Necrotizing Fasciitis Following a Small Burn

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Necrotizing fasciitis (NF) is a life-threatening soft tissue infection that manifests with a rapid course of inflammation and necrosis of the skin, subcutaneous fat, and fascia. NF commonly follows trauma to the skin, such as a laceration, scratch or insect bite. NF is a surgical emergency and requires both a high index of suspicion for diagnosis and prompt operative intervention. Early aggressive surgical intervention is important for improving survival rates. Mortality and morbidity can be decreased with early diagnosis, adequate and urgent surgical debridement, intensive supportive care, and wound resurfacing. Recently, we experienced a case of NF secondary to a third-degree contact burn on the dorsum of the right foot (1% body area). We report our therapeutic experience in this case, with a review of the literature. (J Korean Surg Soc 2010;79:71-74)

Key Words: Necrotizing fasciitis, Burn

INTRODUCTION

Necrotizing fasciitis (NF) is perhaps the most fulminating and deadliest disease, with reported mortality rates ranging from 6% to 76%.(1) NF usually affects the abdominal wall, perineum, and extremities, with trauma to the skin being a common inciting event. The exact pathogenesis of NF has not been established, although released enzymes such as hyaluronidase and the proteolytic portions of cell membranes are causes of the necrosis.(2) Early diagnosis and aggressive debridement are crucial, and delay in diagnosis and surgical debridement increases morbidity and mortality. Therefore, NF is a surgical emergency, requiring both a high level of suspicion for the diagnosis and prompt operative intervention. Recently, we experienced a case of NF secondary to a third-degree contact burn on the dorsum of the right foot, covering 1% of the body surface. We report our therapeutic experience in this case, with a review of the literature.

CASE REPORT

A 55-year-old woman presented to the emergency department with a painful right leg. Twelve days before admission, she had been burned on the dorsum of her right foot. The patient has rheumatoid arthritis and had been taking NSAIDs for several years.

A physical examination showed an acutely ill appearance, with a body temperature of 36.7°C, heart rate of 91 beats/min, respiratory rate of 20 respirations/min, and blood pressure of 93/60 mmHg. An examination revealed eschar on the dorsum of her right foot and a widespread tender erythematous area with palpable crepitus and muscle guarding over the right leg and thigh. The thigh was erythematous with tense edema and had evidence of both hemorrhagic and non-hemorrhagic bullae (Fig. 1). The laboratory findings revealed a white blood cell (WBC) count of 460/mm³ (42% polymorphonuclear cells) and thrombocytopenia (platelet count, 42,000/mm³). The serum lactate was 6.0 mmol/L; sodium, 132 mmol/L; total protein/
Fig. 1. The right leg at initial presentation. The skin was erythematous with tense edema and had evidence of both hemorrhagic and non-hemorrhagic bullae.

Fig. 2. Intraoperative findings. Foul-smelling, turbid “dishwater” pus is seen in necrotizing fasciitis.

Fig. 3. The right leg and thigh after re-debridement. The whole fascia and some muscle were removed.

Fig. 4. The wound after first split thickness skin graft.

Fig. 5. Appearance of wound 3 months postoperatively.

albumin, 4.3/1.7 g/dl; and glucose, 225 mg/dl. There was evidence of mild coagulopathy with a prothrombin time of 15.8 seconds and an international normalized ratio 1.38. She was admitted to the intensive care unit, and fluid resuscitation and broad-spectrum antibiotic therapy were started. The patient was given the triple antibiotic combination of metronidazole (1,500 mg), meropenem (500 mg), and teicoplanin (400 mg) intravenously. In addition, she was given granulocyte colony-stimulating factor (lenograstim 250 μg/s) subcutaneously due to the neutropenia. She was emergently taken to surgery.

In the operating room, an incision was made over the lateral aspect of the calf and extended proximally. Exploration of the calf fascia revealed inflamed, necrotic tissue with much pus (Fig. 2). Anaerobic and aerobic cultures and a biopsy were obtained for confirmation. A radical fasciectomy was then performed. The fascia was excised sharply, exposing the underlying muscles and tendons. We discussed the extent of the debridement with plastic and orthopedic surgeons during the procedure.

Postoperatively, we transfused platelets and fresh frozen plasma and injected anti-thrombin III for disseminated
intravascular coagulation. The triple antibiotic therapy (teicoplanin, meropenem, and metronidazole) was continued with intravenous immunoglobulin as adjuvant therapy. Wound care involved topical 5% mafenide acetate solution daily. The patient had necrotic dead tissue re-debrided on hospital day 6 because of persistent leukopenia and thrombocytopenia (Fig. 3). Aggressive surgical and antibiotic therapies were effective in treating the NF, and on hospital days 21 and 32, the patient received meshed split-thickness skin grafts (Fig. 4). The patient was transferred to rehabilitation medicine for physical therapy. The following photograph is 3 months later after operation (Fig. 5).

