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Original Article – General Urology

Title: Comparison of Negative Pressure Wound Therapy and Conventional Dressing of Fournier's Gangrene (Fournier Gangreninde Negatif Basınçlı Yara Tedavisi ile Konvansiyonel Yara Pansumanının Karşılaştırılması)

Short Title: Comparative Treatment of Fournier's Gangrene (Fournier Gangreninde Karşılaştırılmalı Tedavi)

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Abstract

Objectives: The aim of this study is to compare two patient groups diagnosed with Fournier's Gangrene (FG) and treated with negative pressure wound therapy (NPWT) and conventional wound dressing (CWD) methods.

Materials and Methods: 64 patients with FG, who were followed up and treated at the Urology clinic of University Hospital between January 2011 and July 2020, were included in the study. Patients were divided into two groups: While group 1 received CWD treatment, group 2 received NPWT. Demographic characteristics, etiology, length of stay, number of debridements, additional surgeries, Fournier Gangrene Severity Index (FGSI) scores, analgesic needs, area of necrosis and amount of involvement of the patients were retrospectively analyzed.

Results: 37 patients in group 1 and 27 patients in group 2 were included in the study. All patients were male. The mean hospital stay was 17.9 ± 1.8 days in group 1, while it was 12.7 ± 1.1 days in group 2 (p:0.91). The mean debridement numbers in Group 1 and Group 2 were 7.1 ± 0.8 and 3.7 ± 0.3, respectively (p:0.004). The mean number of daily analgesic use in Group 1 and Group 2 was 2.4 ± 0.12 and 1.44 ± 0.08, respectively (p<0.001). The mean area of necrosis was 124 ± 11.3 cm^2 and 147 ± 18.1 cm2, respectively (p:0.614). In group 1 and group 2, 4 and 2 patients died, respectively (p:1.00).

Conclusion: NPWT reduced the treatment burden of this disease by reducing the number of debridements and analgesic use. However, NPWT did not reduce the length of hospital stay.
Keywords: debridements, Fournier’s gangrene, negative pressure wound therapy, analgesics, FGSI

Özet

Amaç: Bu çalışmanın amacı, Fournier Gangreni (FG) tanısı alan ve negatif basınçlı yara tedavisi (NBYT) ile konvansiyonel pansuman yöntemleri (KPY) ile tedavi edilen iki hasta grubunu karşılaştırmaktır.

Gereçler ve Yöntemler: Ocak 2011-Temmuz 2020 tarihleri arasında Üniversite Hastanesi Üroloji kliniğinde takip ve tedavi edilen Fournier Gangreni tanılı 64 hasta çalışmaya dahil edildi. Hastalar iki gruba ayrıldı: grup 1’e KYP tedavisi uygulanırken, grup 2’ye NBYT uygulandı. Hastaların demografik özellikleri, etiyolojisi, yatış süresi, debridman sayıları, ek ameliyat sayısı, Fournier Gangreni Şiddet İndeksi (FGSI) skorları, analjezik ihtiyacı, nekroz alanı ve tutulum miktarı retrospektif olarak incelendi.

Bulgular: Grup 1'de 37, grup 2'de ise 27 hasta çalışmaya dahil edildi. Hastaların tamamı erkekti. Ortalama hastanede kalış süresi grup 1'de 17,9 ± 1,8 gün iken grup 2'de 12,7 ± 1,1 gündü (p:0,91). Grup 1 ve Grup 2'deki ortalama debridman sayıları sırasıyla 7,1 ± 0,8 ve 3,7 ± 0,3 idi (p:0,004). Grup 1 ve Grup 2'de ortalama günlük analjezik kullanım sayısı sırasıyla 2,4 ± 0,12 ve 1,44 ± 0,08 idi (p<0,001). Ortalama nekroz alanı sırasıyla 124 ± 11,3 cm2 ve 147 ± 18,1 cm2 idi (p:0,614). Grup 1 ve grup 2'de sırasıyla 4 ve 2 hasta öldü (p:1.00).

