Case of Necrotizing Fasciitis from *Streptococcus pyogenes* (Group A) Treated Successfully with Negative-Pressure Wound Therapy

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Abstract

Background: Necrotizing fasciitis is an infection of the soft tissue marked by quickly spreading inflammation and subsequent necrosis of the skin, subcutaneous fat, muscle fascia, and in some cases, the epidermis, associated with a fulminating septic process. Mortality is high without immediate surgical intervention. We report a case of a female exhibiting primary necrotizing fasciitis that was treated with a combination of conservative surgery and negative-pressure wound therapy.

Case Presentation: A 78-year-old female was admitted to our emergency department complaining of left inguinal pain for two days. On arrival, the patient had an extensively spreading, well-demarcated section of purplish discoloration with associated skin peeling over her left lower abdomen and inguinal lesion. A diagnosis of sepsis secondary to necrotizing fasciitis of the left inguinal area was made. She was started immediately on empirical broad-spectrum antibiotics and surgical debridement of the necrotic tissue. Surgical incision culture was positive for *Streptococcus pyogenes* (group A β -hemolytic *Streptococcus*). In addition to using a device to divert stool, negative-pressure wound therapy was applied to the large open wound that successfully helped with wound bed cleansing, which was followed by skin grafting surgery. The patient recovered uneventfully.

Conclusion: We treated a patient with acute necrotizing fasciitis by surgically removing the necrotized tissues, systemically administering broad-spectrum antimicrobial agents, and ameliorating underlying systemic disease processes. Negative-pressure wound therapy prior to definitive surgical management of skin grafting was effective in managing open surgical incisions resulting from surgical treatment for a patient with necrotizing fasciitis. Additionally, the Flexi-Seal[®] device (ConvaTec, Inc., Greensboro, NC) helped keep the wound clean and dry.

Keywords: debridement; NPWT; soft tissue infection; streptococcal gangrene; surgical management

NECROTIZING FASCIITIS is a synergetic infectious disease caused by polymicrobial involvement of aerobic and anaerobic organisms ultimately causing thrombosis of the small subcutaneous vasculature, and hence, regional skin necrosis. The mortality rate ranges from 25% to 35% despite broad-spectrum antibiotic therapy

and surgical debridement, unless the wound is treated immediately [1].

Management of the wound resulting from debridement in patients recovering from septic complication is challenging. Radical removal of all devitalized tissue is still the undisputed standard of treatment. Similarly, intensive care and

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broad-spectrum antibiotics are considered mainstay components of management. Negative-pressure wound therapy (NPWT) is a viable adjunct for the treatment of an open wound after debridement based on possible results of effective control of tissue edema by removing tissue fluid, preventing colonization of pathogens, promoting tissue angiogenesis, and bolstering granulation tissue growth.

We report a case of necrotizing fasciitis treated successfully by a combination of surgery and NPWT; the affected area was subsequently reconstructed with split thickness skin grafting. Although traditional reconstruction of soft tissue and skin grafting may still be required to obtain sufficient coverage, application of NPWT after the initial debridement of wounds may have resulted in an increase in accelerated granulation tissue formation and decreased tissue bacterial levels in the presented case.

Case Presentation

A 78-year-old female was admitted to our emergency department complaining of left inguinal pain for two days. On arrival, the patient had an extensively spreading, well-demarcated area of purplish discoloration with associated

skin peeling over all her left lower abdomen and inguinal lesion (Fig. 1A). The patient denied any history of allergies, tobacco use, alcohol consumption, or intravenous drug use. Her medical history revealed hypertension, hyperlipidemia, and atherosclerosis. Her initial vital signs were stable with temperature of 37.2°C, blood pressure of 87/74 mm Hg, heart rate of 127 beats per minute, respiratory rate of 25 breaths per minute, and oxygen saturation of 92% on room air. Laboratory test results included a white blood cell count of $8.44 \times 10^3/\text{mm}^3$ with left shift, hemoglobin of 11.2 mg/dL, platelets of $151 \times 10^3/\text{mm}^3$, sodium of 140 mmol/L, potassium of 4.7 mmol/L, blood urea nitrogen of 75.7 mg/dL, creatinine of 1.95 mg/dL, creatine kinase of 496 IU/L, total bilirubin of 0.3 mg/dL, lactate of 6.8 mg/dL, and C-reactive protein of 41.8 mg/dL. Coagulation study showed normal prothrombin time and an elevated partial thromboplastin time of 28 sec. Chest radiograph was unremarkable. Pelvic and leg radiographs showed subcutaneous and inter-muscular gas. Wound culture developed *Streptococcus pyogenes* (group A β -hemolytic *Streptococcus*).

Because the patient had presented with hypotension, tachycardia, and renal impairment, saline infusions were

FIG. 1. (A) In the emergency room (d0). (B) After surgical debridement (d1). (C) Negative pressure wound therapy (d4). (D) After skin grafting (d60).

initiated. Over the subsequent few hours, hypotension could not be corrected by the infusions, renal failure developed, and a diffuse light macular rash appeared on her face, neck, and chest. A diagnosis of sepsis secondary to necrotizing fasciitis of the left inguinal area was made. She was started immediately on empirical broad-spectrum antibiotics and the necrotic tissue was surgically removed (Fig. 1B).

