



# Successful Treatment of Necrotizing Fasciitis of the Shoulder with the Application of a Negative-Pressure Wound Therapy: A Case Study

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## Abstract

Necrotizing Fasciitis (NF) is a rapidly progressive soft tissue infection that involves the deep fascia and is characterized by extensive deterioration of the surrounding tissue. Vacuum Sealing Drainage (VSD) is a negative pressure wound therapy that has been commonly utilized in many clinical settings. It has been shown to be successful in the treatment of patients with severe complex wounds, including NF. In this case report, a 79 year-old-man presented with 2 days of fevers accompanied by progressive swelling and pain of the neck and shoulder. He underwent emergent surgical intervention under general anesthesia, including radical exploration and debridement of the wound. After extensive debridement, a VSD system was applied to the large open wound to further clean the wound bed, contributing to successful treatment of the patient. This case demonstrated that the VSD device is well tolerated and efficacious in the wound healing process of patients with NF.

**Keywords:** Necrotizing fasciitis; Negative-pressure wound therapy; Vacuum sealing drainage

## Introduction

Necrotizing Fasciitis (NF) is a life threatening condition that can occur idiopathically, but can also be due to the result of trauma or infection of surgical wounds. NF is characterized by progressive infection in fascial planes with necrosis of the subcutaneous tissue [1,2]. NF affects the extremities more frequently than it does the torso. Risk factors for NF include trauma, alcoholism, diabetes, wound infections, decubitus ulcers, malignancy history, and peripheral vascular disease. A variety of microbes have been found to be implicated in NF, including gram-positives (*Streptococcus pyogenes* and *Staphylococcus aureus*), gram-negatives (*Enterobacteriaceae*, *Escherichia coli*, and *Klebsiella*), and anaerobes (*Peptostreptococcus*, *Clostridium*, and *Bacteroides*). In NF, there is widespread necrosis of the subcutaneous tissue and fascia, which can lead to sepsis [2]. The mortality rate is high (25% to 73%), which means that prompt diagnosis, antibiotic treatment, and surgical debridement are crucial for survival [1,3]. Of these three, aggressive early debridement is the single greatest factor that contributes to the increased survival rates in patients with NF [4]. Negative pressure wound therapies such as VSD are well-established wound care systems for the treatment of complex wounds. This dressing technique entails placing an open cell foam dressing into the wound cavity, draping an adhesive over the wound, and then applying a vacuum to produce negative pressure. Here, we report the case of a 79 year-old-man who presented with NF of the left shoulder and was successfully treated with a combination of surgical debridement, broad-spectrum antibiotics, and VSD therapy.

## Case Presentation

A 79 year-old-man presented to the hospital with 2 days of fever accompanied by progressive swelling and pain of the neck and shoulder. Initially, his symptoms were attributed to cervical spondylosis. However, he was febrile to 38.7°C and there was significant left shoulder pain and decreased range of motion. Physical exam demonstrated erythematous edema and subcutaneous crepitus of the left shoulder. His lab findings revealed a leukocytosis of  $22.7 \times 10^9/L$  (with neutrophilic predominance of 82.8%). C-reactive protein (177.3 mg/L) and procalcitonin (0.409 ng/mL) were both elevated in the setting of normal hemoglobin level and platelet count. Serum calcium (1.8 mmol/L), phosphorus (0.8 mmol/L), chloride (90.2 mmol/L), and sodium levels (125.3 mmol/L)

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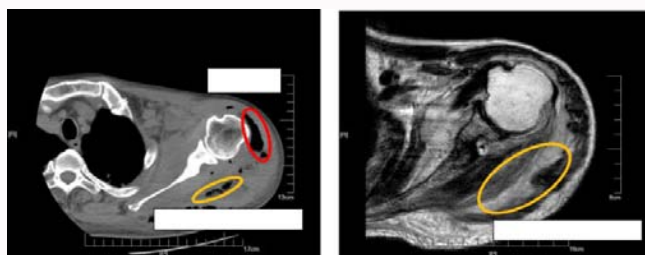
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**Figure 1:** CT and MRI demonstrating soft tissue inflammation and edema with multiple gas bubble formations.



**Figure 2:** Intraoperative photograph of the wound in a patient with necrotizing fasciitis after the first debridement.

