

# FLESH EATING BACTERIA CAUSING NECROSIS: SOURCES AND PREVENTION

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## CASE REPORT

A 30-year-old woman is admitted to the hospital because of pain and swelling of the right thigh. The patient has been in excellent health prior to her admission, when she observed a pimple on her right thigh. During the course of the day, the lesion enlarged, with increasing swelling, pain, and erythema, and was accompanied by vomiting, nausea and delirium. Her temperature is 97.5°F, the pulse is 126 bpm, and the respirations are 20 breaths/minute. BP is 85/60 mmHg. On physical examination, the patient appears ill and in pain. A small, indurated area of skin breakdown with surrounding erythema and warmth is present on the right thigh; no remarkable changes detected. She is unable to flex or extend the right hip because of pain and reports pain on passive extension of the right ankle. The temperature soon rises to 105°F, and the BP drops to 70/40 mmHg. Hematocrit is 40, WBC count 5900/mm<sup>3</sup> (with 65% neutrophils, 20% band forms), serum creatinine 1.9 mg/dL, and BUN 24 mg/dL. She was sent to have a contrast-enhanced CT which showed a diffuse, honeycomb pattern within the subcutaneous tissue of her right thigh. Subcutaneous stranding and thickening of the skin are prominent in the posterolateral aspect of the thigh; there is also thickening of the posterolateral deep fascia.

# EXAMINATION REPORT

- Diagnostic Factors

- Fever
- Tachycardia
- Nausea
- Vomiting
- Delirium
- Edema

- Diagnostic Test

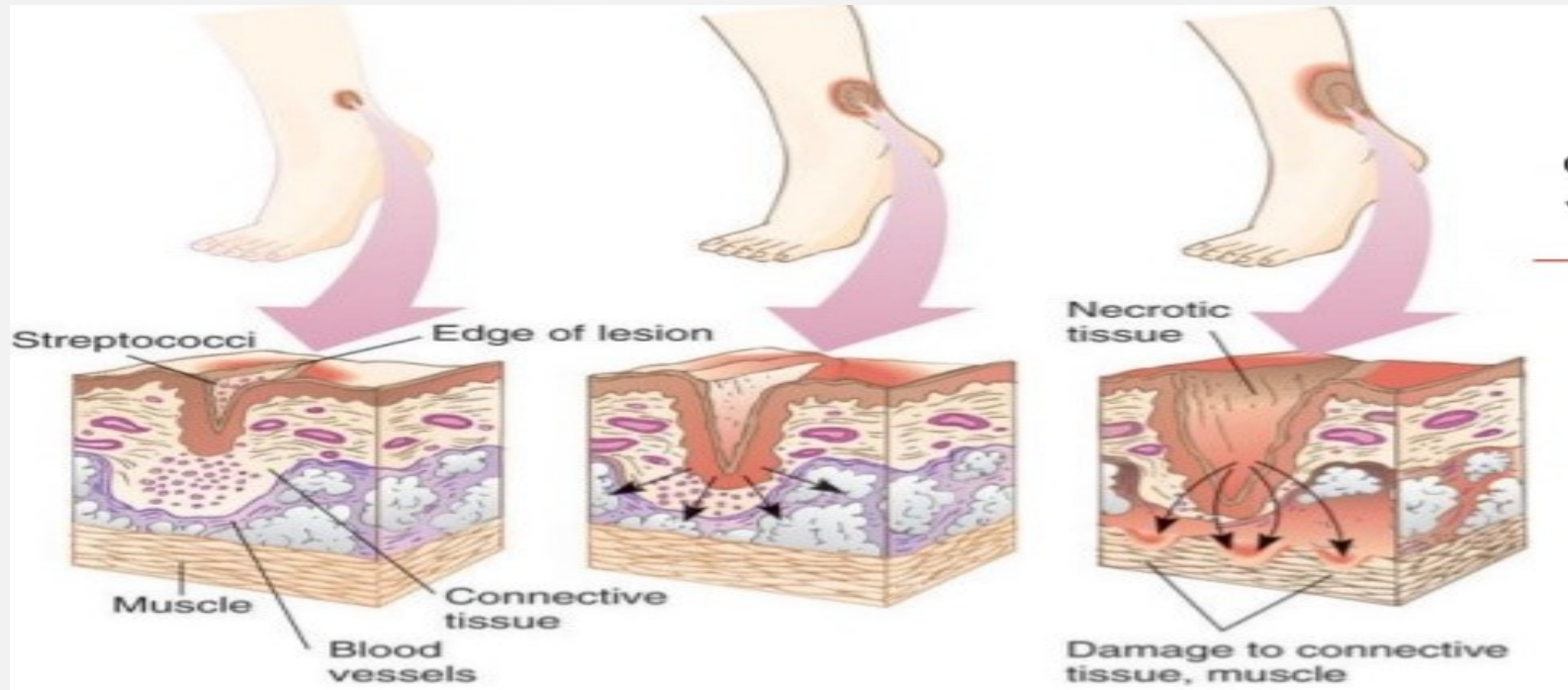
- CBC with differential
- Serum BUN and creatinine
- CT /MRI
- Serum CK

