

Comparison of Conventional Wet Dressing and Vacuum Assisted Closure with Hypochlorous Acid Application in Fournier Gangrene Treatment

Fournier Gangreni Tedavisinde Geleneksel Islak Pansuman'ın ve Vakum Destekli Kapatma eşliğinde Hipoklorik Asit Uygulamasının Karşılaştırılması

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Abstract

Background: Fournier's gangrene; It is a rare, rapidly progressive and potentially fatal necrotizing fasciitis of the genital area and perineum. Bacterial toxins cause local tissue damage and necrosis. This can continue until a significant amount of tissue becomes necrotic. Neutralization of bacterial toxins improves results. Low concentrations of Hypochlorous Acid (HOCl) can be antimicrobial without causing cytotoxicity in normal cells in the wound and surrounding tissues. In this study, we aimed to compare the results of patients treated with HOCl (0.01% w/v) through Vacuum Assisted Closure (VAC) and with traditional wet dressing (WD) after surgical debridement due to Fournier Gangrene (FG) in our clinic.

Materials and Methods: 73 patients treated for FG between 2009-2019 in our clinic were evaluated retrospectively. The patients were divided into two groups: those who received HOCl with VAC (Group A, n = 30) and those who received WD (Group B, n = 42) after the first debridement. HOCl (0.01% w/v), known to destroy bacteria and bacterial toxins, was administered to 30 patients with FG in saline with a pH of 4-5, 5-6 times a day. Using VAC, 5-10 ml of 0.01% HOCl was applied to the wound and aspirated. For WD application, the wound was closed by applying mupirocin calcium and rifamycin to an appropriate number of wet sponges suitable for the wound surface and depth after cleansing the wound with sponges moistened with isotonic 3 times a day. The collected data were compared. P values smaller than 0.05 were considered significant.

Results: The hospitalization time and wound healing time of 30 patients who received HOCl with VAC were shorter (p <0.05), and the number of patients requiring secondary debridement was also lower (p <0.05).

Conclusions: HOCl application with VAC is an effective, successful and important postoperative treatment and wound care method that provides shorter hospital stay and faster recovery time. Toxicity and immune dysfunction due to bacterial toxins and toxins released from damaged cells can be alleviated with HOCl application via VAC. We recommend this method, which is easy to apply and inexpensive in certain FG cases.

Key Words: Hypochlorous Acid, Negative-Pressure Wound Therapy, Fournier Gangrene

Öz.

Amaç: Fournier gangreni; genital bölgenin ve perinenin seyrek görülen, hızlı ilerleyen ve öldürücü olabilen bir nekrotizan fasitistir. Bakteriye toksinler, lokal doku hasarına ve nekroza neden olur. Önemli miktarda doku nekrotik hale gelene kadar bu devam edebilir. Bakteriye toksinlerin nötralizasyonu sonuçları iyileştirmektedir. Hipoklorik asit'in (HOCl) düşük konsantrasyonları, yaradaki ve çevre dokulardaki normal hücrelerde sitotoksisiteye neden olmadan antimikrobiyal etkili olabilmektedir. Fournier Gangreni (FG) gelişen hastalarda, yapılan operasyon sonrası uygulanan Vakum Destekli Kapatma (VDK) eşliğinde yaraya HOCl (% 0.01 w/v) uygulaması ile geleneksel ıslak pansuman (IP) tedavisi uygulanan hastaların sonuçlarını karşılaştırmayı amaçlayan bir çalışma hazırladık.

Materyal ve Metod: Merkezimizde 2009-2019 yılları arasında FG nedeniyle debridman uygulanan 73 hasta retrospektif olarak değerlendirdi. İki grup halinde ele alındılar; debridmandan sonra VDK ile HOCl uygulananlar (A Grubu, n=30) ve IP uygulananlar (Grup B, n = 42). Bakteriye ve bakteriye toksinleri yok ettiği bilinen HOCl (% 0.01 w/v), pH'ı 4-5 olan salin içinde FG'li 30 hastaya günde 5-6 kez uygulandı. VDK kullanılarak 5-10 ml % 0.01 HOCl yaraya uygulanıp aspire edildi. IP uygulamasında ise günde 3 kez, izotonik ile ıslatılan spançlarla yara temizlendikten sonra yara yüzeyine ve derinliğine uygun sayıdaki ıslak spançlara mupirosin kalsiyum ve rifamisin uygulanarak yara kapatıldı. Toplanan veriler karşılaştırıldı. Anlamlılık için 0.05'ten küçük p değeri kabul edildi.

