wound or bed-wetting related to the dressing. There is also less restriction on oral intake owing to the lower need for analgesia and sedation. Therefore, the use of VAC was observed to have a significant positive impact on quality of life of the patient compared with conventional treatment (26). The same authors reported that, in addition to VAC treatment being more comfortable for the patient, it is also preferred by clinicians. As the number of interventions required is reduced, the clinician spends less time on treatment, pain-related complaints are reduced, and there is a lower requirement for analgesia. Consequently, the use of VAC for wound care of patients with FG is easier for both the patient and the clinician.

No cost comparisons were made in the current study but there are previous studies that showed the cost of VAC treatment was similar to or slightly less than conventional treatment (26, 27). As there are more dressings and debridements in the conventional method, it is believed that a similar result would also be obtained in the current study.

Limitations of this study can be considered as not being prospective or randomized in design. However, the number of patients is believed to be sufficient when the low incidence of FG is taken into consideration.

CONCLUSION

The use of VAC in wound care after aggressive debridement in patients with FG is more comfortable for both the patient and the clinician. Although VAC treatment does not shorten the treatment process, less pain is felt during dressing changes as fewer dressings are used and patient tolerance to treatment is increased. This reduces the need for analgesia and reduces the number of repeated debridements with anesthesia. Quality of life is improved for the patients, as they can be easily mobilized and use the bathroom independently. Therefore, it is considered that the use of VAC treatment in the wound care of patients with FG will increase over time.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Health Sciences University, Adana City Training and Research Hospital (12.09.2018/281).

Informed Consent: Informed consent is not necessary due to the retrospective nature of this study.

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