- Differential Diagnosis

- Cellulitis
- Myositis
- Gas gangrene
- Cutaneous anthrax



## PATHOPHYSIOLOGY SKETCH OF FLESH EATING BACTERIA



# FLESH EATING BACTERIA (NECROTIZING FASCIITIS)

Necrotizing fasciitis is a serious bacterial skin infection that spreads quickly and kills the body's soft tissue.

Commonly referred to as a "flesh-eating infection," this rare disease can be caused by more than one type of bacteria.

These include group A *Streptococcus* (group A strep), *Klebsiella*, *Clostridium*, *Escherichia coli*, *Staphylococcus aureus*, and *Aeromonas hydrophila*, among others. Group A strep is considered the most common cause of necrotizing fasciitis.

Usually, infections from group A strep bacteria are generally mild and are easily treated. But in cases of necrotizing fasciitis, bacteria spread rapidly once they enter the body. They infect flat layers of a membrane known as the *fascia*, which are connective bands of tissue that surround muscles, nerves, fat, and blood vessels.

The infection also damages the tissues next to the fascia. Sometimes toxins (poisons) made by these bacteria destroy the tissue they infect, causing it to die. When this happens, the infection is very serious and can result in loss of limbs or death.

# EPIDEMIOLOGY

## **Necrotizing Fasciitis Is Rarely Spread from Person to Person**

Most cases of necrotizing fasciitis occur randomly and are not linked to similar infections in others. The most common way of getting necrotizing fasciitis is when the bacteria enter the body through a break in the skin, like a cut, scrape, burn, insect bite, or puncture wound.

Most people who get necrotizing fasciitis have other health problems that may lower their body's ability to fight infection. If you're healthy, have a strong immune system, and practice good hygiene and proper wound care, your chances of getting necrotizing fasciitis are extremely low.

**Epidemiology** : The incidence of NF in adults has been reported to be 0.40 cases per 100,000 population, while the incidence in children is 0.08 cases per 100,000 population.<sup>[2,3]</sup> Despite the uncommon nature of this condition, over the last decade, there has been a fivefold increase in the incidence of NF.<sup>[4]</sup> Although largely unexplained, the aging of the population and the increase in numbers of immunosuppressed individuals may be related. Rapid early intervention may prevent morbidity and mortality, but, left untreated, mortality rates as high as 73 percent have been reported.<sup>[1]</sup> Mortality varies with age, with increasing mortality seen in older age groups. For example, patients over 50 years of age have a mortality rate of 37 percent, while those over 60 years of age have a mortality rate of 62 percent.

## EPIDEMIOLOGY CONT...

Group A Strep: In the United States, about 1 out of 4 patients with necrotizing fasciitis due to group A strep and approximately 4 out of 10 with STSS die. About 10 to 15 out of 100 patients with any form of invasive group A strep disease die.

