Case report

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Necrotizing Fasciitis in a 7-day-old Term Healthy Neonate

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Necrotizing fasciitis is a rare, but life-threatening infection. Prompt diagnosis and early aggressive intervention is required for survival. However, there has been frequently occurred in delays of diagnosis and treatment due to its non-specific nature. Therefore, a high index of suspicion is needed to ensure timely intervention. We report a case of necrotizing fasciitis in a 7-day-old term healthy neonate.

Key Words: Necrotizing fasciitis, Newborn infant, Infection

Introduction

Necrotizing fasciitis (NF) is a life-threatening soft tissue infection which is characterized by rapid and fulminant progression. It predominantly affects immunosuppressed or diabetic adult patients and is extremely rare in neonates, but is often fatal. It has been reported in 0.08–0.1 per 100,000 children per year¹⁾ and the mortality rate is estimated at about 30–60% in neonates²⁾. Because early diagnosis with prompt aggressive surgical debridement and intensive care can improve the survival, early perception of the signs of NF is important.

We present our experience with upper arm necrotizing fasciitis in a 7-day-old term healthy neonate.

Case report

A 7-day-old boy presented to Haeundae Paik Hospital with a 4-hour history of fever and irritability along with

swelling and redness of the right upper arm. He was born at term via normal vaginal delivery and has been staying at the post-natal care center. He was an otherwise healthy, breast-fed infant with no known ill contacts and no wound or intervention including BCG vaccination on his upper arm. From four hours prior to arrival at our hospital, he was irritable, fed somewhat poorly and the nurse at the post-natal care center noted rapidly spreading redness and swelling originating from the right upper arm.

On admission to our neonatal intensive care unit, the patient's heart rate exceeded 180 beats/min and respiratory rate was 48 breaths/min. His blood pressure was 65/40 mmHg and core temperature was 38.7°C. On physical examination, he was irritable and mottled. Erythema with light purplish discoloration and swelling extended from the shoulder joint to the elbow joint of the right upper arm. Blood was drawn for laboratory test and culture study, and then intravenous antibiotics therapy was initiated with vancomycin and cefotaxime following the diagnosis of

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acute cellulitis. A complete blood cell count with differential revealed a white blood cell count of $12,800/\text{mm}^3$, with 58.3% polymorphonuclear leukocytes, 12.3% band forms, 25.2% lymphocytes. The hematocrit was 40.6% and the platelet count was $162,000/\text{mm}^3$. The C-reactive protein (CRP) level was 4.87 mg/dL. Blood culture later came back negative.

Upper extremity magnetic resonance imaging (MRI) was done considering the possibility of deeper skin infection such as NF. MRI revealed subcutaneous fluid collection and inflammatory thickening along the fascia of the upper arm and shoulder (Fig. 1). During the processing of the MRI work up, the discoloration of the skin has already extended to the distal part of upper extremity. Within 8 hours of the patient's admission, he was taken to the operating room for debridement with a presumptive diagnosis of NF. Intraoperatively, a considerable amount of pus and fluid was noted between the subcutaneous tissue and the fascia of the upper arm. Histology of tissue specimens obtained from surgery was consistent with necrotizing fasciitis. Debridement of the involved subcutaneous tissue and fascia with primary skin suture was done. Culture of the pus obtained during surgery revealed *Staphylococcus aureus*, which was susceptible to vancomycin, clindamycin,

gentamicin, teicoplanin and linezolid but resistant to penicillin and oxacillin. After identification of the causative organism from the culture study of pus, cefotaxime was discontinued. On the 10th day after the first operation, a second operation was done to repair a wound dehiscence. He completed a 4-week intravenous antibiotic treatment course with vancomycin, recovered well and was eventually discharged from the hospital.

Discussion

Necrotizing fasciitis is a fulminant soft tissue infection involving the subcutaneous tissue and superficial fascia. It is extremely rare in neonates with only few cases reported in the literature. The incidence has increased during recent decades. Although the exact reason for this is not yet known, increased microbial virulence and resistance because of excessive use of antibiotics is currently the most acceptable explanation. Although NF remains rare, it is a highly fatal condition requiring early aggressive intervention including surgical debridement.

