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# Necrotizing Fasciitis: Role of Vac Therapy and Multidisciplinary Approach in Management

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***Abstract***

*Necrotizing fasciitis (NF) is a rare, rapidly progressing soft tissue infection characterized by tissue necrosis and a high mortality rate, exceeding 40% in severe cases. Optimal management requires early diagnosis, aggressive surgical debridement, targeted antibiotic therapy, and advanced wound care with complex dressings. Negative pressure wound therapy (VAC Therapy) has emerged as an effective option to enhance wound healing and reduce complications. This article examines the pathogenesis, risk factors, diagnosis, and management of NF, including a successfully treated clinical case and a critical review of recent literature.*

**Keywords:** Biomedical, Necrotizing Fasciitis, Vac Therapy, Medical.

## Introduction

Necrotizing fasciitis is a medical emergency requiring a timely and multidisciplinary approach [1-5]. Although aggressive surgical debridement remains the cornerstone of treatment, post-surgical wound management remains a significant challenge [6]. VAC Therapy, which applies continuous or intermittent negative pressure, has proven effective in improving post-surgical healing and enhancing patients' quality of life [7].

## Discussion

Necrotizing fasciitis caused by mixed aerobic and anaerobic bacteria typically begins with a breach in a mucosal membrane, such as the gastrointestinal or genitourinary tract. The entry point can be a neoplasm, diverticulum, or ureteral fissure. Group A streptococcal necrotizing fasciitis commonly arises as a progressive complication of a superficial tissue infection. The initial pathogenic event occurs at the superficial fascia, where bacterial invasion is accompanied by the local production of exogenous enzymes that degrade tissues and enhance the invasive potential of the pathogens. The immediate consequence is liquefactive necrosis, accompanied by microvascular damage. Histologically, polymorphonuclear infiltration is observed in the superficial fascia and deep dermis, along with thrombosis and suppuration of veins and arterioles in the affected areas [8]. Pathological conditions that predispose individuals to NF include peripheral vasculopathies, diabetes mellitus, immunosuppressive diseases or therapies, recent surgeries, or penetrating injuries to the abdomen and lower limbs [9]. Sometimes, patients recall a minor trauma, such as a simple contusion or muscle strain, suggesting contamination through transient bacteremia. Mixed aerobic-anaerobic bacterial NF may be associated with the presence of gas in deep tissues, which is typically absent in streptococcal infections.

From a microbiological perspective, the pathogens documented in NF cases include [10].

- Gram-positive bacteria: Group A Streptococcus, Group B Streptococcus, Enterococci, Coagulase-negative Staphylococci, Staphylococcus aureus, Bacillus spp.

- Gram-negative aerobes: Escherichia coli, Pseudomonas aeruginosa, Proteus spp., Serratia spp.
- Anaerobic bacteria: Bacteroides spp., Clostridium spp., Pepto streptococcus spp.
- Fungi: Zygomycetes, Aspergillus spp., Candida spp.

The Key Predisposing Factors for NF include

- Obesity due to reduced tissue perfusion and impaired wound healing [11].
- Diabetes mellitus, which leads to immunosuppression and increased vulnerability to infections including Fournier's gangrene [12, 13].
- Chronic tobacco use, which significantly decreases tissue oxygenation and microcirculatory perfusion [14].
- Recent surgeries or trauma, facilitating the direct introduction of pathogens into soft tissues [15].

Timely diagnosis is crucial to prevent unfavorable outcomes [16]. The LRINEC score, which includes laboratory parameters such as leukocytosis, hyponatremia, and elevated CRP levels, is useful for prognosis [17]. Imaging modalities like CT and MRI help assess tissue damage and detect gas presence [18]. Microbiological tests, including tissue cultures, are essential for identifying the causative pathogen and guiding targeted antibiotic therapy [19].

**Management of Necrotizing Fasciitis**

A multidisciplinary approach is essential and includes:

- Surgical debridement, with timely removal of necrotic tissue until well-perfused, granulating tissue is achieved. This may require multiple surgeries under general anesthesia [20].
- Empirical antibiotic therapy, often using a combination of piperacillin-tazobactam, clindamycin, and vancomycin, in consultation with infectious disease specialists [3,4]. The use of ceftobiprole in combination may provide a valid alternative therapy for the treatment of resistant Gram-positive infections [21].
- Intensive care support for sepsis management and hemodynamic stabilization [6].
- Negative pressure wound therapy (VAC Therapy) to optimize healing, expedite recovery, and prevent secondary infections [7, 8].

