Clinical Case Report

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A case report of successful treatment of necrotizing fasciitis using negative pressure wound therapy

Fabiana Martins Paula, Postgraduate[a], Edivania Anacleto Pinheiro, MSc[a,b], Vanessa Marcon de Oliveira, PhD[c], Cristiane Munaretto Ferreira, MSc[c], Maria Tereza Ferreira Duenhas Monreal, PhD[c], Marisa Dias Rolan, PhD[d], Vanessa Terezinha Gubert de Matos, PhD[a,c,*]

Abstract

Rationale: Necrotizing fasciitis is a destructive tissue infection with rapid progression and high mortality. Thus, it is necessary that high-performance dressings be introduced as possibilities of treatment.

Patient concerns: Female patient, 44 years of age, admitted to hospital unit complaining of lesion in the gluteal region and drainage of purulent secretion in large quantity followed by necrosis.

Diagnoses: The diagnosis of necrotizing fasciitis was carried out with the computerized tomography examination result and its association with the patient's clinical condition.

Interventions: Initially, successive debridements were carried out in lower limbs as well as primary dressing with enzymatic debriding action until indication of negative pressure wound therapy, for the period of 2 weeks in the right lower limb and for 5 weeks in the left lower limb, with changes every 72 h. Dressing with saline gauze was used at the end of this therapy until hospital discharge.

Outcomes: After the use of negative pressure wound therapy, we observed the presence of granulation tissue, superficialization and reduction of lesion extension. The patient presented good tolerance and absence of complications.

Lessons: Negative pressure wound therapy constituted a good option for the treatment of necrotizing fasciitis, despite the scarcity of protocols published on the subject.

Abbreviations: °C = degrees Celsius, cm = centimeters, dL = deciliter, g = gram, h = hour, L = liter, mg = milligram, mm = millimeter, mm^3 = cubic millimeters, mm Hg = millimeters of mercury, NF = necrotizing fasciitis, SLE = systemic lupus erythematous.

Keywords: injuries and lesions, injury closure techniques, necrotizing fasciitis, treatment of wounds with negative pressure, wounds healing

1. Introduction

Necrotizing infections of soft tissues are characterized by acute, diffuse, edematous, suppurative, and disseminated inflammation. An example is necrotizing fasciitis (NF), described as a severe infection characterized by progressive purulent necrosis of the fascia and subcutaneous tissue.[1] In this context, high-performance dressings need to be introduced as possibilities of treatment, collaborating to the reduction of exudate, odor and pain, reduction of the number of dressing changes and improvement of patients social interactions as well as early hospital discharge and return to daily activities.

Negative pressure wound therapy was introduced commercially after studies carried out by Argenta and Morykwas in 1997.[2] This therapy is an important adjuvant method in the treatment of wounds, accelerating the process of repair and wound bed preparation until definite coverage by several methods of tissue reconstruction.[3] Thus, this report aims to describe the use of negative pressure wound therapy in the case of NF.

2. Case report

Female patient, 44 years of age, married, housewife, resident in Campo Grande-MS, with the diagnosis of systemic lupus erythematosus (SLE) for 24 years and systemic arterial hypertension for 10 years, in regular treatment with prednisone 20 mg/day, captopril 50 mg/day and acetylsalicylic acid once a day. She was admitted to the hospital unit on September 5, 2015, complaining of purulent lesion in the right gluteus starting in July 2015, with symptoms of edema, heat, and pain. The patient related that cyclophosphamide pulse therapy was carried out on August 24, 2015, due to a clinical condition of vasculitis, and on September 1, 2015, there was skin disruption in the gluteus region with drainage of purulent secretion in large quantity followed by necrosis.

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[a] Residência Multiprofissional em Cuidados Continuados Integrados, [b] Hospital São Julião, [c] Faculdade de Faculdade de Ciências Farmacêuticas, Alimentos e Nutrição, [d] Instituto Integrado de Saúde, Universidade Federal de Mato Grosso do Sul, Campo Grande – MS, Brasil.

[*] Correspondence: Vanessa Terezinha Gubert de Matos, Universidade Federal de Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul Brazil (e-mail: vanessa.matos@ufms.br).

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Still, during admission, she reported pain in the right knee with difficulty to perform extension, edema, and skin hyperpigmentation. She reported prior use of ciprofloxacin 500 mg every 12 h for 7 days, though without improvement of abscess. Patient image use was authorized in written informed consent and the Research Ethics Committee linked to the Federal University of Mato Grosso do Sul approved the publication of this case report.

