CLINICAL CASE

Hydrosurgery with Versajet®, VAC™ system, and early perineal reconstruction for treatment of Fournier gangrene

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Abstract  Fournier gangrene is defined as a fulminating and progressive infection of the perineal and/or genital region. It is an important pathology due to its high mortality rate (42%-84%). The international literature describes current treatment as wide-spectrum antibiotic use and extensive debridement followed by multiple surgical washings and long periods of hospitalization that involve a high rate of morbidity and mortality and a great economic impact. Recent reports propose the use of a vacuum-assisted closure (VAC™) system or hydrosurgery (Versajet®) for debridement. In our review of the international literature we found no reports on concomitant VAC™ system use with Versajet® hydrosdissection for Fournier gangrene management.

PALABRAS CLAVE
Gangrena de Fournier, reconstrucción perineal, Versajet®, VAC™, México.

Resumen  La gangrena de Fournier se define como una infección fulminante y progresiva de la región perineal y/o genital. Su importancia radica en que existe una alta mortalidad (42%-84%). Actualmente, la literatura médica mundial describe el tratamiento mediante la utilización de antibióticos de amplio espectro y debridación extensa, seguida de múltiples lavados quirúrgicos y largos periodos de hospitalización, que implica un alto índice de morbimortalidad y alto...
Introduction

Fournier gangrene is defined as a fulminating and progressive infection of the perineal and/or genital region. It is an important pathology due to its high mortality rate (42%-84%). The international literature describes current treatment as wide-spectrum antibiotic use and extensive debridement followed by multiple surgical washings and long periods of hospitalization that involve a high rate of morbidity and mortality and a great economic impact. Recent reports propose the use of a vacuum-assisted closure (VAC™) system or debridement through hydrosurgery (Versajet®).

Case presentation

The patient is an 82-year-old man who presented with diabetes, heart disease, and high blood pressure of 10-year progression, with poor metabolic control. His symptoms began with acute urine retention (AUR), a deterioration in his general status, and a non-quantified fever for which he sought medical attention at the emergency service of our hospital. A Foley catheter was placed without obtaining urinary flow. Immediately afterwards, the patient presented with important urethrorrhagia that was managed with perineal compression. He was then evaluated by our service and was found to have symptoms of AUR and an over-distended bladder, for which a suprapubic cystostomy was carried out through an ultrasound-guided percutaneous puncture. Retrograde urethrography revealed a false urethral tract with partial contrast medium extravasation at the level of the bulbar urethra. Management was wide spectrum antibiotic therapy and metabolic stabilization by the internal medicine department. The patient was released due to improvement seven days after this event. He came to the emergency room 16 days later, presenting with poor general status, fever, oliguria, and a confused mental state. Physical examination produced clinical data of systemic inflammatory response, an important increase in the volume of the penis, scrotum, and perineal region extending to the upper inner surface of both pelvic members, as well as erythema, hyperthermia, and pain upon palpation with crepitation (Figure 1). He was admitted to the intensive care unit (ICU) for septic shock management and hemodynamic and metabolic stabilization. After 48 hours the patient was stabilized and immediate surgical exploration was carried out after scrotal and perineal ultrasound that reported the presence of gas in the adjacent soft tissues. A new urethrogram revealed total leakage of the contrast material at the level of the bulbar urethra (Figure 2). Urethroscopy with open-end catheter placement was carried out to use the urethral lumen as the reference point for performing the formal surgical exploration, revealing perforation due to necrosis of the anterior surface of the bulbar urethra (Figure 3).

Surgical exploration was performed with an inverted-Y perineal incision and revealed abundant necrotized tissue and purulent matter, as well as perforation and necrosis of the central surface of the bulbar urethra that was amply debrided and followed by the placement of a Blandy perineal flap towards the healthy proximal portion of the bulbar urethra in the same surgery, leaving the rest of the open wound covered with moist dressings. The patient was transferred to the ICU for stabilization. After 48 hours an additional surgical exploration was carried out, performing selective debridement with the Versajet® system (Figure 4) and continuous application of the VAC™ system, 125 mm/Hg, for three days (Figure 5).

