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Necrotizing Fasciitis: a Clinical Case and a Review of the Literature

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Abstract

Necrotizing fasciitis is a soft tissue, life-threatening infection with a fulminant and often fatal course. Early diagnosis is usually delayed as the onset of the disease is often masked in the form of erysipelas or cellulite. The condition is characterized by necrosis of the skin, subcutaneous tissue and underlying fascia. We describe a case of a 42-year-old man with a complaint of erythema, fever and severe pain in his right leg 4 days before hospitalization. The patient was admitted and treated with a diagnosis of erysipelas. A few hours after admission, in connection with a drastic deterioration in the general condition and dermatological status, he was transferred to a purulent-septic ward with a fulminant picture of necrotizing fasciitis. Debridement and fasciotomy were performed successfully and timely. Good prognosis and survival in patients with NF correlate directly with the complex of measures. Appropriate antibiotics and intensive general support avoid massive systemic diffusion. Early and adequate surgical debridement and fasciotomy are associated with improved survival.

Key words: Fasciitis, Necrotizing; Soft Tissue Infections; Diagnosis; Signs and Symptoms; Debridement; Fasciotomy; Treatment Outcome; Antibacterial Agents

Introduction

Necrotizing fasciitis (NF) is an aggressive infection of the skin and soft tissues (SSTI) (1). It is also known as "flesh-eating disease" as it results in necrosis of muscle fascia and subcutaneous tissue (1, 2). The condition is life-threatening with a high mortality rate of nearly 70% (3). It most often affects the limbs, perineum and genitals (Fournier gangrene), and less often the chest or abdomen (2). No age or gender predilection has been observed (2). It is caused by toxin-producing, virulent bacteria (2, 3). NF usually progresses rapidly, within hours, and it is often associated with severe systemic toxicity to sepsis (4). The high death rate in patients with NF requires immediate assessment, antibiotic treatment, and surgical intervention (5, 6).

Case Report

A 42-year-old man was admitted to the University Clinic of Dermatology and Venereology complaining of severe pain in the area of the toes of the right foot. The complaints date back to four days before the admission with the appearance of fever, redness and difficulty in movement of the affected limb. Having been examined by a surgeon, the patient was given the treatment with oral antibiotic, compresses with ethacridine lactate, alcohol and ice was applied - without a satisfactory effect. Gradual deterioration occurred with increasing temperature and progressive redness of the foot and right lower leg. The patient was admitted in an impaired general condition and temperature of 37-37.5°C. He was hospitalized with the suspicion of erysip-

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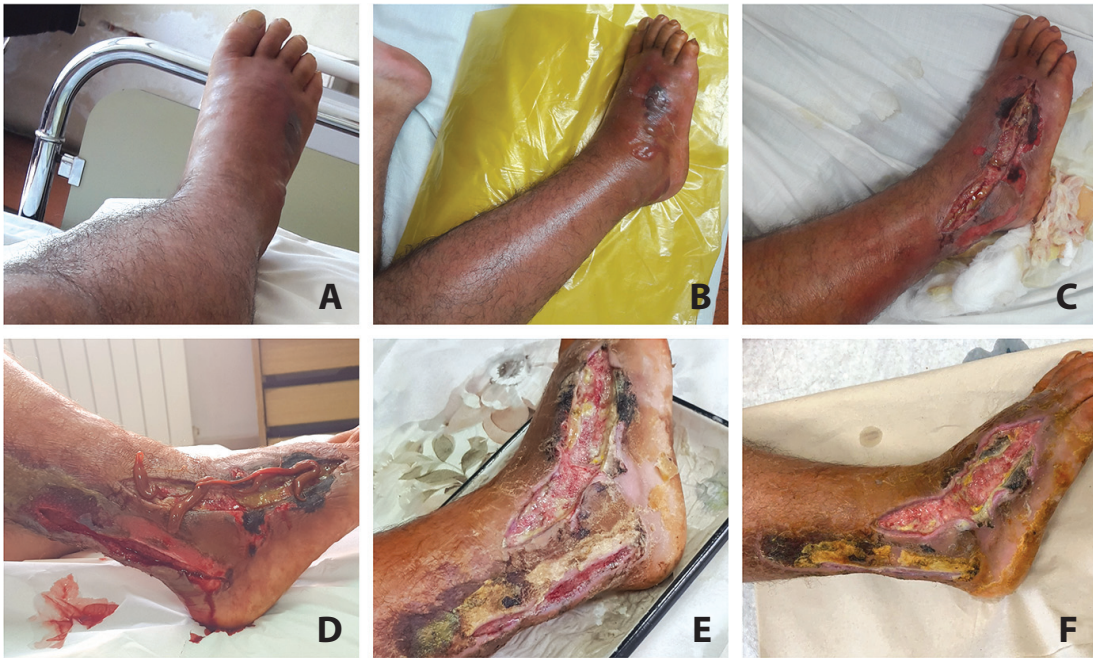