Bulgular: VDK ile HOCl uygulanan 30 hastanın hastanede yatış süresi ve yara iyileşme süresi daha kısaydı (p= 0.018) ve ikincil debridman gereken hasta sayısı da daha düşüktü (p = 0.026).

Sonuç: VDK ile HOCl uygulaması, daha kısa hastanede yatış süresi ve daha hızlı iyileşme süresi sağlayan etkili, ameliyat sonrası için başarılı bir yara tedavi yöntemidir. Bakteri kaynaklı ve zarar gören hücrelerden salınan toksinler nedeniyle ortaya çıkan toksisite ve immün işlevsizlik VDK eşliğinde HOCl uygulaması ile hafifletilebilir. Uygun FG vakalarında kolay uygulanabilir ve ucuz olan bu yöntemi öneriyoruz.

Anahtar kelimeler: Hipoklorik Asit Hipokloröz Asit, Negatif-Basınçlı Yara Tedavisi, Fornier Gangreni

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Introduction

Jean Alfred Fournier described a syndrome with perineal necrosis in 5 men in 1883 (1). This syndrome, which is a polymicrobial necrotizing fasciitis, involves the scrotum and perineum and can invade the adjacent abdominal wall, was called the Fournier Gangrene (FG). This infection, sometimes progressing heavily, can cause fascia destruction at 2-3 cm/h, causing widespread soft tissue necrosis and sepsis (2). It is characterized by thrombosis of micro vessels, tissue ischemia and subsequent necrosis and infective spread. In most of the cases, FG is a polymicrobial infection caused by aerobic and anaerobic organisms of urogenital, colorectal and cutaneous origins (3). FG has high morbidity and mortality rates despite aggressive treatment (3-67%). The delay in treatment causes a serious increase in the mortality rate (4). For Fournier gangrene, the classical treatment is excision of all necrotic tissues with radical excision, use of broad-spectrum antibiotics, intensive care support, and repeated dressings. In this classic treatment, repeated debridement is usually required. Patients' wounds remain open for a long time.

In addition to the conventional wet dressing used in postoperative wound care, there are other procedures such as hyperbaric oxygen, growth agents, unprocessed honey, vacuum dressing technology, and other alternative treatment methods (5).

Low concentrations of HOCl (below CT50 of 286 μ M30) can be antimicrobial without causing cytotoxicity in normal cells in the wound and surrounding tissues (6). HOCl inhibits bacterial growth, cell division and protein synthesis and destroys bacteria by oxidizing sulfhydryl enzymes and amino acids, reducing the production of adenosinetriphosphate, providing DNA breakage, and suppressing DNA synthesis (7,8,9). HOCl is used as a wound cleansing agent (10). Studies show that HOCl acts as an antimicrobial and anti-biofilm agent that also supports wound healing (11,12-15). Sakarya et al. showed that a stable HOCl solution reduces the number of cells in biofilms and has positive effects on in-vitro fibroblast and keratinocyte migration (12). Previous studies have shown that HOCl solution is not painful for patients, eliminates wound smell (16) and is effective in wound healing (17).

A VAC device (Confort NPWT [Negative Pressure Wound Therapy] device - Konfort Private Health Services, Eskisehir-Turkey) (Figure 1) acts by generating a negative pressure and reducing the exudate, inflammation and edema, and is a device which accelerates the healing process. With the absorbing effect of VAC, debris and exudate are removed. There are data indicating that this mechanism stimulates angiogenesis, increases nutritional support of tissue and provides regeneration (18). VAC has become the mainstay of wound treatments within the last 15 years due to its extraordinary effects on chronic and difficult healing (19,20).



Figure 1. Confort NPWT device (Konfort Private Health Services, Eskisehir-Turkey). In this study, we aimed to compare the results of patients treated with HOCl (0.01% w/v) through VAC and with WD after surgical debridement due to Fournier Gangrene in our clinic.

