

Successful treatment of necrotizing fasciitis using handmade negative pressure system wound therapy

Manejo exitoso de fascitis necrotizante con un sistema de presión negativa artesanal

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Abstract

Necrotizing fasciitis is an acute progressive infection that develops severe systemic toxicity. If this is not treated in a timely manner, it leads to a fatal outcome. The treatment with fluids, antibiotics, and debridement is the basis for management; however, negative pressure systems are positioned at a strategic point for treatment, especially in large areas, such as lower limbs. This is the case of a 17-year-old male with no relevant medical history, who developed extensive necrotizing fasciitis in the inguinogenital region after fasciotomies due to compartment syndrome, in whom a handmade negative pressure system was successfully applied.

Key words: Necrotizing fasciitis. Negative pressure system. Soft tissue infection.

Resumen

La fascitis necrotizante es una infección aguda progresiva con desarrollo de toxicidad sistémica grave. Si no es tratada de manera oportuna conduce a un desenlace fatal. El tratamiento con líquidos, antibióticos y desbridamientos constituye la base en el manejo de estos pacientes. Sin embargo, los sistemas de presión negativa se posicionan en un punto estratégico, sobre todo en grandes áreas como los miembros inferiores. Se presenta el caso de un paciente de 17 años, sin antecedentes médicos relevantes, que desarrolló fascitis necrotizante extensa en la región inguinogenital posterior a fasciotomías por síndrome compartimental, en quien se aplicó un sistema de presión negativa artesanal de manera exitosa.

Palabras clave: Fascitis necrotizante. Sistema de presión negativa. Infección de tejidos blandos.

Introduction

Necrotizing fasciitis is a rapidly progressive soft tissue infection with important systemic toxicity¹. This infection affects one in every 100,000 inhabitants². The cutaneous microcirculation thrombosis leads to

tissue necrosis and subsequently to systemic toxicity³, assuming the most serious form of infection that complicates into a multiorgan failure in a third of the patients². The associated mortality ranges between 30 and 80% of cases⁴. The first detailed reference was described as "hospital gangrene" in 1871³, although

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there is historical documentation since Hippocrates⁴. In 1952, Wilson coined the term necrotizing fasciitis³. Associated risk factors include advanced age, diabetes mellitus, immunocompromise, malnutrition and obesity, vascular disease, animal bites, and surgical and traumatic wounds¹. The majority of necrotizing fasciitis is classified as type I or polymicrobial (*Klebsiella* sp., *Vibrio* sp., *Aeromonas*, *Staphylococcus*, and *Clostridium*)⁵, and it generally belongs to elderly patients. On the other hand, type II or streptococcal is associated with young patients without comorbidities² and generally with a worse prognosis. Finally, type III is extremely rare; it has an aggressive evolution caused by *Vibrio vulnificus*⁵. Due to the disease severity, the use of broad-spectrum empirical antibiotic is justified⁶. Yet, despite the medical advances, extensive early surgical debridement remains crucial for patient survival⁶. The adjuvant use of negative pressure accelerates the healing process on the patient, and it is very useful for the treatment of complex wounds⁵. However, the costs and low accessibility for public hospitals represent a limitation for health systems. Even though artisanal negative pressure systems have been used previously, the current literature has few formal reports about the management of complex infections as necrotizing fasciitis, in this case, with sepsis affecting the groin, genital, buttock, and limb regions, and showing favorable results in patient's health and functional limb recovery.

Case report

The patient is a 17-year-old mestizo male, referred from a rural medical unit, with no background history or previous pathologies, with a 4 days history of progressive pain in the left lower extremity at the inguino-genital level, after receiving blunt trauma in gluteus; he was managed with analgesics, but he evolved with a progressive increase in volume, inability to walk and finally attack to general state. At admission to the emergency room, the patient showed hypotension (85/58 mmHg), tachycardia (118 BPM), and diaphoresis, with volume increased in the lower left limb and inguinogenital region and decreased in femoral and popliteal pulse, compatible with compartment syndrome. Laboratories indicated: leukocytosis 13.59, creatinine 2.0, and CPK 5048, so it undergoes emergency decompressive fasciotomies, in which there are data of generalized hypoperfusion. Besides surgical management, the patient was submitted for protocolar treatment dismissing vascular causes (Angio-TAC),



Figure 1. Necrosis and liquefaction of soft tissues after fasciotomies.



Figure 2. Handmade negative pressure system.

immunodeficiencies, and rheumatology, having a clumsy evolution in the wounds, with areas of necrosis and sepsis (Fig. 1). Wound culture reports *Pseudomonas aeruginosa* sensitive to ciprofloxacin and imipenem, so treatment is adjusted. Then, after extensive debridement, the use of a negative pressure system (VAC[®]) is proposed. However, the patient could not afford the treatment cost, for therefore, the use of an artisanal negative pressure system is proposed, using a sterile sponge and hospital aspiration system (Fig. 2). After the first application of the system, significant improvement is observed, decreasing the tissue edema, the fluids thrown by the wound, and the patient's pain. At the same time, it is visible the progressive appearance of granulation tissue (Fig. 3). Thirty days after the first handmade negative pressure system, with made eight replacements, we proceeded to cover the wound in two surgical times with contralateral pelvic limb graft (Fig. 4). Finally, the patient is released for improvement with adequate functionality in the left extremity (Fig. 5).