Figure 1. (A) Initial picture: tense hemorrhagic bulla on a shiny swollen erythemo-infiltrative plaque. **(B)** A necrotic area is established on the back of the right foot as the edema extends beyond the boundaries of the erythematous zones. **(C)** 12 hours after admission to the surgical ward: hyperemia of the right lower leg, extensive necrotic fields on the back of the foot and purulent exudate in the area of the right talocrural joint. **(D–F)** Postoperative status after fasciotomy and initial epithelialization of the wound

elas. The initial examination of the right limb revealed a tense hemorrhagic bulla, on a shiny swollen erythematous-infiltrative plaque and an increased local temperature **(Figure 1a).** Slightly enlarged inguinal lymph nodes on the right were found.

Initial blood investigation revealed C-reactive protein (CRP) 456 mg/dL, white blood cell count (WBC) 18.2 per mm^3, Hgb 126 g/dL, Serum sodium 140 mmol/L, Serum creatinine 82 μmol/l, Serum glucose 11 mmol/L.

The microbiological examination of the culture content, after rupture of the bulla, revealed Gram (+) group B streptococci. No anaerobic microorganisms were detected. The patient was initiated on dual systemic antibiotic therapy with Ceftriaxone 3 g/daily i.v. and Gentamicin 2x80 mg/daily i.v. Topical therapy included fusidic acid cream and compresses with potassium permanganate. Water-salt rehydration was performed with a bank of saline.

Within a few hours after hospitalization, the patient's condition deteriorated and he developed an acute inflammatory reaction with rapid breathing, fever - 38.8°C, erythema along the lymph vessels and complaints of pain in the right inguinal fold. A necrotic area appeared on the back of the right foot, as the edema extended beyond the boundaries of the erythematous areas **(Figure 1b)**.

On the second day of hospitalization in the dermatology ward, the patient was discharged and transferred to the clinic of purulent-septic surgery with suspicion for necrotizing fasciitis. Within 12 hours after admission to the surgical ward, hyperemia of the right lower leg, extensive necrotic fields on the back of the foot and purulent exudate in the area of the right talocrural joint were observed **(Figure 1c)**. The therapy was modified by infusion of Amoxicillin/clavulanic acid 3 x 1.2 g /i.v., Penicillin 4x5 million UI /i.v., NaCl solution 0.9%. Anticoagulant therapy with enoxaparin sodium 0.6/s.c. and analgesia with Dexketoprofen 1 amp./i.v. was initiated. Under general anesthesia, an incision of the skin and subcutaneous tissue was performed, as well as a fasciotomy on the dorsal part of the right foot and the lateral part of the right lower leg

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with evacuation of a large amount of purulent exudate. The wound was treated with oxygenated water, a gauze tamponade was made with brown salt and a sterile dressing. On the 5th postoperative day, the patient was discharged from hospital in good general condition with guidelines for daily cleaning of the wound by a surgeon until its full epithelization **(Figure 1d-1f).**

Discussion

Necrotizing fasciitis belongs to the group of the so-called Necrotizing soft tissue infections (NSTIs). It was first described in the 5th century by Hippocrates as a complication of acute streptococcal infection (3). The term NF was first introduced by Wilson 1952, and it is still used (7).

Although rare, this disease is often a fatal soft tissue infection due to rapidly progressing necrosis of subcutaneous fat and fascia (8). The incidence for Western Europe is 1 case per 100,000 inhabitants and mainly affects adult patients (3). For ages over 80 incidence increases progressively, reaching 12 per 100,000 (3).