DISCUSSION

The term “necrotizing fasciitis” was first coined in 1871 by Joseph Jones, a former Confederate Army surgeon. NF is a severe life-threatening soft tissue infection characterized by rapidly spreading inflammation and necrosis of the skin, subcutaneous tissue, and fascia. The reported incidence of NF is 0.40 cases per 100,000 population. Although NF is uncommon, its mortality rate is high; reported mortality rates vary from 6 to 76%, but have been approximately 25% lower in recent studies owing to early aggressive management. Fortunately, this condition especially caused by a burn is rare in South Korea, with no reported cases until now. Although NF is most commonly associated with mixed bacterial infections, group A streptococcal species, called the “flesh-eating bacteria” in the media, are solely responsible in 10∼15% of cases.

In our study, we took anaerobic and aerobic cultures at surgery, but no organism was identified. The etiology of NF is still not fully understood, because no identifiable cause has been found in many cases. In most cases, NF follows trauma such as a burn, laceration, scratch, insect bite, or needle stick. An immunocompromised state such as that due to diabetes mellitus, HIV, alcohol or intravenous drug abuse, malignancy, chronic liver disease, and postsurgical situations is the greatest risk factor for NF. The extremities are the most commonly affected area, but the abdominal wall, chest wall, and perineum can also be involved, depending on the initial site of trauma and the extent of the infection.

A lack of obvious clinical signs and symptoms and a clinical picture similar to cellulitis during the initial course of NF make early diagnosis difficult. “Clinical pearls” or clues to the diagnosis of NF classically include severe pain out of proportion to physical examination findings, marked tissue edema, crepitus, ecchymosis, non-hemorrhagic and hemorrhagic bullous skin changes, rapidly progressive erythema, high fever, tachycardia, and hypotension. Laboratory findings such as leukocytosis and hyponatremia are common, and lactic acidosis, uremia, coagulopathies, and hypoalbuminemia have been associated with NF. Anemia and hyperbilirubinemia may also occur as a result of the hemolytic action of the bacteria. In our case, the WBC count was decreased to 460/mm³. Tsai et al. found that patients with leukopenia (WBC, ≤5,200/mm³) had a significantly higher mortality rate than those with leukocytosis. Radiographs can be helpful in diagnosing NF. Computed tomography (CT) is more accurate than plain radiographs for detecting soft-tissue gas, and CT is helpful for determining the extent of surgery required. Although magnetic resonance imaging (MRI) can also show good tissue contrast and soft-tissue fluid, MRI is not cost-effective as compared with CT. Thus, CT is the best modality for diagnosing NF. Once suspected, treatment involves immediate fluid resuscitation, early surgical debridement, and the administration of broad-spectrum intravenous antibiotics. Wound exploration shows grayish necrotic deep fascia to blunt finger dissection, lack of bleeding of the fascia, and the presence of foul-smelling “dishwater” pus. Usually, the muscle itself is not involved, although it can be in severe cases. In our case, the underlying muscle layer was dead, and a radical fasciectomy was performed. The aim of surgical debridement is to remove all infected tissue in a single operation. However, extensive surgical debridement results in large raw wound, putting patients, particularly those who are coagulopathic from sepsis, at risk for postoperative hemorrhage. In addition, immunocompromised patients are at risk for secondary infection. Wound care aims to minimize both of these risks, and meticulous
hemostasis is essential. Not all patients will recover with a single debridement. Immunocompromised patients with poor wound healing, such as patients with diabetes mellitus and renal failure, are particularly difficult to manage. In such patients, even with a successful initial debridement, secondary wound infection may occur because of poor healing and decreased tissue perfusion. Peripheral vasoconstriction caused by inotropic agents used to treat the hypotension associated with sepsis may compound this problem. Repeated debridement may be needed, but the treatment is generally supportive while waiting for the systemic conditions to improve. Amputation may be necessary in some cases. Repeated debridement will result in large raw wounds. For such defects, wound coverage is usually achieved using meshed split-thickness skin grafts, which provide effective wound closure with limited morbidity. Wound contracture and hypertrophic scarring can be problematic if occurring around a joint and may restrict the range of movement, with subsequent loss of function.(9) Recently, to reduce drawbacks both functional and cosmetic problem, vacuum-assisted wound closure can be used as adjunctive therapy for large and difficult wounds. Integra™ or AlloDerm™ such as dermal substitute also can be used for the purpose of achieving early wound coverage following excision of extensive full thickness burns. As these approaches can have built dermal layer, cosmetic and functional benefit have been demonstrated in the treatment of NF.(9)

Typically, triple antibiotic therapy, including a broad-spectrum penicillin, an aminoglycoside or vancomycin for the risk of methicillin-resistant Staphylococcus aureus, and either clindamycin or metronidazole, is used. In our case, we used teicoplanin, meropenem, and metronidazole. Other adjuvant therapies include hyperbaric oxygen and intravenous immunoglobulin.(7,10) Although no causative organism was identified in our case, we used intravenous immunoglobulin for 2 weeks due to the risk for group A streptococcal infection. Based on this case, NF can develop after even a small wound such as a contact burn. Physicians should always consider the possibility of NF after small wounds.

In conclusion, a surgeon should not perform debridement with the expectation of returning to find more necrotic tissue and repeat the process. Instead, the aim should be to remove all infected tissue in a single operation. The most important factors in the successful treatment of NF are early diagnosis, early aggressive surgical intervention, and a multidisciplinary team approach such as that at a burn center.

**REFERENCES**