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# Lower Extremity Necrotizing Fasciitis Managed With Negative Pressure Wound Therapy (NPWT) and Split-Thickness Skin Graft: A Case Report

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**ABSTRACT**

**Introduction:** Necrotizing fasciitis (NF) is an infection of the soft tissues (skin, subcutaneous tissue and fascia) that implies a rapidly and progressive evolution. In general, the treatment consists of stabilizing the patient, as well as the use of antibiotics that cover the most common agents, however, in most cases this is not useful without definitive management that consists of cleaning and surgical debridement. In addition to surgical lavage, adjunctive measures are often used in the treatment of complex wounds, such as vacuum-assisted closure (VAC) systems, also known as microdeformation wound therapy (MDWT) or negative pressure wound therapy (NPWT).

**Objective:** The objective is to present a successful case in the treatment of necrotizing fasciitis by negative pressure therapy with subsequent placement of grafts.

**Case report:** We present the case of a 50-year-old male patient with an extensive area of necrosis in the anterior, posterior and external surface of the left pelvic limb secondary to a fall. Treatment consists of antibiotic and debridement of devitalized tissues, followed by VAC therapy to promote granulation of the tissues and prepare them for reconstruction. For its reconstruction, partial thickness grafts were used in the entire exposed area, with 100% integration of the tissues without functional limitation during its follow-up in the outpatient clinic.

**Conclusion:** The use of negative pressure therapy accelerates the wound granulation process, making it an option for patients with large areas of devitalized tissue, thus reducing their hospital stay and improving their quality of life.

**KEYWORDS:** necrotizing fasciitis, negative pressure therapy, grafts.

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## INTRODUCTION

Necrotizing fasciitis (NF) is an infection of the soft tissues (skin, subcutaneous tissue and fascia) that implies a rapidly and progressive evolution, characterized by a decrease in blood supply due to thrombosis, ischemia and necrosis, causing extensive and definitive tissue loss of the superficial fascia (1).

Despite having a low incidence (0.4 to 1 in 100,000 inhabitants per year), it is responsible for a high mortality rate (estimated range of 11 to 36%), which is why it is considered a surgical emergency (2).

In general, the treatment consists of stabilizing the patient, as well as the use of antibiotics that cover the most common agents, however, in most cases it does not work if is not accompanied of cleaning and surgical debridement (3).

After the surgical management, adjunctive measures are often used in the treatment of complex wounds, such as vacuum-assisted closure (VAC) systems, also known as microdeformation wound therapy (MDWT) or negative pressure wound therapy (NPWT) (4).

The importance of considering these systems as therapeutic option lies in the fact that it has been shown to speed up the wound bed preparation process until definitive coverage is achieved with reconstruction methods (2), mainly by reducing the size of the wound by up to 25-60 % (3).

## CASE REPORT

A 50-year-old male with a history of diabetes mellitus 2 of long evolution in treatment and control, the rest were denied. The condition began on June 6, 2021, presenting a fall from a height of 60 cm in which he received a direct contusion on his left leg, causing a break in continuity of skin at knee level, for which he went to his clinic where they performed cleaning and primary closure. After being discharged with unspecified antibiotic treatment, a week later he started with pain of moderate intensity, edema, hyperemia, increased local temperature and pus coming out of the wound.

He came to our unit on June 15, and was assessed by the General Surgery service, hemodynamically stable, highlighting the directed exploration of the left pelvic limb with edema and hyperemia on the anterior, posterior and external surface from the knee to the distal third of the leg, 3 cm wound on the external surface of the proximal third of the leg, abundant seropurulent secretion, as well as crepitus in the distal portion of the leg and limitation of movement.

Laboratories from June 15: glucose 739, creatinine 1.5, total bilirubin 6.6, direct bilirubin 5.6, sodium 122, potassium 3.7, creatine kinase 29, creatine kinase MB 18, leukocytes 19.8, neutrophils 91%, hemoglobin 10, hematocrit 30.8, platelets 292, time prothrombin 13.2, partial thromboplastin time 33.4, INR 1.2.

Soft tissue ultrasound from June 17: increased thickness in subcutaneous cellular tissue, subcutaneous emphysema from the middle third of the thigh to the foot, liquid collection of 42x22 mm on the lateral aspect of the knee, preserved joint.