Sonuç: NBYT debridman sayısını ve analjezik kullanımını azaltarak bu hastalığın tedavi yükünü azalttı. Ancak NBYT hastanede kalış süresini kısaltmadı.
Anahtar kelimeler: debridman, Fournier gangreni, negatif basınçlı yara tedavisi, analjezikler, FGSI

Introduction

Fournier's gangrene (FG) was described in 1883 by the French venerologist Jean Alfred Fournier. In his series with 5 patients, he defined this disease as idiopathic fulminant gangrene involving the scrotum and penis [1]. FG usually begins with perianal or perineal pain. Scrotal swelling, local erythema of the skin and pain are the common symptoms. Also, hyperemia, pruritus, fever, nonspecific abdominal pain are other common symptoms. Cellulitis-like lesions in the early period complexify the diagnosis of the disease and cause it to be missed.

FG mostly develops in patients with comorbidities; however, it can also occur in patients without comorbidities. Hypertension, obesity (BMI>30 kg/m2), congestive heart failure, tobacco use, immunosuppressive conditions (such as acquired immun deficiency syndrome [AIDS]), peripheral vascular diseases and alcoholism have been found to be associated with an increased risk in FG [2]. Diseases and risk factors in the etiology for FG help inoculation of microorganisms by damaging the immune system. Polymicrobial agents, as in many necrotizing soft tissue infections, cause FG. Microorganisms normally found in the perineum and genital area cause infection after a suitable environment is created. The cornerstones of FG treatment are immediate debridement of all necrotic tissues, initiation of broad-spectrum antibiotics, and patient stabilization with hemodynamic resuscitation [3]. FG is accepted as one of the urological emergencies because the rate of spread of facial necrosis can be 2-3 cm/hour. In addition, the fact that up to 21% of patients present with hypotension and septic shock increase the importance of patient stabilization before emergency surgery [4].

Broad-spectrum antibiotherapy should be started empirically as soon as FG is diagnosed, and then revised according to culture results [5]. Initial antibiotherapy should target common bacteria such as staphylococcus and streptococcal species, gram-negative bacteria, clostridium, bacteroides and pseudomonas [6]. In patients with a history of fungal infection or in immunosuppressed patients, antifungals such as amphotericin B or fluoroquinolones should be added to the treatment, considering fungal infection as the causative agent [7]. However, due to poor vascularization in fascial tissues, surgical intervention is key for an effective antibiotic therapy.

Early debridement of necrotic and dead tissue is a critical step in controlling the infection. Debridement of all dead tissues in the first operation is considered the most important factor in the patient's survival [8]. Extensive debridement and ventilation of living tissues by opening windows are recommended. Close monitoring of the wound and repeated debridements are necessary to control infection [9].

While FG can also be treated with classical dressing, vacuum-assisted closure (VAC) therapy has become popular in recent years [10]. VAC method accelerates wound healing by reducing edema and increasing blood flow. VAC system increases angiogenesis and improves tissue nutrition and formation. The main mechanism of the device is that VAC system drains dirty liquid and stagnant debris [6].

In this study, the effect of VAC therapy for the treatment of FG and the factors affecting this disease tried to be shown.

Materials and Methods

Ethical approval for this study was obtained from Dicle University Medical Faculty Ethics Committee (Approval Number: 318, date: 03.09.2020). 64 FG patients who were followed up and treated between January 2011 and July 2020 in the Urology clinic of the University Hospital were included in the study. CWD was applied to 37 patients in Group 1 and NPWT was applied to 27 patients in Group 2. Informed consent was taken from all patients. All patients included in the study were male. FG was diagnosed with pain, edema, purulent discharge, necrosis and crepitation on palpation in physical examination after anamnesis was taken from the patient **(Figure 1)** (scrotal swelling, necrosis and erythema in a patient with FG). As soon as diagnosis was made, fluid resuscitation and antibiotherapy were started. The patient was then taken to emergency operation; and the first debridement was performed, which was performed to necrotic tissues until vital and normal bleeding tissues were seen **(Figure 2)** (vital tissues after surgical debridement). Depending on the vitality, the testicles were either preserved or orchiectomy was performed. Foley catheter was inserted to all patients. In patients with penile or urethra involvement, urinary diversion was performed by inserting a cystostomy catheter. A colostomy was performed in patients in whom the anal sphincter was involved or stool contamination could occur in the debrided area. A fecal management set was applied to the patients who did not undergo colostomy procedure, and who were thought to have stool contamination. In Group 1, mesh dressing prepared with rifamycin SV (sodium salt hydrate); and nitrofurazone pomade was applied 2 or 3 times per day. Epidural anesthesia or narcotic analgesics were used during the dressing. Before starting the dressing, the wound site was washed with hydrogen peroxide and isotonic. Debridement was performed in the operating room under spinal anesthesia, once every 2 or 3 days, depending on the degree of necrosis. Debridement was performed more frequently in cases where the degree of necrosis increased. In Group 2, the VAC device was applied in a sealed way after the first debridements. The pressure value was brought to the subatmospheric mean value of 100-125 mmHg **(Figure 3)**