Once finished, another surgical revision was carried out that found tissues with adequate characteristics for early perineal reconstruction and secondary intention closure with fasciocutaneous flaps (Figure 6). The patient was released after 15 days, and he did not present with complications or surgical wound infection. His outpatient follow-up revealed satisfactory condition of the perineal reconstruction (Figure 7).

Discussion

Fournier gangrene was described for the first time in 1764 by Baurienne. In 1883 Jean Alfred Fournier depicted
Hydrosurgery with Versajet®, VaC™ system, and early perineal reconstruction for treatment of Fournier gangrene

Fournier gangrene is an idiopathic disease of sudden and progressive onset in previously healthy young men.² Fournier gangrene is a rare necrotizing fasciitis of the perianal and the perineal genital region. It is characterized by obliterating endarteritis and subcutaneous arterial thrombosis that result in gangrene of the subcutaneous tissue and the skin. The damaged tissue can extend to the penis, the anterior abdominal wall, and the gluteal and inguinal regions.³,⁴ Fournier gangrene usually begins with pain in the perianal or perineal region and generally is not correlated with clinical findings such as edema and pruritus in the affected area. This disease is not limited to young adults nor is it exclusive to men.

The majority of cases have a polymicrobial etiology, accompanied with synergism and necrotizing infection of the perineal subcutaneous fascia and the male genitals, involving the urethral skin and/or the rectum. The most commonly found microorganisms are *Escherichia coli* (*E. coli*), *Bacteroides*, *Staphylococcus*, *Proteus*, *Streptococcus*, *Pseudomonas*, and *Enterococcus*.⁵⁻⁷ Patients present with fever, general malaise, non-specific abdominal pain, and non-specific symptoms of infection with no specific symptoms of the perineal region. Depending on the degree of progression, the skin can be normal, erythematous, or turgid in appearance and there can be evidence of ecchymosis, crepitation, or gangrene.⁶⁻⁸

Among the predisposing factors are an association with age above 50 years, obesity, diabetes mellitus, peripheral vascular disease, local trauma, urethral stricture, and perianal disease.⁹ The international consensus on Fournier gangrene management indicates an aggressive approach through debridement and wide surgical excision of all the affected tissue, along with multidisciplinary management on the part of the ICU in accordance with the established guidelines for sepsis management.¹⁰

Regardless of the improvements in diagnosis and treatment, the mortality rate varies from 20% to 43% in contemporary series.¹¹⁻¹³ Today, Fournier gangrene management has advanced, but the first indication continues to be an early and aggressive approach. New treatment modalities have focused on a reduction in morbidity and mortality, hospital stay, and costs. The use of hyperbaric oxygen therapy is recommended.¹⁴

Knowledge of and advancement in the concepts of wound management, as well as the creation of new antibiotics and drugs for treating severe infection and sepsis, have revolutionized their management. New technologies and tools have been developed that cause less tissue damage during surgical debridement procedures that are considered selective and minimally invasive, such as hydrosurgery (Versajet® system)¹⁵ and a new system for managing wounds through negative pressure called vacuum-assisted closure (VAC™).

In our review of the international literature, we found that there are still no articles that use hydrosurgery and the VAC™ system together for Fournier gangrene management. Therefore we decided to report our results from the combination of these two therapies in this particular patient.

We will explain the functioning of and principles involved in each of the two systems we consider to be complementary tools that offer another alternative in Fournier gangrene management. The VAC™ system (Vacuum Assisted Closure, Kinetic Concepts INC., San Antonio Texas) also significantly accelerates the cicatrization and tissue remodeling processes.