Clinically and by studies, a diagnosis of soft tissue sepsis is integrated, requiring surgical management, which is carried out on June 18, with the discovery of a 500 cc abscess and necrotizing fasciitis covering the anterior and external surface from the thigh to the leg, so we proceed to abscess drainage, fasciotomy, and extensive debridement; tissue culture was performed, which reported the development of Salmonella enterica ssp and Klebsiella pneumoniae.

A second cleaning and debridement was performed on June 21, finding out two extensive defects with devitalized tissue and macerated skin, without the possibility of primary closure **(Figure 1, 2, 3)**, deciding to start VAC therapy with continuous suction. Subsequently, two changes were made to the system and it was removed on July 9, reporting a defect with abundant granulation tissue, little serohematic exudate and adequate vitality on the edges of the skin **(Figure 4, 5)**.

**Figure 1. Second intervention on June 21, 2021 by cleaning and debridement. It shows two extensive defects with devitalized tissue.**

**Figure 2, 3. Deep zone extension can be seen in the lateral region of the thigh, before initiation of VAC therapy.**

**Figure 4. Second replacement of VAC therapy with silver sponges is observed.**

**Figure 5. Removal of VAC therapy on July 9, 2021. Defect with abundant granulation tissue.**

Afterwards, management continues with cures and antibiotics (21-day regimen with imipenem and vancomycin), however, still with difficulty for primary closure due to the extension of the skin defects, for which reason it was assessed by Plastic and Reconstructive Surgery service, referring to being candidate for skin coverage. The first intervention was made on July 21, through cleaning, tangential excision, harvesting and application of a thin partial thickness graft to cover the leg wound, covering 90% of total defect **(Figure 6,7)**; a calcium alginate and Epifast dressing was placed in the donor area of the abdomen and right thigh, respectively. Then, a second intervention was performed on August 4, by tangential excision, harvesting and application of a thin partial-thickness graft to cover the remaining wound on the thigh, achieving coverage of 100% of total defect.

**Figure 6, 7. One week after the first grafting procedure in the leg.**

On August 9, a review was carried out, finding the recipient area with 99% integrated grafts, few residual defects in the thigh, posterior and distal surface of the left leg, as well as donor areas in process of epithelialization, without active bleeding or infection signs, so it was decided to discharge home **(Figure 8, 9)**. Finally, at two months of follow-up, donor areas with 100% epithelialization were confirmed, grafts integrated in 100% of the surface, and slight limitation of dorsiflexion of the affected limb. The patient was sent to Physical Medicine where he receives muscle stretching therapy, achieving functional gait and his definitive discharge on November 4, 2021 **(Figure 10, 11)**.

**Figure 8,9. Integration of the grafts at patient discharge.**

**Figure 10, 11. Grafts integrated in 100% of the surface at two months of follow-up.**

**DISCUSSION**

The term necrotizing fasciitis was described in 1950 by Wilson, referring to necrosis of the fascia and subcutaneous tissue that spread to the adjacent muscle (5).

Subsequent studies showed that this rapid progression characteristic of this infection, results from vertical spread from the primary site, favored by fascial edema and inflammatory thrombosis that occlude the cutaneous perforators that run through the deep aponeurosis to supply the skin, causing ischemia and necrosis, with the consequent compromise of all the skin and subcutaneous tissue above the fascia (6).

There are several ways to classify NF, among them, by 4 types of etiology according to the agents that cause it. Type I, is the most common, has polymicrobial characteristics and usually affects people with comorbidities; type II is caused by Streptococcus pyogens or Staphylococcus aureus, mainly in healthy patients with a history of trauma or limb injury; type III is associated with Clostridium species or gram-negative bacteria; type IV caused by fungal infection, usually Candida (1).

As precipitating factors, the traumatic ones such as penetrating wounds, burns, surgeries and invasive procedures are mainly referred to; in addition, there are general factors that favor the disease such as diabetes, immunosuppression, autoimmune diseases, alcoholism and malnutrition. There is a strong association between the precipitating factors and the location of the infection, with the extremities being the most frequent site of presentation, with 28% of cases in the lower limbs and 27% in the upper limbs; other locations correspond to the perineum with 21%, thorax 18%, head and neck 5% (5).