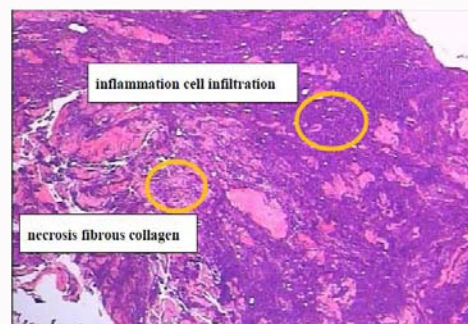


**Figure 3:** Two additional wound debridements were required in the subsequent two weeks.

were abnormal. There was also evidence of renal dysfunction with increased serum creatinine and blood urea nitrogen. Serum creatine kinase levels were slightly decreased and the hepatobiliary enzymes were within the normal range. CT and MRI of the left shoulder demonstrated subcutaneous and inter-muscular gas collections, leading to the diagnosis of NF with gas gangrene (Figure 1). Patient had no prior history of trauma, diabetes, hypertension, or chronic medical issues. His past surgical history was unremarkable, and he was not on any medications. A review of systems was unremarkable. Given the possibility of rapid deterioration and death, the patient underwent emergent surgery under general anesthesia (radical exploration and debridement of the wound). VSD dressing was applied to the wound after the debridement. During the operation, a large amount of purulent liquid in the subcutaneous tissue drained from the wound, consistent with necrotizing fasciitis (Figure 2). Post-operatively, the patient received broad-spectrum antibiotics: Superazone (3 g/day) and vancomycin (2 g/day). The necrotic tissue and blood were cultured. In this case, *Acinetobacter baumannii* was isolated. This is not a very common pathogen found when patients present with NF. After maintenance application of VSD system at 125 mmHg for continuous topical negative pressure, subsequent debridement and wound assessment demonstrated marked improvement with visible granulation tissue. The patient required two additional wound debridements in the subsequent two weeks (Figure



**Figure 4:** The patient after the VSD therapy was discontinued status post the third debridement. It had been placed for two weeks.



**Figure 5:** Pathological findings demonstrating some fibrous collagen and muscle tissues that were accompanied by necrosis and acute inflammatory cell infiltration (x50).

3). The VSD therapy was discontinued after the third debridement, as the granulation that covered the wound was deemed satisfactory (Figure 4). Pathological findings demonstrated some fibrous collagen and muscle tissues that were accompanied by necrosis and acute inflammatory cell infiltration (Figure 5). While the patient did not complain of any pain or bleeding with the VSD usage, those are common side effects that should be kept in mind.

### Discussion

With its rapid and extensive progression, early diagnosis of NF is crucial [1]. NF should be on the differential for any patient presenting with cutaneous infections causing edema, pain, and erythema, especially if there are co-morbidities present, like diabetes or liver disease. CT and MRI are sensitive methods for the detection of NF and other conditions that may also cause soft tissue infection, such as abscesses [2]. In this case, this patient was nearly misdiagnosed as having cervical spondylosis given that he had neck and shoulder pain. Even in this patient, who did not have any medical comorbidities, the disease rapidly progressed. NF of the left shoulder was diagnosed as soon as soft-tissue gas was detected on the CT and MRI scans. The patient in this case report was treated successfully with aggressive hemodynamic stabilization, parenteral broad spectrum antibiotic administration, emergent wide surgical debridement, and VSD application. Once the necrosis is surgically excised, VSD helps physiologically with wound healing. The negative pressure leads to increased blood supply to the wound, and migration

of inflammatory cells into the region [5]. Moreover, VSD can also prevent further infection of the wound. This is a popular treatment choice for both acute and chronic wounds. It has widespread usage amongst the surgical sub-specialties, many of whom employ VSD to varying degrees as part of their arsenal against challenging wounds [6]. Negative pressure dressing was first described by Fleischmann et al. in 1993 [7] by noting that such a method has a positive effect on the granulation tissue in open fractures. In 1997, Morykwas and Argenta [8] studied the use of suctioning applied to polyurethane foam for wound healing. The polyurethane sponge created an interface that allowed good distribution of the sub-atmospheric pressure that could be directed at the wound either at a constant or intermittent fashion. VSD has been reported to be able to reduce wound volume in situations where there was tissue loss and promote the formation of granulation tissues. This reduces the wound surface area by edge contraction [9]. In addition, there were no adverse events detected in this case in association with VSD. VSD facilitated the primary closure of a large left shoulder wound that was caused by acute NF. The VSD application was comfortable for both the patient and the nursing staff. VSD has widespread application: The indications for its use include pressure ulcers, stasis ulcers, chronic wounds like diabetic foot ulcers, post-traumatic and post-operative wounds, soft-tissue trauma, and injuries with bone exposure [10,11]. Growing evidence demonstrates that VSD therapy is useful in the management of infected wounds, including NF [10-12]. Due to the fact that the negative pressure is applied cyclically, this promotes acceleration of wound healing as this increased blood flow leads to enhancement of local oxygenation, stimulating fibroblasts and granulation formation. This also decreases local tissue edema, and accelerates the removal of excessive fluid found in the wound bed, facilitating the removal of wound bacteria [13,14]. A previous comparative study comparing conventional treatment (initial debridement followed by wet-to-dry dressings) with VSD treatment for a patient with NF demonstrated that while both treatments were equally efficacious in wound healing, use of VSD led to fewer skipped meals for the patients, dressing changes and overall discomfort. VSD also led to increased patient mobility [15]. Although VSD is more expensive than other wound-care products, analysis of cost-effectiveness shows overall lower treatment expenses with VSD usage. In a randomized controlled trial, Vuerstaek et al. [16] demonstrated significantly shortened wound healing time when compared to the control group. The control group, with its slower healing, accumulated overall higher treatment costs with increased personnel costs and longer hospitalization time.

## Conclusion

This is an atypical case of NF. The patient did not have any history of left shoulder trauma, diabetes, or other co-morbidities. This case was nearly misdiagnosed as cervical spondylosis due to the presence of neck and shoulder pain. This case demonstrates the advantages of using the VSD device, its well-tolerability, and efficacy in the wound healing of a patient with NF. However, to further prove benefit, more case series and randomized controlled trials are needed.

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