During the hospital stay, she denied alcoholism, smoking, drug allergy, and family morbid history. The patient possessed regular general and nutritional conditions, she was conscious, oriented, and mucous membranes were hydrated and pallid +1/+4. She was acyanotic and anicteric, heart rate was 128 beats per minute, respiratory rate 20 respiratory incursions per minute, axillary temperature was 39.5°C, with oxygen saturation at 96%. There were no alterations in cardiopulmonary auscultation. Abdomen was flat and bowel sounds were present; it was flaccid, painless to palpation and without masses or visceromegalies. She presented crusted lesions without secretion in the posterior region of the forearm; abscess in the right and left posterior coxofemoral region, with a necrotic crust and purulent secretion drainage through orifice; and abscess in gluteus and in the right and left perineal regions, with areas of coagulation necrosis and fetid odor (Fig. 1). Pain was intermittent and sensitive to touch. There was also the presence of necrotic tissue and fibrin spots as well as perilesional skin dyschromic alteration.

She underwent computerized tomography of lower limbs on September 6, 2015, and it was not identified lesion of soft tissues or bone involvement. In association with the clinical condition, NF was diagnosed and the patient underwent emergency surgical debridement for removal of necrotic tissue in the right lower limb and empirical antibiotic therapy with meropenem 1 g every 8 h and vancomycin 500 mg every 12 h, both for 18 days. Right gluteal lesion material collection was performed during the procedure, with positive culture result for *Staphylococcus aureus*. Figure 2 presents the aspect of lesion after urgent surgical debridement.

Conventional dressing was used in post-debridement lesion and it was performed aseptically with the application of papain solution 10% and silver polyethylene mesh, with changes every 48 h and daily changes for secondary dressing.

On September 17, 2015, surgical debridement of the necrotic tissue of the medial and posterior thigh region and right gluteus was carried out. On the day of September 29, 2015, the patient presented lesions in both posterior regions of thigh and gluteus, granulation tissue in the right lower limb and necrotic tissue in the left lower limb (coagulation and liquefaction), as presented in Figure 3.

Figure 2. Aspect of lesion after surgical debridement in the right lower limb (September 06, 2015).

Laboratory exams results were: hemogram with red blood count 2.67 million/mm, hemoglobin 8.0 g/dL, hematocrit 23.3%, leukocytes 3700/mm^3, erythrocyte sedimentation rate 13 mm/h, albumin 2.74 and C reactive protein level of 48.8 mg/L.

Conventional dressing was instituted with cleaning of lesions using physiologic solution 0.9% in conditions of asepsis and antisepsis, as well as topical chlorhexidine digluconate solution 2% in the perilesional area, instrumental debridement of necrotic tissue and application of papain solution 10% in the left lower limb and occlusive dressing with medium-chain triglycerides on the right lower limb. Dressings were carried out under analgesia; with tramadol hydrochloride 50 mg endovenously administered 30 min before dressing.

Afterwards there were 3 surgical approaches on dates October 03, 09, and 20, 2015. On October 20, surgical incision was carried out in gluteus and extended until the distal region of the thigh (posterior aspect), as shown in Figure 4. There were occlusive dressing among performed debridements, cleaning with

Figure 1. Aspect of lesion during admission for both lower limbs.

Figure 3. Aspect of lesion in the right and left perineal region (September 29, 2015). Granulation tissue is noted in the right lesion and liquefaction necrosis in the left lesion.

Figure 4. Aspect of lesion after surgical debridement on October 20, 2015.

a physiologic solution 0.9% and topical chlorhexidine digluconate solution 2% in the perilesional area, and application of papain solution at 10%.

In the histopathological examination of the left limb cutaneous and subcutaneous tissue collected during debridement carried out on October 20, 2015, the presence of fibroconnective and adipose tissue was observed, with moderate suppurative inflammatory infiltrate permeated by fibrosis and necrosis area with absence of criteria for malignancy and negative results for fungus. On the day of October 21, 2015, negative pressure wound therapy (V.A.C. GranuFoam Silver Dressing with SensaT.R.A.C. Pad, KCI, INC) was installed at 125 millimeters of mercury (mm Hg) in continuous mode and high intensity on lower limbs (Fig. 5).