(vacuum device placement after surgery). The VAC system was renewed in the operating room every 2 or 3 days. Tissues were irrigated with rifamycin SV (sodium salt hydrate) before the VAC device was mounted. All VAC device changes were performed in the operating room under spinal anesthesia. Debridements were performed until viable granulation tissue was seen in both group. The wound site was closed primarily in patients with the wound lips reaching each other. In case of extensive tissue loss after aggressive debridement, the plastic surgery department was consulted for free flap transportation. Patients who were planned for reconstruction were transferred to the plastic surgery department. All patient's age and comorbidities, etiologies by origin, additional surgeries such as orchiectomy, penectomy, colostomy and cystostomy, mortality status, length of hospital stay, number of debridements, average analgesic use, Fournier's Gangrene Severity Index (FGSI) scores, area of necrosis involved, and amount of necrosis areas in cm^2 were recorded.

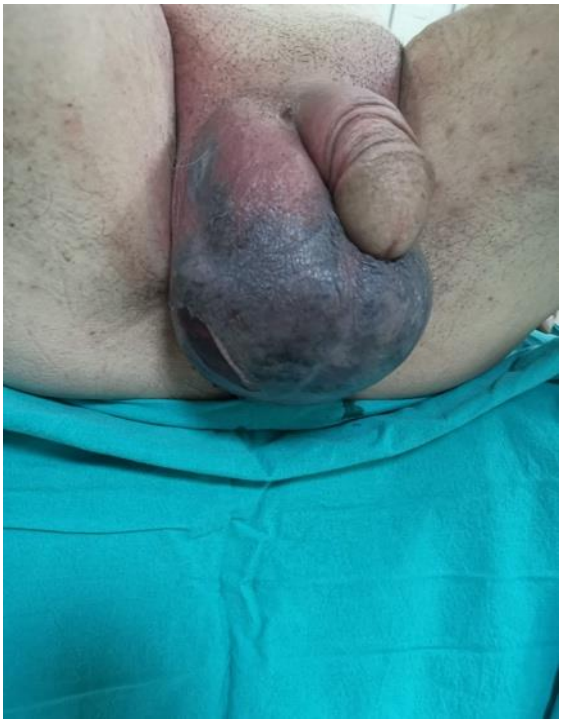

Figure 1. Scrotal swelling, necrosis and erythema in a patient with Fournier's Gangrene

