

Necrotizing Fasciitis:

A diagnosis you can't miss

Daniel Schlatterer D. O.

Wellstar, Atlanta Medical Center

Atlanta, GA



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Objectives

You will learn:

- 1) what is necrotizing fasciitis and its clinical consequences
- 2) how to diagnose NF
- 3) how to treat NF

To achieve these objectives, you will review the:

- a) Clinical & radiographic findings
- b) Laboratory risk indicator for necrotizing fasciitis - LRINEC scale
- c) Surgical debridement
- d) Literature pearls, interesting facts

Let's start with a case example

You are called by the medical service to assess the leg of a 56-year-old male admitted for CHF.



No further clinical information is available.

A) What in the picture is consistent with NF?

B) If you suspect NF, what are your next steps?

Keep these questions in mind as you go through this presentation

Return to these questions before viewing the answer and discussion on the last slide

What is Necrotizing Fasciitis (NF)?

- NF is a rare but serious infection of the subcutaneous tissues and fascia of the skin
- Widespread fascial necrosis with relative sparing of skin and underlying muscle
- Caused by toxin-producing virulent bacteria
- May occur in any region of the body
 - the abdominal wall, perineum, and the extremities
- The causative bacteria thrive in low oxygen level regions
 - For example: blunt trauma areas, or post-surgical areas
- Often fatal unless promptly recognized and treated aggressively

Historical information - 1st Report

- First described by Fournier in 1832
 - Remarkable because the classic signs had not yet been established
 - Patients being very sick with “disproportionate” pain and only minor skin changes in the early phases
- Today, we are much better at recognizing sepsis and organ failure
 - More frequently have NF in our differential diagnosis for very sick patients with skin findings
 - Often skin findings are minor
 - Diagnosis is paramount to rapid, life saving intervention

Epidemiology

- Roughly 1-4/100,000 people
- Most orthopaedic departments in trauma centers treat 1-5/year
- An extremity can be involved at any location

Classification

- By Location
 - Fournier's: perineum
 - Ludwig's angina: floor of the mouth, under the tongue
- Based on Etiology
 - Type I-IV

Classification

- **Type I:** polymicrobial infection
 - most frequent (55–90%)
 - Affected patients are often immunodeficient and show comorbidities such as diabetes mellitus
- **Type II:** monomicrobial
 - Lancefeld group A-streptococcus (*Streptococcus pyogenes*) but often occurs in association with *Staphylococcus aureus* .
 - This type is not linked to certain comorbidities, portal of entry are skin lesions or injections (i.v. drug abuse or iatrogenic)
 - The progression can be fulminant with severe systemic toxicity, septic shock and multi-organ failure

Leiblein et al, 2018

Classification

- **Type III: monomicrobial**
 - clostridium species, Gram-negative bacteria or Vibrio spp. (Vibrio vulnificus)
 - fulminant progression with multi-organ failure within 24 h and high mortality
 - Mortality 35–44% with treatment
- **Type IV: Fungal**
 - most often with Candida spp. or zygomycetes

Leiblein et al, 2018

Vibrio vulnificus (VV) and necrotizing fasciitis

- Bacteria found in coastal waters
- People with open wounds may get infected by swimming in waters with VV leading to NF
- People can get infected by ingesting undercooked shellfish, or raw oysters. The symptoms of diarrhea, cramping fever, chills and vomiting appear within 24 hours and often subside within 3 days

Kuo et al, 2007

How does NF happen?

- Introduction of the pathogen into the subcutaneous space occurs via disruption of the overlying skin or by hematogenous spread from a distant site of infection
- Polymicrobial necrotizing fasciitis is usually caused by enteric pathogens, whereas monomicrobial necrotizing fasciitis is usually due to skin flora.

Green et al, 1996



Who gets Necrotizing Fasciitis ?

- Any patient can get NF
- More frequently occurs in
 - diabetics
 - alcoholics
 - immunosuppressed patients
 - IV drug users
 - patients with peripheral vascular disease,
- May also occur in young, healthy individuals

Atypical etiologies

- 1) Necrotizing fasciitis as a complication of botulinum toxin injection
Patient received botox for cosmetic reasons (Eye. January 1998)
- 2) Necrotizing fasciitis of the breast
(British Journal of Plastic Surgery. January 2001)
- 3) Necrotizing fasciitis and cellulitis after traditional Samoan tattoo
- 4) Necrotizing fasciitis in a patient receiving infliximab for rheumatoid arthritis
- 5) Necrotizing fasciitis following etanercept treatment for dermatomyositis
- 6) Treatment with any immune or disease modulating medication

What are the common sites for NF?

