Necrotizing Fasciitis

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Foot infections are the most common soft-tissue infections in pts with diabetes

Necrotizing fasciitis is the most important soft tissue infection in DM pts involving most commonly the arms, legs and abdominal wall
Necrotizing fasciitis

- Pathogenesis
- Clinical signs and symptoms
- Diagnosis
- Treatment
Necrotizing fasciitis

- Definition: A rare, rapidly progressive, life threatening infection process primarily involving the subcutaneous tissue and fascia with thrombosis of the subcutaneous blood vessels.
Necrotizing fasciitis: synonyms

- Phagadena
- Phagadena gangrenosum
- Meleneys gangrene
- Fournier’s gangrene
- Hemolytic streptococcal gangrene
- Flesh eating bacteria
- Hospital gangrene
Necrotizing fasciitis

- Causative bacteria may be aerobic, anaerobic, or mixed flora, but frequently Group A beta-hemolytic strep and S. aureus alone or in synergism, are the initiating infecting bacteria
- Usually the soft tissue infection has a mixture of anaerobic and gram negative aerobic organisms, these organisms proliferate in an environment of local tissue hypoxia
- In DM pts common organisms include S. aureus, Group A streptococci, E. coli and various anaerobes
- Other organisms seen include bacteriodes, clostridium, peptostreptococcus, enterobacteriaceae, klebsiella, pseudomonas, proteus, coliforms
Necrotizing fasciitis: different types?

- Type I – polymicrobial
- Type II – group A streptococcal
- Type III – gas gangrene or clostridial myonecrosis
Necrotizing fasciitis: type I

- Usually occurs after trauma or surgery.
- May be mistaken for simple cellulitis but severe pain and systemic toxicity reflect widespread tissue necrosis underlying apparently viable tissue.
- Anaerobic and facultative bacteria work synergistically
- Saltwater NF – variant minor skin wound is contaminated with saltwater containing a Vibrio species
Necrotizing fasciitis:

**type II**

- Flesh-eating bacterial infection
- Widespread tissue necrosis underlying apparently viable skin
- Gas usually not evident
- Varicella infection and the use of NSAIDs may be predisposing factors
Necrotizing fasciitis: type III

- Usually caused by clostridium perfringens
- Clostridial myonecrosis
- Gas gangrene
- Skeletal muscle infection may be associated with recent surgery or trauma
- Spontaneous occurrence associated with Clostridium septicum; these cases usually occur in pts with colon cancer or leukemia
Necrotizing fasciitis: pathophysiology

- Organisms spread from the subcutaneous tissue along the superficial and deep fascial planes, facilitated by bacterial enzymes and toxins. This deep infection causes vascular occlusion, ischemia, and tissue necrosis. Superficial nerves are damaged, producing the characteristic localized anesthesia. Septicemia ensues with systemic toxicity.

- (Schwartz 2004)
Pathophysiology cont…

- Bacterial factors M-1 and M-3 surface proteins increase the adherence of the streptococci to the tissues and protect the bacteria against phagocytosis by neutrophils.

- Streptococcal pyrogenic exotoxins (SPEs) A, B, C are directly toxic and tend to be produced by strains causing NF. These exotoxins, together with streptococcal superantigen (SSA), lead to release of cytokines and produce clinical signs such as hypotension. The poor prognosis in NF has been linked to infection with certain strep strains.

  (Schwartz 2004)
Facultative aerobic organisms grow since polymorphonuclear (PMN) leukocytes exhibit decreased function under hypoxic wound conditions. This growth further lowers the oxidation/reduction potential, enabling more anaerobic proliferation and, thus, accelerating the disease process. Carbon dioxide and water are the end products of aerobic metabolism. Hydrogen, nitrogen, hydrogen sulfide, and methane are produced from the combination of aerobic and anaerobic bacteria in a soft tissue infection. These gases, except carbon dioxide, accumulate in tissues because of reduced water solubility (Maynor 2004).
Image: www.ctsus.org
Necrotizing fasciitis: precipitating factors

- Surgical procedures
- Minor insect bites
- Local ischemia and hypoxia e.g. DM and immunocompromised
- Trauma
- Episodes of frostbite
- Infectious processes
- IM and IV injections
- Chronic venous leg ulcers
- Alcoholism
- Idiopathic
Necrotizing fasciitis: early signs and symptoms