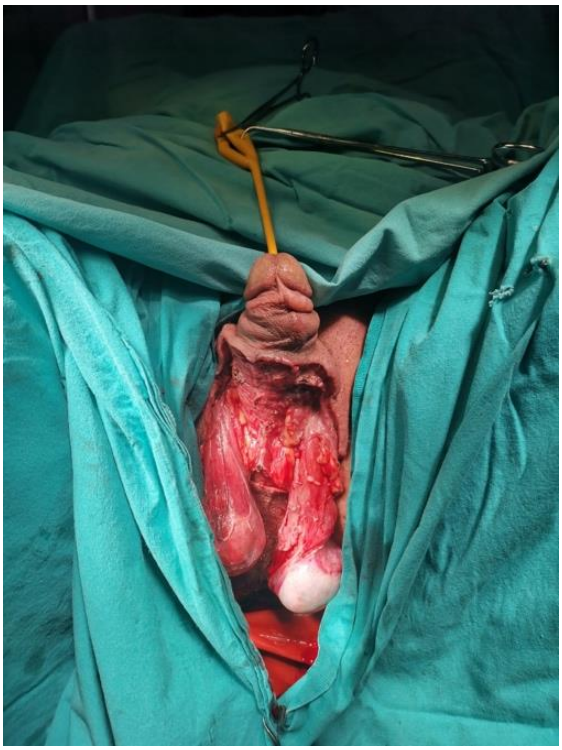

Figure 2. Vital tissues after surgical debridements

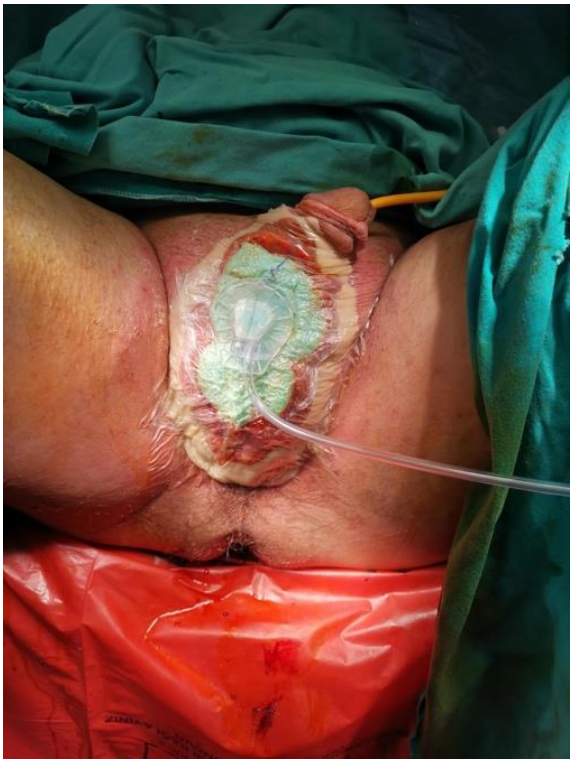

Figure 3. Vacuum device placement after surgery

Statistical Analysis

In the comparison of two independent groups, t test was used to see if the results were in a normal distribution and Mann Whitney U test was used to find out if it did not. Chi-square or fisher's exact tests were used for the analysis of qualitative data. Quantitative data was expressed as mean ± std values in the tables. Categorical data were written as n (frequency) and percentages (%). The data was analyzed at 95% confidence level and the P value was considered significant when it was less then 0.05.

Results

All patients included in the study were male and their mean age was 53.5 ± 2.6 in group 1 and 50.2 ± 3.4 in group 2 (p>0.05). Diabetes mellitus was the most common comorbid disease in both groups **(Table 1)**.

Table 1. Number of patients and comorbidities by groups

Characteristics	**Total**	**Group 1**	**Group 2**	**P value**
Number of patients	64	37	27	
Age	52 ± 2.1	53.5 ± 2.6	50.2 ± 3.4	.434
Diabetes mellitus	23 (35.9%)	13 (35.1%)	10 (37%)	.876
Cardiac problems	7 (10.9%)	4 (10.8%)	3 (11.1%)	1.00
Malignity	10 (15.6%)	3 (8.1%)	7 (25.9%)	.81
Chronic obstructive pulmonary disease	3 (4.7%)	2 (5.4%)	1 (3.7%)	1.00
Infection after surgery	4 (6.3%)	1 (2.7%)	3 (11.1%)	.302
Chronic kidney disease	5 (7.8%)	2 (5.4%)	3 (11.1%)	.642
Wegener Granulomatosis	1 (1.6%)	1 (2.7%)	0	1.00
Paraplegia	1 (1.6%)	1 (2.7%)	0	1.00

FG is basically divided into 3 groups according to its etiology. The group of patients whose etiology cannot be found is called idiopathic. In our study, in group 1, 21 (56.8%) patients had urogenital origin, 7 (18.8%) patients had anorectal origin, 3 (8.7%) patients had skin infection and 6 (16.2%) patients were idiopathic. In group 2, 16 (59.3%) patients had urogenital origin, 9 (33.3%) patients had anorectal origin, 1 (3.7%) patient had skin infection and 1 (3.7%) patient was idiopathic. There was no statistical difference between the groups according to their etiology (p>0.05) **(Table 2)**.