A: Approximately 9,000 to 11,500 cases of invasive group A strep disease occur each year in the United States, resulting in 1,000 to 1,800 deaths annually. Most of these cases are less serious invasive infections, like cellulitis. STSS and necrotizing fasciitis are each responsible for an average of about 6 to 7 out of 100 of these invasive cases. In contrast, there are several million cases of non-invasive group A strep infections, like strep throat and impetigo, each year.

# MICROBIAL PHYSIOLOGY

Flesh-eating disease is divided into four types:

*Type I* caused by anaerobic species in combination with facultative anaerobic organisms (Streptococci-Non-group A, enterococci, and gram-negative rods).

*Type II* hemolytic streptococcal gangrene caused by group A streptococci.

*Type III* caused by marine vibrios (gram negative bacteria).

*Type IV* is due to a fungal infection.

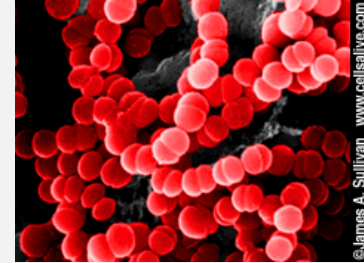


## POLYMICROBIAL TYPE

- Most common
- Account for 70-90% of cases
  - Affects patients with several co-morbidities
- Two or more pathogens are implicated in this infection
- Mostly found
  - Trunk
  - Perineum

# MONOMICROBIAL: GROUP A STREPTOCOCCI (*S. PYOGENES*)

- Natural flora
  - Throat and on the skin
- GAS infections are relatively mild illness
  - Strep throat
  - Impetigo
- On rare occasions can cause other severe and life threatening diseases.
  - Can occur when bacteria gets into parts of the body where they are usually not found
    - muscle , lungs, or the blood



- Invasive infections occur when the defense of the person fail to keep the bacteria out of the body.
  - highly correlated with the use of NSAIDs
- Often co-infection of *S. aureus*.
- Usually occurs in head, neck, arm or legs.
- Less often associated with predisposing risk factors.

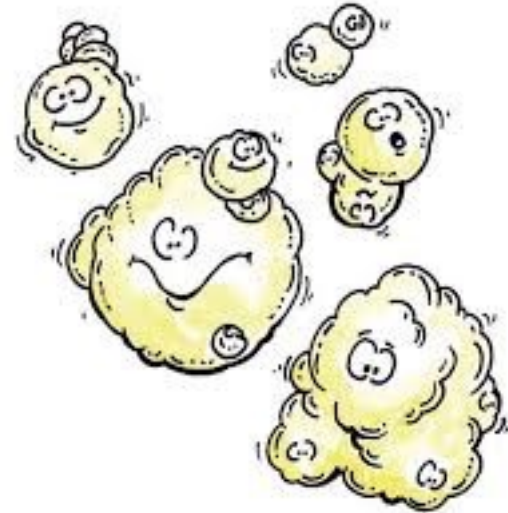
# MONOMICROBIAL: CLOSTRIDIUM

- Anaerobic bacteria produced by external injuries
  - Deep wounds or crush injury causing local devascularization
  - Surgical wounds- intestinal and obstetric
- More frequent in drug addicts
- *Vibrio vulnificus* Infections leads to type III NF
  - Marine bacteria
  - Asia
  - *Aeromonas hydrophila*
  - Enters the skin via puncture wounds from fish or insects in seawater.