**Clinical Case**

**Figure 1:** A 67-year-old woman with grade III obesity and a history of heavy smoking developed NF of the right leg following trauma. After multiple surgical debridements and targeted antibiotic therapy, VAC Therapy was applied at -125 mmHg. The patient was discharged after two weeks with instructions to continue home-based treatment. Two months later, the wound had completely healed without complications.

**Role of VAC Therapy**

Negative Pressure Therapy, known as VAC Therapy (Vacuum-Assisted Closure), represents a significant breakthrough in the management of complex wounds, including necrotizing fasciitis.

This treatment is based on the controlled application of negative pressure to the wound through a sealed system that utilizes a foam or a sterile granuloma-like spongy material. VAC Therapy operates through a combination of physiological mechanisms that contribute to wound healing:

- Removal of exudates and tissue debris: The system continuously suctions fluids and debris, reducing the bacterial load and preventing the accumulation of infected exudates.
- Stimulation of granulation tissue: Negative pressure promotes mechanical micro stress on the tissues, fostering new angiogenesis and cellular proliferation.
- Reduction of edema: Constant suction decreases interstitial pressure, improving local blood flow and oxygen supply.
- Wound sealing: The airtight closure protects the wound from external contamination, maintaining a sterile environment. Thus, VAC Therapy offers several advantages in the management of necrotizing fasciitis, especially after thor-

ough surgical debridement. In our experience, we have particularly observed:

- Improved healing due to stimulation of tissue regeneration.
- Reduction of secondary infections thanks to the continuous removal of exudates, minimizing the risk of reinfection.

Additionally, we have found a reduction in pain, as negative pressure and wound protection help alleviate the discomfort associated with traditional dressing changes, which are sometimes performed twice a day [13]. Its effectiveness has been demonstrated in numerous clinical studies highlighting its benefits. A key element of VAC Therapy's success is its ability to enhance vascularization and promote granulation tissue formation through fibroblast migration and cellular proliferation stimulation [30].

The negative pressure applied to the wound stimulates an angiogenic response, which is essential for the healing process, especially in patients with complex risk factors such as diabetes or obesity [27, 28]. Although VAC Therapy is highly effective, it requires expert management to optimize results. Complications such as deep tissue injuries may occur if used inappropriately, emphasizing the importance of careful monitoring and accurate patient selection [29, 30].

Several randomized studies and clinical cases have supported the use of VAC Therapy in necrotizing fasciitis. In a study by Gabriel et al. (2009), patients treated with VAC Therapy showed a significant reduction in healing time compared to traditional methods [27, 28]. Moreover, the use of VAC Therapy has been associated with improved granulation tissue quality and a reduced risk of reinfection [27 ,28]. Similarly, a meta-analysis by Blume (2008) confirmed that VAC Therapy is associated with a 30% reduction in healing time in patients with complex wounds [29].

**Essential Requirements**

- Complete surgical debridement until obtaining non-necrotic wounds free of active infections.
- Proper setting of suction pressure to ensure optimal outcomes.
- Only its correct application and management by trained personnel can guarantee optimal results. Generally, a negative pressure of -125 mmHg is used, which can be adjusted based on the patient's condition and BMI.
- Duration and Treatment Protocol
- VAC Therapy is applied in continuous or intermittent cycles with dressing changes every 48-72 hours, ensuring constant monitoring to assess the clinical response and prevent complications such as fistula formation or skin lesions.
- Limitations and Contraindications

**Absolute Contraindications**

- Untreated osteomyelitis.
- Organ or body cavity fistulas.
- Presence of necrotic tissue with inadequate surgical debridement.
- Exposure of nerves, arteries, or vital organs.

**Relative Contraindications**

- Patients with coagulopathies.
- Patients on anticoagulant therapy or with actively bleeding wounds [30].

More recently, VAC Therapy has found new applications, thanks to integrated systems equipped with digital sensors that allow real-time monitoring of wound pressure and humidity, as well as integration with bioactive therapies that release growth factors.

## Conclusions

VAC Therapy (Negative Pressure Wound Therapy, NPWT) is an advanced wound management technology that has proven particularly effective in treating necrotizing fasciitis. This technique utilizes a negative pressure system to promote healing through various mechanisms, including continuous exudate removal, bacterial load reduction, stimulation of granulation tissue formation, and increased tissue perfusion [31-33]. Therefore, VAC Therapy represents an essential option, as demonstrated in our experience in managing NF, seamlessly integrating into a multidisciplinary approach.

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