Materials and Methods

The study was approved by the Social and Humanity Sciences Ethical Committee of Canakkale Onsekiz Mart University Medical Faculty with dated 03.06.2020 and numbered 2011-KAEK-27/2020-E.2000070227.

Data of 72 patients treated for Fournier Gangrene in our clinic between 2009-2019 were compared and analysed. FG was diagnosed by seeing necrotizing fasciitis in the scrotal and perineal area. Patients with simple inflammation without involving fascia were excluded from the study group. 3rd generation cephalosporin and Metronidazole were initiated in the patients at first, and fluid and electrolyte treatment was given. All patients were operated on the day of arrival for surgical debridement. Empirical antibiotic therapy was renewed according to the culture of the removed tissues and antibiotic susceptibility test. After the first surgery, patients were divided into two groups: HOCl application with VAC (Figure 2) (Group A) and WD treatment (Group B).

HOCl application with VAC was repeated 3-4 days after the first application during surgery. Patients were evaluated for the necessity of debridement between the applications. VAC treatment was applied by irrigating the wound using 5-10 ml of 0.01% HOCl (0.01% w/v) with Confort NPWT device in saline (pH 4-5) and with a negative pressure of 50-120 mmHg 5-6 times a day. For wet dressing application, the wound was closed by applying mupirocin calcium and rifamycin to an appropriate number of wet sponges suitable for the wound surface and depth after cleansing the wound with sponges moistened with isotonic 3 times a day. Patients were evaluated for the necessity of debridement between the dressings. In the presence of newly developing necrotizing tissue, debridement was repeated. Healed wounds were closed. but in some cases, it was necessary to use flaps or grafts (Fig. 2).



Figure 2. Patient with Fournier Gangrene treated with HOCl application with VAC

Fournier gangrene etiology, demographic data, necrosis area and location, length of hospital stay, second debridement requirement, wound healing times, and the need to use grafts were recorded.

Independent Groups t-test was used for statistical analysis. For statistical significance, p value was considered less than 0.05.

Results

All 72 patients were male, and mean age was 63.5 ± 25.5 years. After the first operation, those who received HOCl with VAC (Group A) comprised 30 people (41.6%), and those who received conventional wet dressings (Group B) consisted of 42 people (58.3%). In the treatment process of this disease, we had 1 patient who died in our hospital. While 40 (55.5%) of our patients had type 2 Diabetes Mellitus (Type 2

DM), 27 (67.5%) of these Type 2 DM patients had uncontrolled blood sugar. Vascular disease (hypertension, peripheral artery disease, coronary artery disease) was present in 50 (69.4%) of the patients. Table 1 shows the demographic information of our patients. The duration of our patients' stay was 18 ± 11 days, and the mean width of the debridement site was 71.5 ± 18.5 cm².

Full thickness skin graft was required to close the wound of only 3 patients. In group A compared to group B, mean hospital stay duration and wound healing time were significantly shorter ($p < 0.05$). The location and width of the wound, variables related to the treatment of the wound, and comparison of both groups according to the variables are shown in Table 1.

Table 1. Demographic information, the width of the wound, variables related to the treatment of the wound, and comparison of the two groups

Variable	Value*1			P value
	Total	Group A*2	Group B*3	
Number of patients	72 (100%)	30 (41.6%)	42 (58.3%)	-
Diabetes Mellitus	40 (%55.5)	17(%23.6)	23(%31.9)	-
Chronic Disease	50(%69.4)	21(%29.1)	29(%40.2)	-
Mean age (years)	63.5±25.5	64.9±21.1	62.6±26.4	p<0.05
Body mass index (kg/m ²)	28.3±3	27.4±2.3	28.8±3.3	p<0.05
Hospital stay duration (days)	18±11	13.6±5.4	21.1±7.9	p<0.05
Wound healing time (days)*4	15.1±11.9	10.7±4.3	18.2±8.8	p<0.05
Number of patients requiring a second debridement	10	1	9	p<0.05
Width of the wound (cm ²)	71.5±18.5	70.6±19.4	72.2±17.8	p<0.05
Number of patients with graft used to close the wound	3	1	2	p<0.05

*1. Values were provided as number (percentage) or mean ± standard deviation

*2. The group receiving HOCl with Vacuum-Assisted Closure

*3. The group receiving Conventional Wet Dressing

*4. Time from the first operation to the operation where the wound was closed (number of days)

Discussion

FG is a high-mortality polymicrobial necrotizing fasciitis that involves the scrotum and perineum regions and can invade the adjacent abdominal wall, progressing rapidly in the subcutaneous tissue and deeper (2). In most of the cases, FG is a polymicrobial infection caused by aerobic and anaerobic organisms of urogenital, colorectal and cutaneous origins (3). The basis of treatment in FG is the excision of all necrotic tissues, use of broad-spectrum antibiotics, intensive care support, and repeated dressings (5). Incision limits should include healthy and bleeding tissue (21).