# FUNGAL INFECTIONS

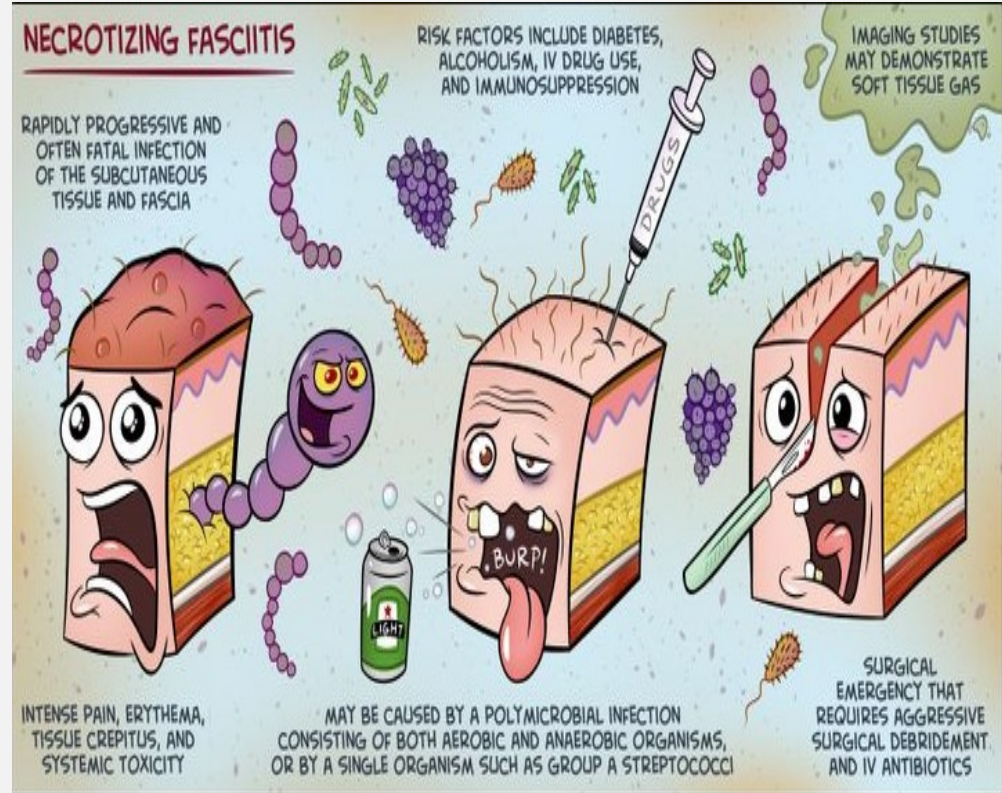
- Mostly caused by Candida
- Mainly found in the immunocompromised host
  - Aggressive and rapidly extensive clinical image
- Occur after trauma
  - Traumatic wounds
  - Burns



Candida albicans

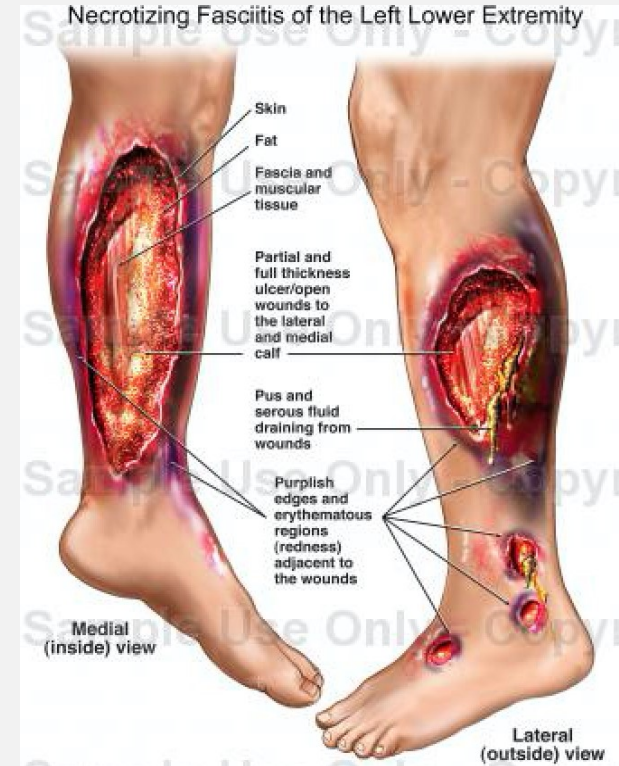
# MECHANISM OF ACTION/VIRULENCE FACTORS

- Spread from Subcutaneous tissue along superficial and deep fascial planes by bacterial enzymes and toxins
- Surface Proteins - M1 & M3
- Adherence & Protection from Phagocytosis
- Streptococcal Pyrogenic Exotoxins A,B,C and Streptococcal Superantigen release cytokines that cause hypotension