The dimensions of the wound before negative pressure wound therapy installation were 35 centimeters (cm) in length and 15 cm in width in the right lower limb and 37 cm in length and 8 cm in width in the left lower limb. Cleaning of the lesion with a physiological solution 0.9% and degerming chlorhexidine, as well as friction with gauze, soap removal, and drying of the area were performed before the installation of negative pressure wound therapy. The negative pressure wound method was applied by placing polyurethane hydrophobic sponge with silver on wound bed covering its whole extension. It was sealed with a transparent film, thus obtaining a hermetic seal connected to the suction pump in continuous mode with the pressure of 125 mm Hg. Dressing was changed every 72 h with aseptic technique.

Interruption of therapy in the left lower limb occurred on October 30, 2015, for removal of suture stitches, and on November 04, 2015, therapy was suspended in the right lower limb, with the application of conventional daily dressing with non-adherent gauze. On November 06, 2015, therapy in the left lower limb was reinstalled in intermittent mode at 125 mm Hg, with the suspension on November 30, 2015, keeping the conventional dressing method with humid saline gauze until hospital discharge on December 23, 2015.

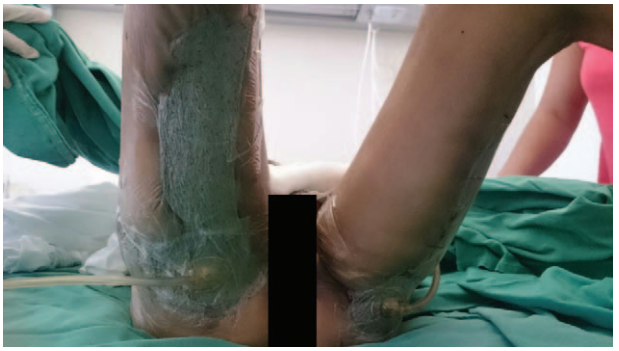

Figure 5. Hermetically closed dressing on both lower limbs.

The dimensions of the wound after negative pressure wound therapy suspension were 18 cm in length and 6 cm in width in the right lower limb and 10 cm in length and 12 cm in width in the left lower limb (Fig. 6). The observed improvements were both wounds with granulation tissue throughout their length with healing of first and second intention; absence of exudate; epithelial, irregular and preserved edges; intact periphery and absence of phlogistic signs. A 24-day home visit was performed after hospital discharge when complete healing of the lesion in both lower limbs was verified.

3. Discussion

NF is a severe and potentially fatal infection of soft tissues characterized by a rapid progressive necrosis of fascia and the subcutaneous tissue along fascial extents. Infection site is mainly seen in lower extremities, followed by abdomen and perineum.[4] Incidence is 0.4 at 1 person in 100,000 per year and it is responsible for elevated mortality and morbidity rates. Mortality associated with NF ranges from 11% to 36%.[5]

Few cutaneous symptoms reported by the patient in the onset of NF occur due to the deep infection, which is generally disproportional to the skin lesion. For that reason, clinical judgement is the most important element for diagnosis.

Etiology is not yet fully understood and is not identified in many cases. However, it might result from the previous history of traumatism and certain conditions, such as immunosuppression, diabetes melito, malignity, drug abuse, and kidney disease.[6] The patient did not report the history of the prior trauma common in most cases, but the presence of previous vasculitis and the use of immunosuppressant agents might have been factors that contributed for the development of the infectious state.

Despite greater propensity for patients with SLE to develop common and opportunistic infections, NF is rare in this group of patients, with few cases reported in literature,[7–9] but there are cases of NF in other rheumatic diseases, such as polymiositis, systemic sclerosis, rheumatoid arthritis, dermatomyositis, and ankylosing spondylitis.[10,11]

Primary management of NF involves urgent surgical debridement of affected tissues. The aim of surgical intervention is to remove all necrotic tissues, including muscle, fascia, and skin, in order to preserve the viable skin and reach hemostasis.[12]

Treatment of NF includes the intravenous administration of broad-spectrum empirical antibiotics taking into account the microbiological classification. Type I, with greater prevalence, corresponds to polymicrobial NF (presence of 2 or more agents, where these can be gram-positive, anaerobic or gram-negative) and affects mainly patients with comorbidities. Type II occurs with less frequency and affects mainly patients that are young or without comorbidities. It is caused by beta-hemolytic *Streptococcus* group A or *S aureus*, which may occur both in association. Type III is extremely rare, its evolution is the most aggressive (septic condition with insufficiency of multiple organs in less than 24 h) and it is caused by *Vibrio vulnificus*, associated with contact with sea water and marine animals.[9] Vacomycin combined with a carbapenem, in this case "meropenem", were the empirical choices of medications due to the purulent secretion and wound phlogistic signs, and they were continued after culture results.