Can occur anywhere on the body

- Perineum (36%),
- Lower extremities (15.2%)
- Postoperative wounds (14.7%)
- Abdomen, oral cavity, and neck

Diagnosis: History

- Pain out of proportion to the visible findings
 - Relatively unresponsive to pain medications
- History of minor trauma, needle puncture or extravasation of drugs, an insect bite, scratch, or abrasion
- In many cases no identifiable cause can be found
- Symptoms may develop over a period of hours to several days

Diagnosis: Physical Examination

- Initially there may be only slight skin changes
 - An open wound or sore with surrounding erythema
- Progressive changes
 - Skin becomes increasingly tense and erythematous with indistinct margins.
 - Color can change from a red-purple to a dusky blue before progressing to necrosis and formation of bullae and eventually becoming hemorrhagic
- Crepitus of the affected area may be palpated and may even be seen as soft tissue air on a plain radiograph or CT scan

Diagnosis: Physical Examination

- Strongly recommend serial physical examination by same individual
- Surgical skin marking pen to outline borders to help track progression objectively or photographic documentation per hospital protocol
- Tenderness beyond the apparent margin of infection is diagnostic and present in 98% patients

What does Necrotizing Fasciitis look like?



This was the start of a tattoo
Several days before presentation



On examination, crepitus would be felt,
and multiple bullae would be noted.
This does not appear worse than many
of the traumatized legs seen by
orthopaedic surgeons, but it is limb and
life threatening



A benign appearing soft tissue wound.
The surrounding erythema may cause
one to only consider cellulitis
The most concerning aspect of this
wound is tissue at the margins which
appears separated from deeper tissue
and able to be easily pulled away. In a
matter of hours this will be limb and
life threatening.

Non-orthopaedic case



This patient had a C-section several days prior to presentation

This case is included because it nicely illustrates

- the bullae that form,
- the wound weeping,
- the epidermal loss

Left untreated, this patient will become septic and likely progress to organ failure, or even death.

Lost in the clinical picture is the intolerable wound malodor.

Diagnosis: Imaging

- Subcutaneous air or gas is a hallmark finding on plain radiographs and CT scans, which gives rise to crepitus on examination. All three of these patients need to be seen immediately.



Ultrasound and MRI imaging

- Subcutaneous air or gas is the universal finding on any imaging modality
- US has the advantage of being rapid, portable and even connected to smart-phone applications
- NF requires immediate diagnosis and emergent surgical intervention
- **DO NOT DELAY** for advanced imaging such as MRI
 - diagnosis should be obtainable from the history and physical examination.
 - Imaging is not a mainstay of diagnosis,
 - be aware of subcutaneous gas especially incidental finding on another study. For example on a calf US to rule-out a DVT.

Diagnostic tools:

Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC)

Metric		
CRP	<15mg/dl (0 points)	>15mg/dl (4 points)
WBC	15-25 (1 point)	>25 (2 points)
Hemoglobin	11-13.5 (1 point)	<11 (2 points)
Sodium	>/=135 (0 points)	<135 (2 points)
Creatinine	</= 1.6 mg/dl (0 points)	>1.6 mg/dl (2 points)
Glucose	</=180 mg/dl (0 points)	>180 mg/dl (1 point)

Point system cut-off is 6

< 6 points does not override physical exam findings, or rule-out the diagnosis

> 6 points, in general rules in NF

Sepsis parameters are not part of the formula and should be considered separately

Non-survivors had sodium levels <127.7

Diagnostic tools- LRINEC

**** Scoring and classification systems are not fool-proof**

A case of NF reported with score = 0

- They guide us on things to look for and assess only
- Must have a high index of suspicion
 - clinical suspicion trumps any score
- Confer with experienced colleagues when in doubt

Beware the elderly

- May show signs of systemic shock and sepsis
- Often pose diagnostic difficulties since they may be confused, agitated, or even have a reduced level of consciousness such as intubated and sedated (ICU pts for example).

Management

- Emergent surgical consultation
- Fluid resuscitation as needed
- Start IV antibiotics aerobic and anaerobic coverage
- Infectious disease consultation
- If convinced NF is present, then proceed to surgery
- Do not delay for lab results



Antibiotics

- NF infections can be polymicrobial
- Usually group A streptococcus
- The antibiotic regime often includes
 - Penicillin G
 - Clindamycin
 - Vancomycin
 - Aminoglycoside if renal function permits
- IV immunoglobulin therapy has been reported
- Fluids and blood products as indicated
- Transfer to an ICU can be done post-operatively

Surgical Management

- Extremity fascial planes are continuous
 - from the fingers to the axilla
 - from the toes to the groin and beyond
- Surgical debridement requires excising to healthy margins which often extends proximal to the elbow and the knee
- Healthy margins noted surgically by bleeding skin and skin adherent to the underlying fascia
- Obtain multiple fluid and tissue samples for culturing

