



Necrotizing Fasciitis

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Learning Objectives

- Maintain a high level of suspicion of complicated soft tissue infection.
- Early initiation of empirical broad-spectrum antibiotic therapy.
- Request urgent surgical consultation, ideally by the Traumatology Team.
- Perform an urgent imaging test, ideally a soft tissue CT scan.

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4.1 Introduction

Necrotizing soft-tissue infections (NSTIs) are infrequent but associated with a high mortality grade. An accurate diagnosis is difficult in the early stages, and a high level of suspicion is required. The pillar of the treatment is early surgical debridement backed up by empirical broad-spectrum antibiotic therapy. Management in an Intensive Care Unit is recommended because of the high risk of organ failure as well as physiologic support with aggressive fluid resuscitation, nutritional support, and septic shock management.

Necrotizing infections can be divided into three groups according to the affected area: cellulitis (skin and subcutaneous fat); fasciitis (involvement of the superficial fascia with or without the involvement of the deep fascia – being the most frequently diagnosed), and myositis with injury at the muscular level. They can also be classified according to the bacteria causing the disease. The three entities can have a mono-microbial or polymicrobial cause, with *Streptococcus pyogenes* being the most frequent bacteria isolated in the case of monomicrobial involvement. Another way of characterizing necrotizing infections is by the presence or absence of an entry point.

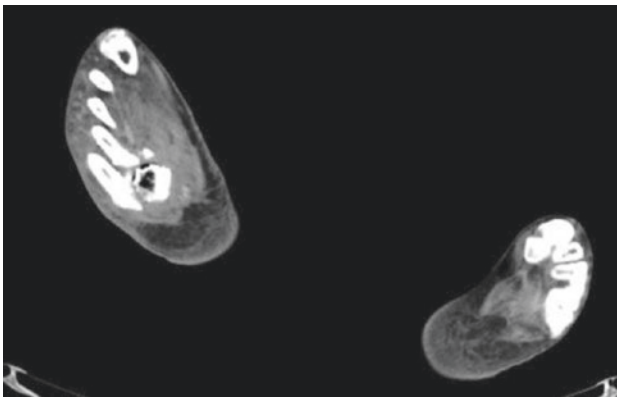
Regardless of the affectation level (cellulitis, fasciitis or myositis, or all), the appearance of necrotizing tissue is due to the presence of microthrombi at the capillary level induced by bacterial exotoxins and by the surrounding inflammation, giving rise to the appearance of skin bullae and necrotic ulcers.

Case Presentation

A 45-year-old male came to the Emergency Department due to general malaise along with pain, inflammation, and functional impotence of the right leg secondary to a deep wound at the sole of the right foot, with approximately three months of evolution ( Fig. 4.1). No personal disease history was found. Vital signs: Blood pressure 100/50 mmHg, heart rate 103 bpm, respiratory rate 20 bpm, oxygen saturation 100%, and temperature of 38.5 °C.



■ Fig. 4.1 Right foot with clinical signs of soft tissue infection



■ Fig. 4.2 CT scan of the lower limbs with the presence of a right foot ulcer of approximately 3 cm deep with intraosseous gas

4.2 Investigations

We performed the following tests: blood count and coagulation within normal range, lactic acid 6.7 mmol/L, pH 7.28, bicarbonate 18 mmol/L, creatinine 1.26 mg/dL, creatinine phosphokinase 192 UI/L, Na 123 mEq/L, K 5.3 mEq/L, C-reactive protein 386 mg/L, and procalcitonin 7.07 ng/mL. CT scan: right foot ulcer of approximately 3 cm deep with the presence of intraosseous gas, abundant gas in the superficial and deep layers is compatible with necrotizing fasciitis, presence of gas from the foot to the gluteus (■ Fig. 4.2). Microbiological cultures: soft tissue culture positive for *Streptococcus agalactiae*, *Streptococcus oralis*, *Proteus Houseri*, *Peptostreptococcus Anaerobius*, and *Prevotella bivia* with blood cultures negatives (■ Table 4.1).

Table 4.1 Results of antibiogram culture sample of soft tissue

Antibiotics	(1)	(2)	(3)	(4)
Ampicillin	Sensitive			
Gentamycin				
Erythromycin	Sensitive			
Tetracycline				
Moxifloxacin				
Clindamycin	Sensitive			
Rifampicin				

Streptococcus agalactiae (Group B) (1)

Proteus hauseri (2)

Peptostreptococcus anaerobius (3)

Streptococcus oralis (4)

4.3 Differential Diagnosis

First, a differential diagnosis should be made among necrotizing cellulitis, necrotizing fasciitis, and necrotizing myositis. This can be difficult only with a clinical approach and the diagnosis often is set in the operating room.

Other diagnoses should be considered like gas gangrene or toxic shock syndrome.