Figure 3. Improvement observed after the first cure with a handmade negative pressure system.



Figure 4. Final management of wound with take and apply contralateral pelvic limb graft.



Figure 5. Final result of the patient before hospital delivery.

Discussion

Knowledge of the pathophysiology of necrotizing fasciitis is essential to understand the clinical course

and the importance of an opportune diagnosis and treatment to have a favorable prognosis². The most outstanding clinical injuries are severe and extensive necrosis of the fascial surface and subcutaneous cellular tissue with destruction and liquefaction of the fat tissue³. Likewise, the main clinical signs to suspect a necrotizing infection are edema with induration that exceeds the area of erythema, presence of flictenas, subcutaneous crepitus in the absence of lymphangitis, or associated adenopathies⁴. However, the evidence of massive fascial necrosis, with the absence of bleeding during surgical debridement is the most objective point for the confirmation of the diagnosis⁶. The process by which the patient reaches this clinical state begins with harm in the superficial fascia, minor trauma or localized infection, showing erythema and induration of the skin⁷, regardless of its origin, factors like the proliferation of bacteria and release of inflammatory toxins allow the extension of the process horizontally². Most of the bibliographic reports agree that the complex interactions between the host and the factors specific virulence are the conditioning factors for tissue damage through proinflammatory cytokines³, presenting signs of clinical toxicity, such as fever, confusion, dizziness, weakness and malaise, appearance of rashes, purulent and hemorrhagic flicten, inflammation with increased disproportionate pain, and subcutaneous emphysema with focused gas in certain areas. The worst-case scenario involves shock and multiorgan failure, acidosis, coagulopathy, changes in mental status⁷, coupled by the thrombosis of microvessels that perpetuate the lesion of the tissues affecting the deep planes and the superficial dermis². The differential diagnoses that should be considered are anaerobic streptococcal myositis, pyomyositis, necrotizing synergistic cellulitis (Meleney's syndrome), Clostridium myonecrosis, or gas gangrene¹. Although paraclinical studies are very useful, surgical exploration is the diagnostic method par excellence and should never be delayed pending complementary imaging or laboratory workup⁴. Likewise, clinical suspicion is sufficient justification for the use of broad-spectrum antibiotics empirically, given the acute progression of the disease⁶, with integral management based on emergency surgery, nutritional support, and optimization of tissue oxygenation to prevent fulminating courses¹. Negative pressure therapy has been shown to be useful in these cases; the cyclical application accelerates the healing process, optimizing the blood supply, increasing local oxygenation, promoting fibroblastic stimulation and

granulation tissue formation, as well as angiogenesis, with decreased tissue edema, and accelerating the removal of interstitial fluid of the wound bed, which facilitates the elimination of infectious material⁸. Its application consists of coverage of the wound with cross-linked polyurethane sponges of open cells, covered with an adhesive sheet in which a vacuum generator was connected, which at the same time has the function of extracting the exudate and the fluids to a container⁹. Chiummariello et al. analyzed 135 patients who were subjected to negative in chronic wounds, demonstrating greater recovery and healing, reducing hospital stay. It has been shown to be beneficial and cost-effective in the wound healing process, achieving results 60% faster than conventional methods¹⁰. Some publications have discussed the possibility of treatment with handmade negative pressure systems, which consist of the combination of a small number of materials available in most medical units such as gauze, sterile sponges, vacuum tubes, and impermeable plastic dressings for coverage (Steri-Drape, Op-site, Tegaderm)⁹. In the present case, necrotizing fasciitis was satisfactorily treated according to current therapeutic concepts, as well as handmade negative pressure therapy. There were no adverse effects associated with the application of negative pressure therapy, facilitating the application of grafts in the affected limb¹⁰.

Conclusions

The management of complex wounds with handmade negative pressure system allows to treat appropriately both acute and chronic wounds, managing to stimulate the formation of granulation tissue, providing a quick and easy alternative with an affordable cost for patients of limited resources who receive medical care in hospitals of public attention, and providing a useful alternative for serious and extensive infections such as necrotizing fasciitis. It is considered that with the detailed description of the use of the system that we present and its management, it can be reproduced in any hospital, however, it is necessary to follow-up with a greater volume of cases to identify the factors associated with the success in the treatment, as well as the possible causes of

complications associated with negative pressure therapies already described.

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Conflicts of interest

It is considered that there are no conflicts of interest between the proponents and participants in the present work.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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