# CLINICAL PRESENTATION

- ❖ Intense Pain reported by patient
- ❖ Diarrhea and Vomiting
- ❖ Inflammation → fever and tachycardia
- ❖ Tissue will swell, appear discolored, and develop blisters
- ❖ Necrosis of subcutaneous tissue
- ❖ CBC Count scoring system is used for diagnosis
  - ❖ “Laboratory Risk Indicator for Necrotizing Fasciitis” (LRINEC)
  - ❖ Elevated WBC count ( $> 25 \times 10^3/\text{mm}$ ),
  - ❖ Low Hb (11 g/dL),
  - ❖ Low Sodium (,135mmol/L)
  - ❖ High Glucose ( $>10 \text{ mmol/L}$  Sodium ( $<135 \text{ mmol/L}$ ),
  - ❖ High Creatinine ( $>141 \text{ umol/L}$ )





# CLINICAL PRESENTATION - PROGRESSION

Infection results in severe loss of tissue if left untreated



Early, treated



Severe, treated



Severe, untreated

# TREATMENT

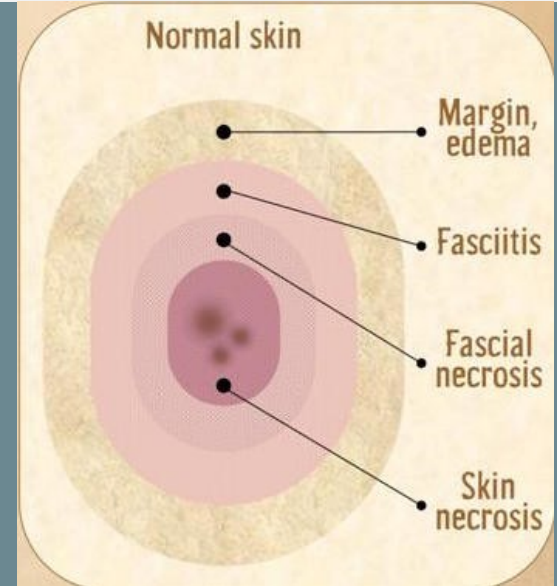
- Complex treatment
- Wound management
  - Excise the disease
  - Care of the wound until closure
  - Closing of the wound
- Antibiotic Therapy
  - Controls sepsis
  - Vancomycin, Linezolid, daptomycin for MRSA
- Hyperbaric Oxygen
- IV immune globulin Therapy





# WOUND MANAGEMENT

- Debride/ Drain/ Excise
  - Removal of dead, damaged, or infected tissue
  - Time dependent
  - Average of 3 procedures
- Tx of Zones
  - Central Zone
    - Complete excision
  - Fascial necrosis Zone
    - Complete excision
  - Marginal Edema
    - Drainage



# WOUND CLOSURE

- Simple Repair
  - Advances margins
  - No additional materials
  - Pros
    - Minimal loss if it fails
    - Efficient and economical
  - Cons
    - Wound pathology can cause failure
- Grafts
  - Closure for large areas
  - Pros
    - Renewable resource
    - Minimal loss
  - Cons
    - Dependent on health of the host



- Flaps
  - Anatomically attached to host
  - Contains its own blood supply
  - Pros
    - Covers large areas
  - Cons
    - Significant donor sites



# INTEGRA

- Advanced wound care device
- Contains a porous matrix of cross-linked collagen, glycosaminoglycan and a semi permeable polysiloxane
- Benefits
  - Gives immediate coverage
  - Exceptional strength and flexibility
  - Excellent for deep donor sites
  - Suppression of inflammation



# PREVENTION

- Keep open wounds covered with clean, dry bandages
- First aid of even minor, non-infected wounds, including:
  - blisters, scrapes, or any break in the skin
- Open wound or active infection:
  - avoid spending time in whirlpools, hot tubs, swimming pools, and natural bodies of water (e.g., lakes, rivers, oceans) until infections are healed
- Wash hands often with soap and water
- Use an alcohol-based hand rub if washing is not possible

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