4.4 Treatment

Our treatment was based on three major blocks. First, we initiated physiologic support with intensive intravenous fluid therapy, noradrenalin to maintain a MAP around 65 mmHg with the amendment that high blood pressure could worsen the peripheral ischemia, and shock corticoid therapy due to the high dose of vasopressor. Simultaneously, we started the empiric antibiotic therapy with Peperacilin-Tazobactam and Clindamycin. Third, we immediately asked for our Traumatology Team's assessment due to a clear indication of urgent surgical treatment backup by a high Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score. As soon as the patient was hemodynamic and respiratory stable, he was transferred to the operating room where a right supracondylar amputation was made (■ Figs. 4.3, 4.4, 4.5, and 4.6).

■ **Fig. 4.3** Lateral view of the right foot with the presence of necrotizing tissue

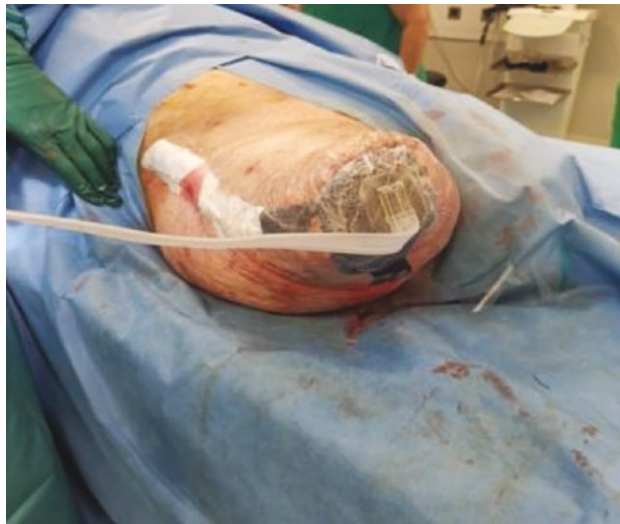


■ **Fig. 4.4** View after urgent supracondylar amputation





■ Fig. 4.5 Surgical reexamination of the injury due to persistent fever. Surgical debridement was performed



■ Fig. 4.6 Vacuum-Assisted Closure (VAC) therapy was applied to help the healing process

4.5 Evolution, Outcome, and Follow-up

Despite the broad-spectrum antibiotic that was changed to Meropenem, Vancomycin, and Clindamycin, the main problem was a prolonged high fever with negative blood cultures and eventually negative tissue cultures. After 44 days of ICU admission, the patient was transferred to a standard care hospital room and eventually was discharged with a modern prosthesis.

4.6 Discussion

Necrotizing fasciitis (NF) is a part of necrotizing soft tissue infections (NSTIs) with a low incidence, but potentially life-threatening and with a high disabling risk. The beginning of the disease can be misleading, and a high grade of suspicion is necessary to establish the diagnosis of NF and appropriate treatment, often in the Intensive Care Unit (ICU) due to the need to prioritize time intervention, especially in patients with septic shock. Necrotizing infections can be divided into three groups according to the affected area: cellulitis (skin and subcutaneous fat); fasciitis (involvement of the superficial fascia with or without the involvement of the deep fascia – being the most frequently diagnosed); and myositis with injury at the muscular level. It can also be classified according to the bacteria causing the disease. The three entities can have a monomicrobial or polymicrobial cause, with *S. pyogenes* being the most frequent bacteria isolated in the case of monomicrobial involvement.

Laboratory findings are most often nonspecific and can and must be used to assess the gravity of organ dysfunction. The LRINEC score can be helpful to establish a prognosis and help with the decision of surgical intervention, but a low (<6) LRENEC score does not rule out the diagnosis of NF. Blood cultures are positive in approximately half of the patients, especially if necrotizing myositis is present. A radiographic exam with a CT scan is most often necessary to determine the extension of the injury but should not delay surgical intervention when crepitus or rapid progression is present.

Empirical broad-spectrum antibiotic therapy is needed. The most common antibiotic strategy is the combination between Piperacilin-Tazobactam or Meropenem with Vancomycin or Linezolid and Clindamycin for its antitoxin effects on *Streptococci* and *Staphylococci*. Hemodynamic instability is not rare and may require aggressive fluid therapy and vasopressors like noradrenaline. Capillary leak syndrome associated with streptococcal toxic shock syndrome may appear in which the intravenous immune globulin treatment can be considered. Nevertheless, the medical treatment has to be initiated as fast as possible so that surgical intervention can be performed for being the cornerstone of the treatment. Other treatments like hyperbaric oxygen therapy (HBOT) are not recommended in the latest guidelines because of the lack of evidence and the risk of delaying resuscitation and surgical debridement.

Necrotizing fasciitis as well as other NSTIs remains a diagnostic and therapeutic challenge. A multidisciplinary approach is needed as early treatment can reduce mortality.

Take-Home Messages

- Necrotizing fasciitis is a morbid entity with rapid evolution, high aggressiveness, and a poor prognosis.
- No investigation test can adequately replace diagnosis by surgical inspection.
- An aggressive surgical approach with multiple debridements to healthy tissue is the cornerstone.
- Empirical broad-spectrum antibiotic therapy with double coverage for *Streptococcus pyogenes*, methicillin-resistant *Staphylococcus aureus*, and anaerobic germs.
- Multidisciplinary management in the Intensive Care Unit.