**Vacuum assisted closure (VAC™)**

In 1995 wound closure with negative pressure was introduced by Morykwas et al. for the purpose of accelerating the secondary intention cicatrization process.¹⁶ The VAC™ system is applied to the open wound and consists of an ether sponge dressing, an occlusive covering, a canister, and a pump.¹⁷ The sponge pore sizes range from 400 to 600 um, favoring tissue growth.¹⁸ It has a non-collapsible fenestrated drainage tube embedded in the sponge that comes out away from the wound zone and...
parallel to the skin. The sponge can be modified and cut to exactly fit the wound. The wound and the sponge are covered with a transparent adhesive film that should extend 3 to 5 cm over the adjacent healthy skin, creating a controlled closed system over the wound. The drainage tube coming out of the sponge is connected to a tube that collects the fluids. The vacuum system is connected, creating continuous sub-atmospheric negative pressure. The porous nature of the sponge ensures that there is equal negative pressure over the entire surface of the covered portion of the wound. The applied negative pressure can be intermittent or continuous. In the majority of wounds, it is applied continuously at 125 mm/hg, and there is the option of using 25 mm/hg increases for 15-minute intervals. These increases have shown an elevation in granulation percentage of 103%±35%, greater elimination of bacteria in previously infected wounds, and reduced necrosis in the flaps of up to 41%.17

There are various factors with this system that promote and accelerate the granulation process in chronic wounds:

1. The elimination of excess fluids that are created in chronic wounds reduces the disproportionate production of inflammation promoters,19 as well as metalloproteinases.20
2. An increase in the vascularity of tissues undergoing VAC™ is also conditioned; recent studies have shown that mechanical stress can stimulate cell growth21 along with vascular neoformation and fibroblast proliferation and migration, promoting the initial epithelialization in regard to the reduced bacterial colonization and infection. The reduction in the amount of bacteria and leukocytes has been seen to start 3 to 4 days after VAC™ therapy is begun.22 Fluid extraction from the third space in the healthy tissue that is adjacent to the wound augments the capillary flow, thus increasing the release of oxygen at the wound site. A certain mechanical approximation of the wound edges takes place, reducing the area of the exposed tissue and favoring the formation of a layer of collagen that supports the epithelial cells and promotes fibroblast migration.

It is important to emphasize that VAC™ therapy should only be used as an adjuvant in wound management, because in no way does it substitute a formal surgical procedure. And it is essential to carry out adequate surgical debridement before employing this type of therapy. To the contrary, if necrotic tissue is left in the wound, it will exacerbate an inflammatory response and be a source of bacterial growth. Using this system requires experience and training of the medical group and nursing personnel in...
The principal aim of the introduction of hydrosurgery into the surgical armamentarium was to revolutionize wound management and surgical debridement. The Versajet® system is made up of a reusable energy console with an activation pedal, a disposable hand piece (15º/14mm, 45º/14mm, 45º/8mm), a mounting tube in conjunction with sterile saline solution, and a recipient with a residue level for attaining maximum efficiency. It uses a water compression mechanism that produces a very fine high-pressure stream through a manual device that simultaneously debrides, irrigates, and removes necrotic tissue. This hydrosurgery system is a selective, safe, and innovative tool that enables there to be better control, reducing collateral damage to the neurovasculature and the healthy tissue adjacent to the wound and also diminishing bleeding and local pain. Its applications range from traumatic and non-traumatic wound debridement (acute and chronic), wound washing, debridement of burns of different degrees, and vascular bed preparation for the application of free grafts and flaps to complex infections such as necrotizing fasciitis.

Conclusions

Currently, there is no ideal consensus as to how these patients should be managed. However, surgical treatment for Fournier gangrene should be directed towards the preservation of life and function. The use of new technologic resources can very favorably modify patient clinical
progression. The use of hydrosurgery with Versajet combined with VAC is one more option in the management of these patients that facilitates rapid recovery and the possibility of performing early secondary intention reconstruction with good results, as was demonstrated in this particular case.

Conflict of Interest

The authors declare that there is no conflict of interest.

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References