The initiating factors for NF include trauma, surgical wounds and varicella lesions. According to case reports, even a minor rectal mucosal injury which is induced by rectal temperature measurements can lead to extensive NF³⁾. In newborns, omphalitis, circumcision and placement of electrodes for monitoring of vital signs have been reported, whereas intramuscular injection sites were the most common initiating factor. However, over half of patients had no specific identifiable inciting event⁴⁾. And moreover, it can be affected in previously healthy and non immune-compromised host like as our case.

NF is classified as polymicrobial and monomicrobial depending on the number of or type of the causative microbial agent. Polymicrobial NF results from the combination of gram-positive cocci, gram-negative rods and anaerobes. Less commonly, bacterioides or clostridium can be the causative agent. This polymicrobial infection tends to occur in perineal area and trunk and is often diagnosed in immunocompromised or high risk patients such as di-

Fig. 1. T1-weighted images show enhancement along thickened fascial planes of right shoulder and arm. Diffuse edema and reticular enhancement is seen in subcutaneous layer. There is no evidence of gas bubble on magnetic resonance images.

abetics, patients with peripheral vascular disease, obesity and chronic renal failure. The monomicrobial NF is mainly caused by group A streptococcus either alone or in association with *S. aureus*. This monomicrobial type is far less common than polymicrobial infection and tends to occur in otherwise healthy, young, immunocompetent hosts and is often located in the extremities. In neonates, NF is usually a monomicrobial infection most commonly due to *Streptococcus pyogenes*, *S. aureus*, *Pseudomonas*, *Escherichia coli*⁵⁾. In particular, NF caused by community-acquired methicillin (MRSA) has risen in recent years⁶⁾. This tendency of clinical findings of NF is consistent with our case. The baby in our case was relative previous healthy full term neonate, so we did not test the immune function of him. And the organism was identified as MRSA and the affection site was extremity.

Common clinical symptoms associated with NF are fever, pain and irritability. The initial skin presentations are erythema, edema and indurations. Some might have a history of trauma or break on the overlying skin within 48 hours before the onset of symptoms, but the classic history can be seen in only 10–40% of all patients⁷⁾. Localized erythema and swelling with pain are the most common presenting signs of NF. Systemic symptoms and signs including high fever, anxiety, altered mental status, leukocytosis, hypotension, tachycardia and eventually shock are observed as a consequence of the toxic processes exerted by exotoxins and inflammatory cytokines. However, these symptoms and signs are not unique to NF. As noted previously, the skin may appear normal in the early stages of the disease because the infection can track subcutaneously⁸⁾. Delays in treatment owing to misdiagnosis of a minor superficial skin infection in many cases have occurred. According to previous reports, only about 15% of patients were properly treated with the correct diagnosis at presentation and the remainder was misdiagnosed as cellulitis or simple abscesses. Even though, it was unclear if the initial diagnosis of cellulitis was, in fact, correct and the cellulitis progressed to a NF, clinicians should have a high index of suspicion and should consider

the possibility of a deeper soft tissue infection in cases with seemingly less serious condition⁹⁾.