Table 2. Distribution of patients by etiology

Origin	Total (n=64)	Group 1 (n=37)	Group 2 (n=27)	P value
Urogenital	37 (57.8%)	21 (56.8%)	16 (59.3%)	.841
Anorectal	16 (25%)	7 (18.9%)	9 (33.3%)	.188
Skin infection	4 (6.3%)	3 (8.7%)	1 (3.7%)	.632
Idiopathic	7 (10.9%)	6 (16.2%)	1 (3.7%)	.223

The mean hospital stay was 17.9 ± 1.8 and 12.7 ± 1.1 days, for group 1 and group 2, respectively (p:0.91). The mean debridement numbers were 7.1 ± 0.8 and 3.7 ± 0.3, respectively (p:0.004). The mean number of daily analgesic use was 2.4 ± 0.12 and 1.44 ± 0.08, respectively (p<0.001). The mean area of necrosis was 124 ± 11.3 cm^2 and 147 ± 18.1 cm2, respectively (p:0.614). In group 1, orchiectomy was performed on 8 patients, 3 patients bilaterally and 5 patients unilaterally. In Group 2, a total of 8 patients underwent unilateral orchiectomy (p: 0.465). In addition, colostomy was performed on 4 patients in group 1, penectomy on 1 patient, colostomy on 5 patients in group 2, and cystostomy on 2 patients (p> 0.05). The wounds of 14 patients in group 1 and 16 patients in group 2 were closed primarily. The wounds of 19 patients from group 1 and 9 patients from group 2 were closed after reconstruction by the plastic surgery department (p:0.103). The mean FGSI scores in group 1 and 2 were 4.6 ± 0.5 and 3.8 ± 0.6, respectively (p:0.227). In group 1 and 2, 4 and 2 patients died, respectively (p:1.00) **(Table 3)**.

Table 3. Patient characteristics and additional surgeries

Characteristics	Total	Group 1	Group 2	P value
Number of patients	64	37	27	
Mean hospitalization	15.7 ± 1.2	17.9 ± 1.8	12.7 ± 1.1	.91
Mean debridements number	5.7 ± 0.5	7.1 ± 0.8	3.7 ± 0.3	.004
Mean daily analgesic use	2 ± 0.1	2.4 ± 0.12	1.44 ± 0.08	<.001
Area of necrosis(cm^2)	134 ± 10	124 ± 11.3	147 ± 18.1	.614
Number of orchiectomy	16 (25%)	8 (21.6%)	8 (29.6%)	.465
Number of colostomy	9 (14.1%)	4 (10.8%)	5 (18.5%)	.475
Number of cystostomy	2 (3.1%)	0	2 (7.4%)	.174
Number of penectomy	1 (1.6%)	1 (2.7%)	0	1
Type of wound closure Primary	30 (51.7%)	14 (42.4%)	16 (64%)	.103
Reconstructive	28 (48.3%)	19 (57.6%)	9 (36%)	
FGSI	4.3 ± 0.4	4.6 ± 0.5	3.8 ± 0.6	.227
Mortality	6 (9.4%)	4 (10.8%)	2 (7.4%)	1

All patients included in the study had scrotal involvement. Inguinal region involvement was 17 (45.9%) and 13 (48.1%) in group 1 and 2, respectively (p:0.862). Perineal involvement was 20 (54.1%) and 13 (48.1%) in group 1 and 2, respectively (p:0.641). Abdominal spread was 3 (8.1%) and 4 (14.8%) in group 1 and 2, respectively (p:0.443). Penile involvement was 2 (5.4%) and 4 (14.8%) in group 1 and 2, respectively. In group 1 and 2, spread to the thigh region was 2 (5.4%) and 5 (18.5%), respectively **(Table 4)**.

Table 4. Distribution according to the areas of necrosis involved

Area of necrosis involved	Group 1 (n=37)	Group 2 (n=27)	P value
Scrotum	37 (100%)	27 (100%)	1.00
Inguinal	17 (45.9%)	13 (48.1%)	.862
Perineum	20 (54.1%)	13 (48.1%)	.641
Abdomen	3 (8.1%)	4 (14.8%)	.443
Penis	2 (5.4%)	4 (14.8%)	.231
Thigh	2 (5.4%)	5 (18.5%)	.122

A total of 6 patients who participated in the study are deceased. The mean FGSI score of the surviving patients, whom we mentioned in Table 5 as survivor, was 3.4 ± 0.3. The mean FGSI score of the patients who deceased, whom we defined as non-survivors, was 12.5 ± 1. A statistical difference was found between them (p<0.001) **(Table 5)**.