In the present clinical case, the precipitating factor is a fall injury, which, associated with the history of uncontrolled diabetes mellitus as a general factor, led to the development of necrotizing fasciitis in the pelvic limb, coinciding with being the most frequent site of presentation. The case also shows that the most common etiology is polymicrobial, since Salmonella enterica ssp and Klebsiella pneumoniae were isolated in the patient's cultures.

Its presentation is more frequent as cellulitis with systemic manifestations that does not improve despite management with antibiotics, causing a delay in its diagnosis. Besides, some laboratory parameters can guide us in the diagnostic suspicion, but they are not very specific and its absence does not rule it out (1).

For this reason, the histopathological study is considered the gold standard, however, during the clinical or surgical examination, highly suggestive findings may be observed, such as loss of fascia integrity, foul-smelling exudate with a grayish color or “in dishwashing water”, as well as the absence of bleeding, muscle contractility and resistance to dissection (5).

To carry out an adequate surgical management, extensive incisions and even multiple incisions are usually required, which allow access to the entire fascia for its complete resection, considering a margin of 5-10 mm of healthy fascia (6).

As a result, large areas are usually left uncovered, making difficult closing the defect, which is why high-performance dressings have been created that reduce the need for cleaning and facilitate management, providing comfort for the patient and even the possibility of outpatient follow-up (2).

Negative pressure systems have been created to allow through the application of mechanical and biological principles, the creation of an environment that favors the resolution of this type of wounds from four primary mechanisms: macrodeformation, microdeformation of the surface, removal of exudate and stabilization of the wound environment (7).

Broadly, this therapy favors the increase cell proliferation, angiogenesis and blood flow, as well as the removal of interstitial fluid, toxins and cell debris, which accelerates preparation for wound closure thanks to the formation of granulation tissue (4).

These systems were initially recognized for their effectiveness in treating pressure ulcers and diabetic foot ulcers, based on the studies by Argenta and Morykwas published in 1997. Muller reported their use for drainage of wounds generated in patients with necrotizing fasciitis (8).

Currently the vacuum-assisted closure systems are an option with excellent evidence in the treatment of complex wounds (4).

Among the limitations, stand out the difficulty in mobilizing the patient, the dressing changes that are usually laborious, the need to maintain a hermetic seal and the possibility of presenting pain and discomfort caused by the suction of the system. Also, to date it is considered a high-cost resource, however, several studies have compared VAC therapy with conventional management, showing that the total cost of negative pressure wound therapy can be three times lower in comparison with traditional wounds therapy (2)

After the use of VAC therapy and once the reduction in the size of the wound has been achieved, it is possible to consider definitive closure for the reconstruction of the anatomy. Skin grafts are commonly used in the management of defects generated by FN (1).

In our case report, the patient required two extensive surgical debridement prior to the placement of VAC therapy, for which a total of two replacements were performed at intervals of approximately 4-5 days. During therapy, the system was maintained at a continuous pressure of 125 mmHg with no leaks or dysfunction, and at the time of its removal, extensive areas with granulation tissue were obtained, which allowed reconstructive management applying split-thickness grafts with favorably evolution up to 100% integration and minimizing limitation in the function of the limb.

## CONCLUSION

The VAC system facilitates the cleaning of wounds, reduces the number of cures and surgical interventions and accelerates the granulation process of the wounds, therefore, it reduces the length of hospital stay. Once the VAC system is removed and adequate granulation tissue has been achieved, the possibility of success in definitive closure of the wound is greater, either by approximation of the edges, closure by secondary intention, application of a skin graft or flaps (2).

Due to its multiple advantages, negative pressure therapy is currently used in the management of traumatic wounds, crush injuries, bites, burns and recipient areas of skin grafts, in addition to having modalities adapted for patients with abdominal wound dehiscence, open abdomen or mediastinitis (7).

The removal of devitalized tissue and delimitation of the infection is a difficult job, but the reconstruction of the limb with the least number of sequelae in terms of functionality is the real challenge. For this reason, proper diagnosis and timely treatment is important.

**Conflicts of interests:**

The autor declare no conflict of interest.

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