- S/S can begin up to one week after initiating event but once started progress very rapidly
- Severe pain far out of proportion to clinical findings on examination. This is because the inflammation is deep and rarely involves the overlying skin early on
- Tenderness on palpation beyond the apparent margins of the infection
- Edema
- Erythema and warmth of the skin
- Systemic toxicity (fever, tachycardia, hypotension)
Necrotizing fasciitis: late signs and symptoms

- S/S occur over several hours to days
- Bullae formation in skin
- Gangrene- multiple identical patches develop to produce a large area
- Ulcerations
- Skin discoloration- dusky or purplish
- Sensory and motor deficits- local pain progresses to anesthesia due to nerve fiber necrosis
- Gas in soft tissues
- Crepitus- due to underlying gas formation
- Putrid discharge- foul smelling and watery
Necrotizing fasciitis: diagnostics

- CBC with differential – elevated WBC with a left shift
- Serum sodium less than 135mmol/L
- BUN greater than 15mg/dl
- Tissue biopsy and culture
- Gram stain of exudate

- CT scan/ MRI – pinpoint anatomic site of involvement and confirm if necrosis is present
- X-ray - presence of gas in subcutaneous fascial planes classic sign but not always seen (less than 50% of the time). In DM pts up to 80% have gas on radiograph
Necrotizing fasciitis:

- Definitive dx is by surgical exploration with presence of necrotic tissue identified
Necrotizing fasciitis: differential dx

- Differential dx cellulitis- pain in affected area and systemic toxicity are far more severe than would be expected in simple cellulitis
Necrotizing fasciitis: treatment

- Early aggressive surgical exploration and debridement of nonviable tissue (associated with higher likelihood of survival)
- Antibiotic therapy
- Hyperbaric oxygen
- Supportive care
Necrotizing fasciitis: surgical care

- Initially, diagnostic exploration can be limited to a small incision under local anesthesia.
- Once dx is confirmed debridement should be done early and aggressively.
- The surgical incision should be deep and extend beyond the areas of necrosis until viable tissue is reached.
- The entire necrotic area should be excised.
surgical care cont…

- The wound should be well irrigated
- Hemostasis should be maintained and the wound kept open
- Surgical debridement and evaluations should be repeated almost daily until infection has been arrested
Necrotizing fasciitis: antibiotic therapy

- Empirical administration of broad spectrum antibiotics should be started immediately
- Once culture and gram stain results are known therapy should be adjusted as appropriate
- A combination of antibiotics are typically used
- Foul smelling wound strongly suggest anaerobes
antibiotic therapy cont...

- Empirical therapy usually involves;
  - PCN or a cephalosporin for gram +
  - Aminoglycoside, third generation cephalosporin or ciprofloxacin for gram –
  - Clindamycin or metronidazole for anaerobes
  - PCN allergy use a flouroquinolone
antibiotic therapy cont...
ampicillin/sulbactam (unasyn)

- Active against gram +, −, and anaerobes
- 1.5-3g IV/IM q6hrs
antibiotic therapy cont…
clindamycin

- Active against anaerobes
- 600-1200mg/d IV/IM bid/tid/qid
- Use in combination
antibiotic therapy cont...
ciprofloxacin

- Active against gram+ and –
- 400mg q8hrs IV
Necrotizing fasciitis: hyperbaric oxygen therapy

- Unclear role, may have some benefit
- Involves the intermittent inhalation of 100% oxygen in chambers pressurized above 1 atmosphere absolute
- Benefit is based on assumption that raising tissue oxygen levels will enhance wound healing ability
hyperbaric oxygen cont...

- Cautions – pressure related traumas (pneumothorax), oxygen toxicity (myopia, seizures), claustrophobia
- Usually administered at 2-3 atmosphere absolutes for 90 minutes with number of sessions ranging from 4-44
- Started aggressively after first surgical debridement
- Studies suggest helpful but lacking large controlled randomized studies
- Best outcome obtained when combine surgery, antibiotics, and hyperbaric oxygen therapy when readily available
Necrotizing fasciitis: supportive care

- Provide supplemental oxygen
- Fluid resuscitation
- Continuous cardiac monitoring
- Consults
Necrotizing fasciitis: prognosis

- Mortality rate as high as 25%. In DM pts as high as 40%.
- Poor prognosis linked to streptococcal strains
- Missed dx can be fatal to pt
- Early dx and initiation of treatment is key to increasing survival rates of pts
Necrotizing fasciitis with well defined necrosis
Medial calf
References