***no patient handout*

Necrotizing fasciitis

Synopsis

Necrotizing fasciitis is a deep and often devastating bacterial infection that tracks along fascial planes and expands well beyond any outward cutaneous signs of infection (ie, erythema). It may be classified as polymicrobial (type I) or monomicrobial (type II). It occurs from the extension of infection at the site of a skin lesion such as an abrasion, furuncle, or insect bite in 80% of cases. Classically, group A beta-hemolytic streptococci (*Streptococcus pyogenes*) are associated with necrotizing fasciitis, but many other organisms including *Staphylococcus aureus*, *Vibrio vulnificus*, Enterobacteriaceae, and *Bacteroides* spp. have been reported. Polymicrobial infection is frequent. Group A *Streptococcus* and *S. aureus*, in particular, should be considered in necrotizing fasciitis resulting after a varicella infection.

Aeromonas hydrophilia is part of the Vibrionaceae family and can cause necrotizing fasciitis in both immunocompromised and immunocompetent patients. Unlike *V. vulnificus* sepsis, where exposure is usually to seawater, in *A. hydrophilia* infection, contact with brackish water, soil, wood, or dirty ditches is typically the common exposure. Infections can follow any trauma, fracture, or injury where there was exposure to fresh water. Infection has also occurred in the setting of debris or floodwater after a hurricane. Both *V. vulnificus* and *Aeromonas* infections can present with lower leg hemorrhagic bullae, purpura, and skin necrosis. *Aeromonas hydrophilia* infection, in contrast to infection with *V. vulnificus*, is marked by more myonecrosis and a distinctive foul odor when the wound is debrided. Most patients with *A. hydrophilia* had exposure to wet soil or dirty ditches.

Patients with necrotizing fasciitis are acutely ill. They are often thought to have **cellulitis** that is not responding to standard antibiotic therapy. Pain is out of proportion to physical findings. There is often associated skin necrosis and bullae formation. Signs of systemic illness such as fever, lethargy, hypotension, and tachycardia are present; these may progress to multiorgan failure. Predisposing factors for necrotizing fasciitis include recent surgery, diabetes mellitus, malignancy, and alcohol use disorder.

The mortality of necrotizing fasciitis is high. Treatment includes broad-spectrum intravenous antibiotics and **immediate** surgical debridement of infected and devitalized tissue. Therefore, if you are considering this diagnosis, stop reading this and contact a surgeon **now**.

When necrotizing fasciitis is localized to the lower abdominal wall, perineum, or genitals, it is known as **Fournier gangrene**. Diabetic patients are particularly susceptible to Fournier gangrene, which is often polymicrobial with mixed anaerobic organisms.

Codes

ICD10CM:
M72.6 – Necrotizing fasciitis

SNOMEDCT:
52486002 – Necrotizing fasciitis

Look For

Early on, there is erythema and edema typical of cellulitis in the setting of a patient who appears severely ill. Despite standard antibiotic therapy, the edema progresses and can become associated with bullae, cyanosis, and eventual gangrene. Crepitus may be present. The subcutaneous tissues will often have a hard, wooden feel.

Diagnostic Pearls

Distinguishing necrotizing fasciitis from a cellulitis that does not require surgical intervention may be challenging. The following clinical features suggest a deep necrotizing infection:

- Constant pain that is often quite severe and is out of proportion with visible skin changes
- Presence of bullae
- Skin necrosis or ecchymosis that precedes necrosis
- Gas in the soft tissues
- Edema extending beyond areas of erythema
- Systemic toxicity (fever, delirium, renal failure, hypotension, tachycardia)
- Cutaneous anesthesia
- Rapid spread despite antibiotic therapy

Differential Diagnosis & Pitfalls

It can sometimes be difficult to differentiate necrotizing fasciitis from **pyoderma gangrenosum** (PG). This is especially true in the pustular variant of PG that may not develop into frank ulceration. Relatively rapidly progressing soft tissue inflammation not responding to broad-spectrum antibiotics and surgical debridement should be promptly evaluated by a dermatologist to rule out PG.

Also consider:

- **Cellulitis**
- **Calciphylaxis**
- **Ecthyma gangrenosum**
- **Erysipelas**

- **Purpura fulminans** complicating varicella
- Insect bite (eg, **brown recluse spider**)
- **Vasculitis**
- **Disseminated intravascular coagulation**
- **Staphylococcal scalded skin syndrome**
- **Toxic shock syndrome**
- **Sweet syndrome**
- ***Vibrio vulnificus* infection**

Best Tests

This diagnosis is made on clinical grounds. Immediate surgical intervention is required. Therefore, if you are considering this diagnosis, **contact a surgeon now**. To confirm suspected necrotizing fasciitis, a small, exploratory incision can be made at the site of maximum suspicion. In cases of necrotizing fasciitis, there will often be a thin, brownish exudate with extensive undermining of the surrounding tissues, which dissect easily with a blunt instrument or gloved finger. The fascia will be swollen and gray, with areas of necrosis.

CT scan or MRI may demonstrate edema extending along fascial planes, and plain films may demonstrate gas in the tissues. However, definitive treatment of this disease should not be delayed in order to obtain radiologic studies.

Obtain blood cultures, tissue, and exudate specimens for Gram stain and culture (aerobic and anaerobic) from the deep tissues at the time of surgery.

Management Pearls

Necrotizing fasciitis is a medical and surgical emergency that often requires a tertiary medical center and supportive treatment in an ICU setting. In addition to debridement and intravenous antibiotics, patients will require wound care and careful attention to fluid and electrolyte balance, nutrition, and temperature regulation. Patients may need ventilatory and/or hemodynamic support.