The main risk groups include immunocompromised patients, patients with diabetes mellitus, underlying malignancy, kidney impairment, obesity, malnutrition, peripheral vascular disease, alcohol use, and varicella infections (for pediatric patients) (5). Caution is given to groups of patients taking nonsteroidal anti-inflammatory drugs (NSAIDs) (2, 5). NSAIDs may suppress any signs and symptoms of inflammation and may be associated with a worsened clinical course leading to alterations in the immune response (2, 5). Animal and insect bites (honey bee sting) are considered to be predisposing factors (9, 10), as well as childbirth, burns, soft tissue infections, minor invasive procedures, traumatic injury, visceral-cutaneous fistulas, percutaneous catheter insertion, and gastrointestinal perforation (5). Fournier gangrene or NSTIs of the perineum and genitalia can occur due to trauma, urinary tract infections or stones, Bartholin's gland abscesses, and surgery or other instrumentation (2).

First described by Giuliano et al., the classification divides Necrotizing fasciitis into three types according to bacteriologic classes (11).

Type I NSTIs

Type I infections are classically polymicrobial (2). They are the most common subtype (55–80%) and are usually a mixture of aerobic and anaerobic organisms (2, 3). The main causative agents in this group are:

– Gram-positive cocci, such as *S. aureus, S. pyogenes, and Enterococci;*

– Gram-negative rods such as *E. coli and P. Aeruginosa*;

– Anaerobes like *Bacteroides or Clostridium species - Clostridium perfringens, C. septicum, and C. Sordellii, Proteus, Klebsiella, Peptostreptococcus*

Type I predominantly affects the trunk and the perineum (2). The main risk groups are older immunocompromised patients, with more medical comorbidities such as diabetes, chronic renal failure and others. Usually, there is no evidence of previous trauma in this subtype.

Type II NSTIs

Type II (20% of cases) is a monomicrobial infection or also called group A β-hemolytic streptococci (GAS) necrotizing fasciitis (8). The most common location is the limbs. It can also be combined with infection from staphylococcal species. The predominant group is healthy young immunocompetent hosts, with a history of recent trauma, surgery, or IV drug-abuse (12). GAS infections have a high potential for aggressive local spread, including toxic shock syndrome (13).

Type III NSTIs

The infections caused by Vibrio species (*V. vulnificus*). It occurs along warm-water coastal regions in the southeastern United States, Central and South America, and Asia. Infection can occur via exposure through an open wound or other break in the skin (contact with seawater) or via ingestion of raw seafood (Aeromonas, a bacterium found in fresh and brackish water) (5, 14). *Vibrio vulnificus* is a fatal, rapidly progressive soft-tissue infection with early evidence of significant systemic toxicity (14). All age groups are affected, and multisystem organ failure and cardiovascular collapse without any localized cutaneous evidence of infection may be observed (2).

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Some authors have described ***type IV of NF***, caused by fungal pathogens, such as *Candida albicans* (15). Eleven cases of Candida species necrotizing fasciitis have been described, as the major risk factors include trauma, gunshot wounds, diabetes and immunocompromised individuals (15).

Clinical Presentation

Early signs and symptoms of NSTI often mislead to a diagnosis since they resemble cellulites, abscesses or erysipelas (2). NF is divided into two main clinical subtypes - hyperacute and sub-acute variants (16). Initial complaints include intense pain, erythema, swelling, and fever (4, 5). Necrotizing fasciitis typically presents without a defined margin or lymphangitis (12). There is a fast progression to tense edema, grayish-brown discharge, and vesicles (3, 17). Several "hard" clinical signs are more suggestive of NSTI: (1) the presence of bullae, (2) skin ecchymosis that precedes skin necrosis, (3) presence of gas in the tissues by examination or radiographic evaluation, and (4) cutaneous anesthesia (1–3). Hemorrhagic bullae and crepitus are a sign of underlying fascia and muscle being compromised (18). Crepitus is a later sign, very specific, but found in only 13–31% of patients (3, 19). Less specific clinical signs are pain out of proportion to examination, edema that extends beyond the skin erythema, systemic toxicity, and progression of infection despite antibiotic therapy (4, 12). Hyperacute course presents with sepsis and rapidly progresses to multiorgan failure (12). Complaint of pain range from severe to decreased pain or anesthesia in some group of patients, notably those with diabetic neuropathy (12, 17).

