

## Necrotizing Fasciitis: Flesh Eating Bacteria

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### Introduction

Necrotizing fasciitis (NecFasc) is a term for a severe soft tissue infection of the subcutaneous skin and muscle fascia. It is a rare but deadly infection with an estimated mortality of 25-35%. The severity of the illness stems from its aggressive spread along tissue planes via the blood-deprived fascia. The speed of disease progression coupled with the variety of presentations make this illness difficult to quickly diagnose. NecFasc can affect all parts of the body but most commonly occurs in the extremities and in the perineum/genitalia.<sup>1</sup>

Now, we say the term Nec Fas a lot, but Nec Fas is really just on a spectrum of other necrotizing soft tissue infections. Obviously you can have necrosis and severe infection of other areas like necrotizing myositis or necrotizing cellulitis right? So keep that in mind for the rest of this review.

NecFasc is divided into 2 categories: polymicrobial (type I) and monomicrobial infection (type II). Polymicrobial (type I) is caused by both aerobic and anaerobic bacteria. It typically occurs in older adults or in individuals with underlying comorbidities, especially diabetes mellitus.<sup>2</sup>

Monomicrobial (type II) is usually caused by Group A streptococcus or other beta-hemolytic streptococci. Type II NecFasc may occur in any age group and in individuals without any comorbidities.<sup>3</sup>

Two classic “subtypes” of NecFasc include:

- Fournier’s gangrene: perineal and genital infection caused by *E. coli*, *Klebsiella*, enterococci, or anaerobes.
- Head/neck necrotizing infection: caused classically by mouth anaerobes like Fusobacteria.

The classifications are not the most important for you to know in real life because you will usually start the same antibiotic regimen each time (see below). The key to avoiding devastating outcomes relies on accurate diagnosis and timely treatment, which includes NOT ONLY antibiotic therapy but usually surgical intervention. This review will focus on rapid recognition and understanding how to diagnose this scary condition more reliably.

### Risk Factors

The most common comorbidity for NecFasc is diabetes mellitus, which predisposes to necrotizing infections of the lower extremities, perineum, and head and neck region.<sup>4</sup> Other common risk factors for NecFasc include liver cirrhosis, alcoholism, hypertension, chronic renal insufficiency, and malignancy.<sup>1</sup>

Any recent surgery should get your attention as well. Even if the surgical site is clean. They were in a hospital setting, and hospitals are dirty with dangerous bacteria, so be cautious of dismissing soft tissue infections.

### Clinical Manifestations

The presentation of NecFasc is variable, but **early recognition is crucial**. NecFasc may be misdiagnosed as cellulitis up to ¾ of the time!<sup>5</sup>

Presentation is typically hours or days within the start of a skin infection, but even this is variable as patients can have smoldering infections that suddenly progress in a rapid way. The most common presenting signs and symptoms are:

- **Pain out of proportion to injury → earliest hallmark of necrotizing fasciitis**
- Erythema (without sharp, delineating margins)
- Edema extending beyond erythema
- Fever (102-105°F)
- Crepitus<sup>1</sup>

NecFasc progresses quickly, usually displaying changes in skin color—changing from red/purple to patches of blue/gray. Skin findings are due to vascular thrombosis and destruction of blood vessels. Sometimes no skin changes may be seen as the infection is more subtle and deep. Over the next three to five days, skin breakdown and gangrene can be seen.

Crepitus and bullae are frightening and are specific for necrotizing fasciitis, but not at all sensitive. These signs along with cutaneous anesthesia and gas formation, are seen less than 25% of the time.<sup>5</sup>

So what’s the lesson here? Do a complete skin exam on patients who either have an undifferentiated fever of unknown origin or they have surgical site pain. This is so critical. I always do a total skin exam on my altered mental status patients who are elderly from a nursing home. Many of these patients are high risk, and are rarely examined laying in bed for several days.

Shock is uncommon, less than 25% will be hypotensive with obvious septic criteria. Fever is only in ~75% of patients, again, its helpful but not absolute.

Laboratory findings are generally nonspecific and unreliable. Some common lab abnormalities include leukocytosis with left shift, metabolic acidosis, coagulopathy, hyponatremia, elevated inflammatory markers (e.g. CRP, ESR), and elevations in serum creatinine, lactate, CK, and AST/ALT. These lab studies are all quite nonspecific, and **no single lab component can diagnose NecFasc**. A rise in serum CK is suggestive of infection involving muscle or fascia, contrary to cellulitis.<sup>6</sup>

Even x-rays are not that helpful even though they are frequently ordered. The diagnostic yield of x-rays for subcutaneous gas is low (<25%).<sup>5</sup> Taking this one step further, CT is also disappointing. It has much better sensitivity than x-ray at picking up gas formation or deep fluid collections, but it lacks specificity.

There has been some discussion about bedside ultrasound identifying hyperechoic foci, but this is not realistic right now for the average emergency physician.

**Diagnosis**

Given that no single radiographic or laboratory test is reliable in predicting NecFasc, there has been a push to use decision-making tools. A commonly used tool to distinguish NecFasc from “just cellulitis” is the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score. Its sensitivity and specificity for NecFasc is 90% and 95%, respectively, for a LRINEC score >6. The LRINEC score takes CRP, WBC, Hgb, sodium, Cr, and glucose into consideration. **Despite this, approximately 10% of all patients with NecFasc still had it with a LRINEC score <6.**<sup>7</sup>

The LRINEC score is helpful to raise your suspicion, but if it's low, don't dismiss NecFasc! The score has *not* been validated, and even patients with a score of 0 may have it.

- Pain out of proportion
- Indistinct borders of infection
- Tenderness and swelling beyond erythema margin
- Infection progression despite antibiotics

Fever and tachycardia are the 2 most common vital sign abnormalities.

Surgical exploration is the only way to establish a diagnosis of NecFasc while determining the degree of involvement and allowing debridement of tissue. Surgery should never be delayed when the clinical suspicion is high. Aggressive debridement is performed until healthy viable (bleeding) tissue is reached. Typical surgical findings include soft tissue swelling and dull gray appearing fascia and “dish-washer” fluid drainage.<sup>9</sup>

**Management**

The gold standard for diagnosis is obviously surgical exploration, but early antibiotic therapy is essential in the ED while waiting for surgical evaluation. Antibiotic therapy should be started immediately after obtaining blood cultures. Hemodynamic instability requires IV fluids and vasopressors.

Acceptable antibiotic regimens:

- Carbapenem (imipenem, meropenem, ertapenem)

OR

- Piperacillin-tazobactam

**PLUS**

- Vancomycin or daptomycin (activity against MRSA)

**PLUS**

- Clindamycin (decreases toxin production caused by invasive group A strep)<sup>7</sup>

If you are worried about *Vibrio vulnificus* (any salt or brackish water exposure), add doxycycline.

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