Table 5. Mortality and FGSI scores

Variables	Survivor (n=58)	Nonsurvivor (n=6)	P value
FGSI (mean ± SD)	3.4 ± 0.3	12.5 ± 1	**<0.001**

Discussion

Despite all advances and early interventions in the medical world, FG is still a disease with high mortality. FG mortality rates range from 3% to 45%. In Eke et al.'s 1726 disease series, this rate was found to be 16%. In our study, this rate was found to be 9.3%. Severe sepsis, coagulopathy, acute renal failure, diabetic ketoacidosis, and multiple organ failure were the causes of death. Less than 1⁄4 of FG cases are currently considered idiopathic. The most common causes are known as gastrointestinal tract with 30-50%, genitourinary tract with 20-40% and cutaneous causes with 20% [11]. In our study, urogenital causes were 57.8%, anorectal causes 25% and cutaneous causes 6.3% in etiology. The rate of idiopathic patients was 10.9%. In our study, the majority of patients with urogenital causes was due to the fact that we are a urology clinic.

NPWT was described by Argenta and Morykwas in 1997 [8]. Then it was used for the first time in FG treatment by Weinfeld et al [12]. This technique transforms an open wound into a temporarily closed and controllable environment. In laboratory and clinical studies, it has been shown that the use of a VAC device increases blood flow and creates a suitable environment for wound healing [13]. There are different opinions about whether NPWT shortens the hospitalization time in patients with FG. In their study, Assenza et al., reported that NPWT treatment shortens the hospitalization time and leads to an early reconstructive surgery [14]. In a study by Czymek et al., it was found that NPWT prolongs the length of stay compared to the CWD method [15]. However, in the study of Yanaral et al., no difference was found between CWD and NPWT applied groups in terms of hospitalization length [16].

In our study, there was a decrease in the number of debridements and daily average analgesic use in NPWT applied group compared to CWD group. With a decrease in the use of analgesics, the number of complications associated with the use of these drugs also decreased. The scarcity of analgesic use indicates that patients comfort has increased and their pain has also decreased. In addition, this comfort causes NPWT to be preferred not only by patients but also by physicians. As the number of debridements decreases, the physician spends less time and the patients complain less about pain. These factors are some of the reasons why most physicians prefer NPWT. In a study conducted by Ozturk et al., it was shown that 92% of physicians prefer NPWT in the treatment and management of FG [17]. It is seen that the high mortality rate has decreased with improvement in health services, better definition of the treatment algorithm of the disease and technological advances. In our study, mortality rates were 10.8% with 4 patients and 7.4% with 2 patients in CWD group and NPWT group, respectively. The total number of patients, who deceased, is 6 and this rate is 9.4%. Considering that FG disease progresses with high mortality, our result was lower than the literature [18]. We attribute this to the fact that our hospital is centrally located therefore easily accessible, and that we work with a serious team approach, which does not delay the urgent surgery of these patients.

Urinary and fecal diversion are essential in the management of FG disease. For FG, which often involves the scrotum and perineum, contamination of the wound with urine or feces will delay wound healing. Urethral catheterization and cystostomy catheter are among the options for urinary diversion. Although it has been stated by a small number of researchers that cystostomy can be applied to all patients, and urethral catheterization is often sufficient [19]. In Ghnnam's series of 74 patients published in 2008, all patients except one with urethral injury received a urethral catheter and it was sufficient for urinary diversion [20]. In our series of 64

patients, a single cystostomy catheter was applied to 2 patients, which is compatible with the literature. Although cystostomy catheter application is a minimally invasive procedure, it is still a surgical procedure that may have complications. In our opinion, a cystostomy catheter is not required for all patients; a cystostomy catheter is required only in cases of necrosis involving the penis and urethra. The issue of fecal diversion is controversial in the treatment management of FG. Some researchers recommend routine fecal diversion to reduce wound contamination and speed healing [21]. Diversion colostomy is recommended in cases of anal sphincter involvement, in order to eliminate fecal incontinence and fecal contamination risk of the wound. In the study conducted by Chen et al., it was shown that primary diversion colostomy reduces the risk of mortality compared to secondary colostomy [22]. However, this issue raises doubts because it is not correlated with the place where the disease first reached. In a retrospective study by Korkut et al., the mortality rate was 7% in the group that did not require a stoma, while it was 38% in the group that required a stoma [23]. In another study by Kızılay et al., the necessity of peroperative colostomy was reported as a risk factor that increases mortality in multivariate analysis. In this research article, it is stated that colostomy application is a result rather than a cause in showing mortality, and that this alone is an important factor showing the prevalence and severity of the disease [24]. As an alternative to diversion colostomy, a fecal management system has been described. This method protects the wound from fecal contamination, such as a colostomy [25]. In the study conducted by Estrada et al., it was stated that the fecal management system is an effective method for fecal diversion and is an alternative to colostomy [26]. With this device, stoma-related complications are eliminated, it also provides better psychological recovery for the patient and is more economical. Fecal management system contraindications; rectal neoplasm, penetrating rectal injuries and fistulas. In our study, protective colostomy was performed on a total of 9 patients, 4 patients in CWD group and 5 patients in NPWT group. Fecal management system was applied to patients with extensive perineal involvement. A colostomy was performed in 2 of the 6 patients who deceased.