Post-operatively, the patient was transferred to the intensive care unit (ICU) for respiratory, renal, and circulatory support. The patient was stabilized in the ICU with inotropic support and intravenous antibiotic therapy. Between days four and 25, the open wound was treated with NPWT after debridement (Fig. 1C). After multiple debridements and NPWT, the perineal skin defect was ready for resurfacing with a split-skin graft. Bacterial examinations and cultures of secretion were negative three times, thus, skin grafting was performed on day 26 and day 83 (Fig. 1D). The patient recovered satisfactorily.

Discussion

Acute necrotizing fasciitis is a serious infectious process requiring urgent surgical debridement. Rapidly spreading soft tissue infection marked by widespread fascia and subcutaneous tissue necrosis can lead to extensive sepsis and necrosis. Treatment with intravenous antibiotics, hyperbaric oxygen, and wound management are considered the standard of care. Early recognition and prompt intervention are critical to reduce morbidity and mortality rates. Physicians need to keep a high index of suspicion for necrotizing fasciitis because any delay in diagnosis results in greater soft tissue loss and mortality. It is challenging to distinguish necrotizing fasciitis from other soft tissue infections because of non-specific skin findings in the early stage. Predisposing conditions for the acquisition of necrotizing fasciitis include minor cuts and penetrating injuries. The most common source is polymicrobial, with group A *Streptococcus* being the most common organism cultured. Imaging tests, such as computed tomography or magnetic resonance imaging, provide important evidence supporting clinical diagnoses.

Despite the cause, rapid, accurate diagnosis with early aggressive debridement is the cornerstone of life-saving treatment. In addition, good intensive care to correct the underlying systemic illness and microbial treatment are key adjuncts. Wound healing is a dynamic and complicated process that includes a rapid sequence of cell migration leading to repair and closure. Treating chronic, open wounds is variable and costly, requiring long hospital stays or specialized home care with skilled nursing and costly supplies. Fast healing of open wounds could result in reduced hospitalization and more rapid return of function. A treatment that improves the healing process could greatly lessen the risks of infection and amputation and hospital stay length, and result in potential health care cost savings.

Negative-pressure wound dressing was first described by Fleischmann et al. [2] in 1993. Accumulating evidence indicates that NPWT is useful for the management of infected open wounds, including necrotizing fasciitis [3]. Negative-pressure wound therapy is useful for improving a wound to a point at which more traditional dressings or more

simple surgical reconstructive methods can be used. The cyclical application of negative pressure can quicken wound healing, in which optimized blood flow increases local oxygenation and promotes fibroblast stimulation and granulation formation, decreases local tissue edema, and accelerates removal of excessive fluid from the wound bed, which in turn facilitates the removal of bacteria from the wound. A recent study showed the positive effects of NPWT on levels of the adhesion molecule fibronectin in the serum, promoting the migration of inflammatory cells and remodeling stages [4].

Fecal management is a priority in the management of necrotizing fasciitis. Exposure of a peri-anal open wound to excess wetness and feces increases the risk for surgical site infection and delayed wound healing. In an effort to protect the wound from fecal discharge, colostomy is routinely performed mostly for wounds close to the perianal region. Recently, the Flexi-Seal® Fecal Management System (ConvaTec Inc., Greensboro, NC) has been developed for fecal diversion. This alternative to colostomy provides economic benefits and patient comfort for short-term fecal diversion [5]. It was originally designed for ICU patients and has a rectal tube that allows fecal matter to be diverted from the rectum to a collection bag. In this manner, it prevents fecal leakage, thus keeping the wound clean. In our patient, this system could be used successfully in an attempt to divert feces. The device not only prevents fecal contamination of the wound, but also the complications of colostomy. In our patient, the Flexi-Seal Fecal Management System was used as an alternative fecal diversion method to colostomy and helped the wound remain clean.

Conclusion

Management of a wound resulting from debridement in patients recovering from septic complications can be challenging. Conventional wound closure methods such as delayed wound closure and/or skin grafting combined with NPWT was effective in our patient by removing tissue fluid, preventing colonization of pathogens, promoting tissue angiogenesis, and enhancing granulation tissue growth.

Author Disclosure Statement

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References

1. Sarani B, Strong M, Pascual J, Schwab CW. Necrotizing fasciitis: Current concepts and review of the literature. *J Am Coll Surg* 2009;208:279–288.
2. Fleischmann W, Strecker W, Bombelli M, Kinzl L: [Vacuum sealing as treatment of soft tissue damage in open fractures]. *Unfallchirurg* 1993;96:488–492.
3. Czymek R, Schmidt A, Eckmann C, et al. Fournier's gangrene: Vacuum-assisted closure versus conventional dressings. *Am J Surg* 2009;197:168–176.
4. Arslan E, Ozturk OG, Aksoy A, Polat G. Vacuum-assisted closure therapy leads to an increase in plasma fibronectin level. *Int Wound J* 2011;8:224–228.

5. Padmanabhan A, Stern M, Wishin J, et al. Clinical evaluation of a flexible fecal incontinence management system. *Am J Crit Care* 2007;16:384–393.

Abbreviations Used

ICU = intensive care unit
NWPT = negative-pressure wound therapy

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