Laboratory studies should be performed in NF patients. Leukocytosis with left shift or toxic granules on peripheral blood smear and rising of CRP and erythrocyte sedimentation rate are commonly observed findings in NF. But, these findings are also commonly detected in other infectious diseases. Meltem et al described growth of the causative organism in peripheral blood culture in 70% of cases in their retrospective study¹⁰⁾. Radiologic evaluations are conducted to determine the presence of NF. Unfortunately, there are no powerful and well-designed radiologic studies to confirm the presence of NF. Plain X-ray can reveal subcutaneous gas or soft tissue swelling and ultrasonography can detect superficial skin abscess¹¹⁾. However, these findings cannot reliably diagnose a NF due to their low sensitivity and specificity. CT scan is more sensitive in showing edema and thickening of the fascia or abscess formation, in addition to gas formation¹²⁾. MRI has more high sensitivity up to 90–100%, but has only 50–85% specificity for detecting NF. Characteristic findings of NF in MRI include soft tissue and fascial thickening on T2-weighted images and the more specific findings of NF include hyperintense signal on T2-weighted images at the deep fascia and within muscles and peripheral enhancement on contrast-enhanced T1-weighted images. However, MRI imaging work up is often hesitated to carry out for critically ill or unstable infants due to long time demanding test, so frequently results in delay in diagnosis and treatment, and so CT scan is more universally available. Even with all these efforts made to promptly diagnose NF, which include physical finding, laboratory and radiologic work up, good results have been limited due to NF's non specific nature. The gold standard method for diagnosing NF is operative exploration. Operative findings consistent with the diagnosis of NF include "dishwater" or foul-smelling pus-like discharge and necrosis and loss of the normal resistance of the fascia to finger dissection.

Conservative treatment with intravenous antibiotics should be initiated with the possibility of NF and critical care

is needed to support the NF patients in overcoming the systemic toxic process. However, early and extensive surgical debridement is the mainstay for successful treatment^{13, 14)}. Because the affected site is thrombogenic in nature and medications are unable to penetrate the infected necrotic tissues, surgical approach should be done to adequately treat NF¹⁵⁾. Numerous studies have shown that the most important factor of mortality in NF patients is the timing and adequacy of initial debridement. We cannot stress enough the need for early and complete debridement in NF^{16, 17)}. In general, the boundaries of excision are at least as wide as the rim of cellulitis, in cases where the covering skin changes are evident. However, in many cases, the extent of debridement is larger than the area of surface change, because subcutaneous infection and necrosis is usually much larger than what is appreciated on physical examination. Recurrent surgical debridement and reconstruction of skin defects with split-thickness skin graft are frequently needed in NF patients. Beside the surgical approach, antibiotic therapy is important to control systemic sepsis. Empiric regimen using high-dose penicillin and clindamycin was recommended as the first line therapy to cover gram positive and anaerobes in the past. However, the emergence of resistant microbes has changed the choice of antibiotics. Vancomycin, linezolid is currently recommended for empiric therapeutic agent due to concerns over possible MRSA infection. The optimum duration of antibiotic therapy is not yet determined, but should last at least 14 days. Up to the present, although there has a lot of controversial issues, IV gamma-globulin therapy has offered some benefits in the treatment of NF in some clinical trials¹⁸⁾.

It has been well described that the time to surgical intervention is the most important determinant of mortality in NF patients. Old age and diabetes mellitus can also affect on mortality in adults. In children, the clinical status on admission is considered as prognostic factor to predict the mortality. Nosocomial infection is the most common complication in NF.

In conclusion, necrotizing fasciitis is extremely rare, but

highly lethal disease. A high index of suspicion is needed to ensure timely intervention with appropriate antibiotics therapy and early complete surgical debridement. Even if optimal care is practiced, infants with NF frequently suffer from substantial morbidity and require reconstruction and eventually, a course of rehabilitation.

한글요약

괴사성 근막염은 급격히 진행되는 심부 연 조직 감염으로 주로 면역 저하나 당뇨를 앓고 있는 성인에서 발병하나 드물게 신생아에서도 생길 수 있으며, 감염 초기에 괴사 조직을 제거하는 수술을 포함한 적절한 치료가 이루어지지 않으면 사망에 이르는 매우 위험한 질환이다. 그러나 증상과 이학적 소견이 비특이적이고 매우 드물게 발생하므로 때로는 진단과 치료가 늦어지기도 한다. 그러므로, 피부 또는 피하 조직 감염 소견을 보이는 모든 환아에게서 항상 심부 조직 감염의 가능성을 염두에 두고 진단적, 치료적 접근이 이루어져야 하겠다. 저자는 생후 7일째 인 건강한 만삭 신생아에서 특별한 선행 요인 없이 지역 획득 메티실린 내성 황색포도상 구균에 의해 발생한 괴사성 근막염을 경험하였기에 보고하는 바이다.

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