In addition to the conventional wet dressing used in postoperative wound care, there are other procedures such as hyperbaric oxygen, growth agents, unprocessed honey, vacuum dressing technology, and other alternative treatment methods (5). Low concentrations of HOCl (below CT50 of 286 µM30) can be antimicrobial without causing cytotoxicity in normal cells in the wound and surrounding tissues (6). HOCl is used as a wound cleansing agent (10). Studies show that HOCl acts as an antimicrobial and anti-biofilm agent that also supports wound healing (11,12-15). VAC technology is a mechanism that generates a negative pressure and acts by reducing exudate, inflammation and edema, and accelerates the healing process. With the absorbing effect of VAC, debris and exudate are removed. There are data indicating that this technology stimulates angiogenesis, increases nutritional support of tissue and provides regeneration (18). VAC has been the mainstay of wound treatments in recent years due to its extraordinary effects (19,20). VAC technology was originally investigated by Morkywas and Argenta et al. in 1997 (22). It was first applied for FG treatment in 2009 (23). In this study, we aimed to compare the results of patients treated with HOCl (0.01% w/v) through VAC and with WD after surgical debridement due to FG in our clinic. While 55.5% of our patients had Type 2 DM, 67.5% of these Type 2 DM patients had uncontrolled blood glucose. Vascu-

lar disease (hypertension, peripheral artery disease, coronary artery disease) was present in 69.4% of the patients. We think that Type 2 DM and vascular diseases play an essential role in FG development and that these diseases accelerate the progression of inflammation, delaying wound healing.

VAC application accelerates the wound healing process and shortens the length of hospital stay (24,25). HOCl has prevented infectious complications in a short amount of time, without administering systemic antibiotic administration and causing local side effects such as allergies or skin irritation, in clinical studies of the treatment of chronic diabetic foot ulcers, osteomyelitis and pressure sores (26,27).

Horsanali et al. showed that the duration of hospital stay of patients who received VAC was shorter than those who did not receive VAC treatment (24). Aslam et al. compared VAC and conventional dressing in the treatment of diabetic foot ulcers. In this study, it was shown that healing time was shortened, cost was decreased and morbidity was reduced in patients who received VAC (25).

The duration of hospital stay of the group which was applied HOCl with VAC was significantly shorter compared to the group which received conventional WD, similar to the studies of Aslam and Horsanali, and the mean duration was 13.6 ± 5.4 days. Yanaral et al. did not find a significant difference in the mean number of surgical debridements between conventional dressing and VAC groups in their study (28). In our study, the number of cases requiring secondary debridement was significantly lower in the first group. This may be due to the fact that VAC accelerates the healing process by generating a negative pressure and reducing exudate, inflammation and edema; that it stimulates angiogenesis and increases the nutritional support of tissue (18) promoting regeneration; and that the HOCl solution reduces the number of cells in biofilms and has positive effects on in vitro fibroblast and keratinocyte migration (12).

Conclusion

The method of applying HOCl (0.01% w/v) to the wound with VAC provides shorter hospitalization time and faster recovery time in the management of patients with FG compared to WD. It is an effective, successful, and important postoperative treatment and wound care method. Toxicity and immune dysfunction due to bacterial toxins and toxins released from damaged cells can be alleviated with HOCl application via VAC. We recommend this method, which is easy to apply and inexpensive in certain FG cases. The results of this retrospective study should be supported by prospective studies with larger patient samples.

Ethical Approval: The study was approved by the Social and Humanity Sciences Ethical Committee of Canakkale Onsekiz Mart University Medical Faculty with dated 03.06.2020 and numbered 2011-KAEK-27/2020-E.2000070227.

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Analysis and interpretation: HAK,ED

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