Surgical Management

- The indications and technical aspects of negative pressure wound therapy (NPWT) have not been studied for NF after a debridement which is often circumferential
- The surgical team must be prepared for urgent repeat debridements extending into the thorax, abdominal, or back regions.
- Limb disarticulation is a surgical decision based upon limb salvage potential
- “Life over Limb”

Treatment adjuncts and wound closure

- Negative pressure wound therapy (NPWT) does not have a defined role in treating NF
- Hyperbaric oxygen therapy (HBO) has been shown to be beneficial (Riseman, 1990)
- Intravenous immunoglobulin treatment is investigational
- In general, since NF does not involve muscle, the need for muscle or fasciocutaneous flaps is rarely required
- The debridement of NF involves large areas of skin and fascia
- In cases of extremity NF, consider NPWT over the debrided areas for 3-5 days and then returned for split thickness skin grafting for wound closure.

Treatment Pearls and adjuncts

- Fascial involvement beyond the boundaries of skin redness, blistering or other visual demarcations
- Intraoperatively, may be able to run hands under the skin in all directions with very little to no resistance
- The fascial area soft with mixture of purulence and watery soft tissue
- Purulence may have odd smell or color
- Skip lesions may be noted, where purulence not continuous under the fascia
 - Be sure to evaluate/debride circumferentially

Treatment pearls and adjuncts

- The extent of NF under the skin is hard to determine

#1 Assume that the fascial extent is much further than the boundaries of skin redness, blistering or other visual differences

#2 Extend the 1st debridement widely beyond the suspected margins of involvement

#3 Serial operating room debridements until

A) the patient stabilizes clinically

B) advancement of the infection beyond its initial borders has ceased

Outcomes

Who is in danger? Impingement and penetration of the anterior cortex of the distal femur during intramedullary nailing of proximal femur fractures: Preoperatively measurable risk factors

Angoules et al, 2007

- 451 patients reviewed
- rapidly progressive, life threatening soft tissue infection. the extremities are involved as a result of
 - Minor blunt or penetrating trauma, needle puncture or extravasation of drugs,
- 22.3% underwent amputation or limb disarticulation following failure of multiple debridements to control infection
- Mortality rate was 21.9%.

Jason W. Roberts, MD, Lev A. Libet, and Philip R. Wolinsky, MD,
Sacramento, California

Angoules, 2007

Outcomes

Leiblein et al, 2018

- 15 patients with necrotizing fasciitis over a 21-month time period
- Two patients underwent limb amputation;
- diabetes mellitus was assigned with a significant higher risk for amputation.
- The mean hospitalization was 32 days, including 8 days on intensive care unit.

Outcomes

Leiblein et al, 2018

The authors concluded:

- Surgical therapy is indicated if necrotizing fasciitis is suspected.
- Aminopenicillin ± sulbactam in combination with clindamycin and/or metronidazole is recommended as initial antibiotic treatment.

NF versus Cellulitis, or Gangrene

- Both can have erythema, swelling, fever, and pain
- NF confirmed when followed by
 - Bullae
 - Skin sloughing
 - Tissue necrosis
- Gangrene similar in presentation but slower to progress than NF

Is NF contagious? Precautions for physicians

- NF is a bacterial infection, not a virus (unlike Ebola).
- The bacterial endotoxins cause the rapid decline for patients and for their organs to fail.
- Transmission via a needle stick or splash exposure is remotely possible.

Is NF contagious? Precautions for physicians

- Theoretically, a needle stick during a surgical procedure on a patient with NF could lead to NF in the surgeon
 - This event has never been reported
- **Always use universal precautions** when treating any infection or patient.

Back to our case example

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Case example - Discussion

Answer:

A) This is a classic presentation before the wound progresses and the patient becomes septic or experiences organ failure. The leg is erythematous, edematous with multiple bullae that could probably be easily separated from the deeper dermis

B) If NF is suspected, call an attending surgeon who can manage NF

Better yet consider calling the attending surgeon before seeing the patient (to confirm availability!)

Again if NF is suspected pre-op the patient (NPO, consent, type and screen, call the OR).

Don't waste time checking, ordering labs, or calculating the LRINEC.



Maintain High Index of Suspicion

Successful outcomes rely on two important factors:

- 1) Awareness of the disease, despite its rare occurrence
- 2) Immediate therapy

Leiblein et al, 2018

Summary

- Always have a high index of suspicion for all traumatized areas that are exquisitely painful in sick patients
- LRINEC not absolute but helpful
- IV antibiotics
- **Aggressive debridement is the key**
- Worry about soft tissue reconstruction later – life over limb

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- Images: all images were obtained after searching for “images of necrotizing fasciitis” on Google.