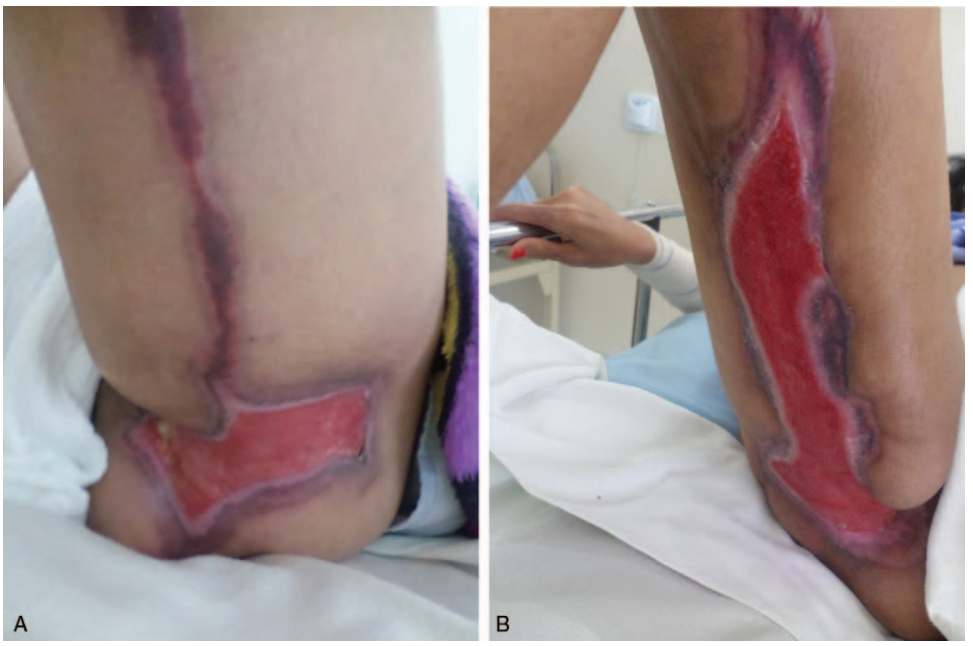

Figure 6. Left (A) and right (B) lower limb lesion with granulation tissue throughout its length, absence of exudate and epithelialized edges, and skin hyperpigmentation, after suspension of negative pressure wound therapy at 125 mm Hg. mm Hg = millimeters of mercury.

Postoperatory wound management and adequate nutritional support are vital for the patient's survival.[12] When associated with surgical debridement, conventional dressing had enzymatic debriding action. Tissue invasion associated with necrosis, severe septic systemic repercussions and patient's multiple basal comorbidities warn of the gravity of the condition.

Faced with the constant difficulty to achieve good results in the treatment of NF lesions, the utilization of negative pressure wound therapy was proposed as an auxiliary method for treatment.[13] The use of negative pressure wound therapy in the treatment of NF has been efficient.[13,14] Complex wounds of other etiologies are also successfully treated with this technique, such as burns, open fractures, fasciotomies, diabetic foot wounds, and pressure ulcers.[3,14,15]

In 4 cases of NF, treatment with negative pressure wound therapy was applied immediately after debridement to avoid the future formation of pseudo-eschars and necrotic membranes that could require other debridements. After adopting this technique, the patient's general condition and wound condition dramatically improved.[15] Still, a prospective study on 35 patients with Fournier's syndrome treated with negative pressure wound therapy demonstrated a meaningful decrease in mortality when compared to conventional dressings.[16]

The negative pressure wound therapy application provides uniform negative pressure to the wound bed and its mechanism of action eliminates the extravascular edema and improves microcirculation blood supply. Besides, it gives rise to a cellular cytoskeleton microdeformations responsible for initiating potent stimulus to cellular proliferation and angiogenesis. It also stimulates the formation of granulation tissue and reduces the wound size and bacterial load. However, in extensive wounds, the foam may cause persistent infections. Other disadvantages of the device include high cost of material, inconvenience for ambulation, dressings changes with intensive work, difficulty to maintain a hermetic sealing, pain and the discomfort caused by suction. Even so, the total cost of negative pressure wound therapy can be 3 times lower in comparison with traditional wounds treatment for post-operative patients of acute treatment in the long term.[3,17]