Commonly needed consultations (in addition to general surgery) include infectious disease, critical care, and plastic surgery.

There is an association between NSAID use and the development of necrotizing fasciitis. Although no studies have been able to show a causative role, it is generally accepted that NSAIDs mask the symptoms and potentially delay diagnosis. Thus, NSAIDs should be avoided in patients suspicious of having necrotizing fasciitis.

In the United States, infections due to methicillin-resistant *S. aureus* (MRSA), vancomycin-resistant *S. aureus*(VRSA), vancomycin-intermediate *S. aureus*, vancomycin-resistant *Enterococcus* species, or vancomycin-resistant *S. epidermidis* are reportable in AK, AZ, CT, DE, FL, CA, IL, IN, IA, LA, ME, MI, MN, MO, NE, NV, NY, NC, ND, OH, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, and WY.

In the United States, infections due to invasive Group A *Streptococcus* are reportable in all states **except** AL, CO, MS, MT, ND, OR, and UT.

Surviving Sepsis Campaign Guidelines – Protocols for initial management and treatment of septic patients to reduce mortality, adapted from Rhodes et al (*Crit Care Med*. 2017;45[3]:486-552) (see References).

To be completed within 3 hours:

1) Sepsis and septic shock are medical emergencies. Begin resuscitation immediately.

- Administer at least 30 cc/kg intravenous (IV) crystalloid within the first 3 hours.
- Check initial lactate and guide resuscitation to normalize lactate if elevated.
- Monitor dynamic variables to predict fluid responsiveness to guide further fluid resuscitation.
- If no hemodynamic response to resuscitation, initiate vasopressors.
- Target initial mean arterial pressure of 65 mmHg in those requiring vasopressors.

2) Obtain appropriate cultures prior to administration of antibiotics if doing so does not result in a substantial delay in the initiation of antibiotics.

3) Administer broad spectrum antibiotics as soon as possible after recognition of sepsis or septic shock, **ideally within 1 hour**.

Therapy

Therapy **requires** immediate surgical intervention in addition to antibiotics. Antibiotics alone are of little benefit because of the ischemia found in these infections. **All** infected and devitalized tissue must be removed. Often, patients will need multiple (if not daily) trips to the operating room to accomplish this.

Initial choice of antibiotic therapy can be directed by Gram stain(s) taken at the time of the initial operation. Antibiotics will need to be continued until such time as operative procedures are no longer needed and the patient has been afebrile for 2-3 days.

Patients will require aggressive fluid resuscitation.

Polymicrobial infection (adult dosing):

- Piperacillin-tazobactam 3.37 g IV every 6-8 hours PLUS vancomycin 30 mg/kg/day in 2 divided doses, or
- Imipenem-cilastatin 1 g IV every 6-8 hours, or
- Meropenem 1 g IV every 8 hours, or
- Ertapenem 1 g IV every 24 hours, or
- Cefotaxime 2 g IV every 6 hours PLUS metronidazole 500 mg IV every 6 hours or clindamycin 600-900 mg IV every 8 hours.

For patients with severe penicillin hypersensitivity – Clindamycin or metronidazole (if *Staphylococcus* is present or suspected, add an appropriate agent) with an aminoglycoside or fluoroquinolone.

Streptococcal infection (adult dosing):

- Penicillin 2-4 million units IV every 4-6 hours PLUS clindamycin 600-900 mg IV every 8 hours.

For patients with severe penicillin hypersensitivity – Vancomycin, linezolid, quinupristin / dalfopristin, or daptomycin.

***Staphylococcus aureus* infection (adult dosing):**

- Nafcillin or oxacillin 1-2 g IV every 4 hours, or
- Cefazolin 1 g IV every 8 hours, or
- Vancomycin (for resistant strains) 30 mg/kg/day IV in 2 divided doses, or
- Clindamycin 600-900 mg IV every 8 hours (if MRSA is present or suspected, add vancomycin [not to exceed the maximum adult daily dose]).

For patients with severe penicillin hypersensitivity – Vancomycin, linezolid, quinupristin / dalfopristin, or daptomycin.

Clostridial infection (adult dosing):

- Clindamycin 600-900 mg IV every 8 hours PLUS penicillin 2-4 million units IV every 4-6 hours.

***Aeromonas hydrophilia* infection (adult dosing):**

- Doxycycline 100 mg IV every 12 hours PLUS ciprofloxacin 500 mg IV every 12 hours or ceftriaxone 1-2 g IV every 24 hours.

***Vibrio vulnificus* infection (adult dosing):**

- Doxycycline 100 mg IV every 12 hours PLUS ceftriaxone 1 g IV 4 times daily or cefotaxime 2 g IV 3 times daily.

These therapeutic recommendations are adapted from the Infectious Diseases Society of America's 2014 update to Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections.

Drug Reaction Data

Below is a list of drugs with literature evidence indicating an adverse association with this diagnosis. The list is continually updated through ongoing research and new medication approvals. Click on Citations to sort by number of citations or click on Medication to sort the medications alphabetically.

Medication	Citations
Antimetabolite	2
azacitidine	1
Calcineurin inhibitor	1
cyclosporine	1
diflunisal	1
dipyrone	1

Medication	Citations
etanercept	1
infliximab	1
methotrexate	1
NSAID	2
onabotulinumtoxinA	1
phenylbutazone	1
sunitinib	1
Tyrosine kinase inhibitor	1