Although it is stated that the blood supply of the testicles originates from the retroperitoneum and therefore will be preserved in FG, it is a known fact that it goes to necrosis, especially in late cases. In a study by Morua et al., orchiectomy was performed in 18% of patients [27]. In our study, orchiectomy was performed on a total of 16 patients (25%), 3 of whom were bilateral. In our study, we attribute this high rate to the higher rate of urogenital causes in etiology. Bilateral orchiectomy and penectomy were performed on a patient diagnosed with prostate cancer in CWD group. This is the only patient for whom we performed penectomy. Unfortunately, this patient died on the first postoperative day.

FGSI scoring system was developed in 1995 by Laor et al. In this scoring, when the cut-off value is taken as 9, it is stated that the mortality probability is 75% for the values above it, and probability of survival is 78% for the values below 9 [28]. In a study by Corcoran et al., a statistically significant difference was found between the average FGSI score of the living and the average FGSI score of the deceased as 5.3 and 10.9, respectively [29]. In a recent study by Kutsal et al., it was shown that NPWT causes significant decrease in 1st week's FGSI mean score. But mortality assessment wasn't evaluated in their study [30]. We evaluated FGSI scores during the first day of patients' hospitalization. In our study, the higher score in FGSI was correlated with the increased risk of mortality.

Another important issue concerning with NPWT is cost. The seemingly expensive VAC device is at par with the CWD method as it reduces the number of debridements and the need for analgesics. It has been stated by some researchers in the literature that NPWT is not more expensive yet even cheaper than CWD method [31].

The shortcomings of our study are that it is retrospective, and that no cost analysis was performed. Despite all its advantages, NPWT should not be used in all cases such as malignant tissues, exposed vessels, nerves, organs and anastomoses, untreated osteomyelitis, non-enteric or unexplained fistulas. In addition, it should not be used in cases with high bleeding risk and in cases where infective tissues are not fully debrided [32]. It is imperative to treat the right patient with the right indication to avoid unnecessary complications.

Conclusion

FG, which was a feared disease in the past, has become a manageable disease with the advances in medicine today. Early diagnosis of the disease, immediate surgical intervention and initiation of broad-spectrum antibiotics are critical. NPWT, which has started to be used relatively recently in FG, is becoming an integral part of the treatment as it both increases patient comfort and facilitates the work of physicians and healthcare team. NPWT appears to be safe and effective in many ways. NPWT reduces the number of debridements and analgesic use, but does not reduce the length of hospital stay. Prospective, randomized studies with larger groups are needed for a better understanding of NPWT.

Ethics Committee Approval: Ethical approval for this study was obtained from Dicle University Hospital Medical Faculty Ethics Committee (Approval Number: 318, date: 03.09.2020).
Informed Consent: An informed consent was obtained from all the patients.
Publication: The results of the study were not published in full or in part in form of abstracts.
Peer-review: Externally peer-reviewed.
Authorship Contributions: Any contribution was not made by any individual not listed as an author. Concept – M.A, M.D.; Design – M.A, M.D.; Supervision – M.A, M.D.; Resources – M.A, M.D.; Materials – M.A, M.D.; Data Collection and/or Processing – M.A, M.D.; Analysis and/or Interpretation – M.A, M.D.; Literature Search – M.A, M.D.; Writing Manuscript – M.A, M.D.; Critical Review – M.A, M.D.
Conflict of Interest: The authors declare that they have no conflicts of interest.
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