The therapy may be applied with different clinical objectives, as a bridge until definite surgical completion, or for the progress of wound closure by the second intention.[3,17] However, just as important as therapy beginning is the decision about ending it. The therapy allows the movement of keratinocytes to be organized and that they re-epithelialize more rapidly, increasing healing speed and encouraging the growth of healthy granulation tissue.[17] When reaching this level, it is important to discuss the possibility of definite closure procedures, for example, cutaneous graft, local skin flap, and wound edges approximation. The ideal wound for repair is that in which we observe granulation tissue with little or no fibrin and with non-existent or low output, and that of a serous aspect. Small wounds are likely to progress by the second intention, but an extensive lesion would need bed preparation for graft, which shall be carefully indicated.[18,19]

We chose progression by the second intention for several reasons, including the lack of access to surgical closure, countraindication of surgery to the patient or countraindication for wound surgical closing. Absence of adequate flap or presence of complex comorbidities makes the patient an unfit candidate for reconstruction. In these cases, negative pressure wound therapy may be the ideal solution, mainly in lesions that involve extensive bodily areas.[17]

Many clinical circumstances do not allow wound closure in the first surgical procedure, including the patient's serious condition, meaningful wound infection, the need of additional debridement procedures, the need of edema reduction, among other factors.[17–19] In the described case, graft was contraindicated due to the clinical condition, with relevant autoimmune characteristics and malnutrition, associated with absence of adequate flap. Thus, therapy was extended until wound tunnel

superficialization, which may also occur when there is exposure of bone tissue and tendon, providing these structures with granulation tissue formation.

The hermetically closed dressing changed every 72 hours, in contrast with wounds treatment with conventional technique, allows the covering not to be altered daily, keeping the wound in an isolated environment, impeding contamination and offering better comfort to the patient. This therapy is an excellent management tool for post-surgical wounds and it is able to accelerate healing time, reducing the number of dressings changes.

Studies are not conclusive as for the level of negative pressure that we shall apply in the dressing, but early granulation tissue formation is evident under pressure of 125 mm Hg when compared to pressures of 25 mm Hg and 500 mm Hg. Vacuum dressing at the 125 mm Hg value has greater use in clinical practice,[5,17] just as it had in the described case, with good results obtained for healing and wound granulation.

Because of the cost, though, it is necessary that the therapy use be standardized, contemplating mainly complex wounds of difficult management in order to help in granulation tissue formation and abbreviate the time of hospital stay.

Negative pressure wound therapy has proved to be a safe and effective alternative with satisfactory scar evolution, wound tunnel superficialization, formation of granulation tissue and epithelialization, edges approximation, ensuring perilesional skin integrity, with less manipulation of patient during dressings change.

Author contributions

Conceptualization: Fabiana Martins Paula, Edivania Anacleto Pinheiro, Vanessa Terezinha Gubert de Matos.
Formal analysis: Fabiana Martins Paula, Edivania Anacleto Pinheiro, Vanessa Marcon de Oliveira, Marisa Dias Rolan.
Investigation: Fabiana Martins Paula, Edivania Anacleto Pinheiro.
Supervision: Cristiane Munaretto Ferreira, Maria Tereza Ferreira Duenhas Monreal, Vanessa Terezinha Gubert de Matos.
Writing – original draft: Fabiana Martins Paula, Edivania Anacleto Pinheiro, Vanessa Marcon de Oliveira, Cristiane Munaretto Ferreira, Maria Tereza Ferreira Duenhas Monreal, Marisa Dias Rolan, Vanessa Terezinha Gubert de Matos.
Writing – review and editing: Fabiana Martins Paula, Edivania Anacleto Pinheiro, Vanessa Marcon de Oliveira, Cristiane Munaretto Ferreira, Maria Tereza Ferreira Duenhas Monreal, Marisa Dias Rolan, Vanessa Terezinha Gubert de Matos.

Vanessa Terezinha Gubert de Matos orcid: 0000-0002-9361-2780.

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