Evaluation

The Laboratory Risk Indicator for Necrotizing Infection (LRINEC) Score is the most common system for assessing the severity of necrotizing fasciitis that was proposed in 2004 by Wong et al. (20). Even clinically early cases of necrotizing fasciitis can be distinguished through it (20). It evaluates abnormalities in six independent variables: C-reactive protein, mg/L, Total white cell count (WBC), cells/mm, Hemoglobin, g/dl, Sodium, mmol/L, Creatinine, mg/dL, Glucose, mg/dL (1). According to Wall and colleagues, white blood cell (WBC) count <15,000 cells/mm^3 and a serum sodium level greater than 135 mmol/L have about 99% negative predictive value, and a 90% sensitivity for detecting NSTIs (21). It should be noted, however, that author teams noted that many other conditions could cause similar laboratory derangements (2).

Histological criteria for diagnosing NF are: 1) extensive superficial fascial necrosis; 2) aggregates of neutrophils; 3) fibrin thrombi with fibrinoid necrosis of arterial and venous walls; 4) clusters of various types of microorganisms within the destroyed fascia and dermis (1, 3).

Plain radiography, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) may be used as diagnostic adjunct.

Treatment

The treatment for NSTI involves different therapeutic modalities (13, 22–25):

– Resuscitation of the patient in shock

– Early and complete debridement and fasciotomy of the necrotic tissue is essential for the treatment of NSTI; debridements should be repeated every 24 to 48 hours until the infection is controlled

– Appropriate broad-spectrum antibiotic coverage (Linezolid, Aminogliycosides, Cephalosporins, Piperacillin/Tazobactam, Clindamycin, Penicillin G, Vancomycin, and Gentamicin, fluoroquinolones – instead of Gentamicin to avoid the nephrotoxicity of aminoglycosides); widely used regimen is the combination of Penicillin G, Clindamycin and Gentamicin

– Hyperbaric oxygen (HBO) therapy - the assumptions are that elevated oxygen levels reduce edema, stimulate fibroblast growth, and increase the killing ability of leukocytes

– Intravenous immunoglobulin (IVIG) therapy - based on the idea that it leads to a limitation of the systemic inflammatory response

– Reconstruction of skin defects either on the extremities and torso, or on the abdominal or chest wall; novel concepts of layer-specific reconstruction include biologic meshes

Mortality in patients with NSTI remains high. Patients with necrotizing fasciitis are at risk for a variety of complications: multiorgan failure, compartment syndrome, acute respiratory distress syndrome, septic shock, toxic shock syndrome, loss of extremity, severe scarring, disseminated intravascular coagula-

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tion, rapid advancement of disease resulting in death (26). Early diagnosis and extensive surgical debridement of affected tissue performed within 24 hours are associated with a lower mortality (27).

Abbreviations

NF – necrotizing fasciitis
SSTI – skin and soft tissues
CRP – C-reactive protein
NSTI – necrotizing soft tissue infection
NSAID – nonsteroidal anti-inflammatory drug
GAS – group A β-hemolytic streptococci
LRINEC– Risk Indicator for Necrotizing Infection
WBC – white cell count
CT – computed tomography
MRI – magnetic resonance imaging
HBO – hyperbaric oxygen

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Nekrotizirajući fasciitis – klinički slučaj i pregled literature

Sažetak

Nekrotizirajući fasciitis je infekcija mekog tkiva, opasna po život, sa fulminantnim i često fatalnim tokom. Rano dijagnostikovanje se obično odlaže, jer se početak bolesti često maskira u obliku erizipela ili celulita. Stanje karakteriše nekroza kože, potkožnog tkiva i osnovne fascije. Opisujemo slučaj 42-godišnjaka koji se žalio na eritem, temperaturu i jake bolove u desnoj nozi četiri dana pre hospitalizacije. Pacijent je primljen i lečen pod dijagnozom erizipela. Nekoliko sati nakon prijema, zbog drastičnog pogoršanja opšteg stanja i dermatološkog statusa, prebačen je na infektivno odeljenje sa fulminantnom slikom nekrotizujućeg fasciitisa. Uspešno i blagovremeno su izvedeni debridman i fasciotomija. Dobra prognoza i preživljavanje kod pacijenata sa nekrotizirajućim fasciitisom direktno koreliraju sa kompleksnim terapijskim merama. Odgovarajući antibiotici i intenzivna opšta podrška sprečavaju masovnu sistemsku difuziju. Rano i adekvatno hirurško određivanje i fasciotomija povezani su sa poboljšanim preživljavanjem.

Ključne reči: Nekrotizirajući fascitis; Infekcije mekih tkiva; Dijagnoza; Znaci i simptomi; Hirurški debridman; Fasciotomija; Ishod terapije; Antibakterijski lekovi

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