



## Necrotizing Fasciitis and All of Its Causes

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The mere utterance of the words necrotizing fasciitis are enough to bring a sense of fear and panic to healthcare workers. These same words carry an even more powerful message to the public and media. This condition is typically attributed to *Streptococcus pyogenes*, but there are actually a number of other causes; therefore, the bugs responsible for necrotizing fasciitis are this month's **Bug of the Month**.

### *What is necrotizing fasciitis?*

Necrotizing fasciitis is an uncommon skin and soft tissue infection, with about 90 to 200 cases in Canada per year. This extremely serious infection which will kill 20% of those infected, can be broken down into three types, based on the microbiology of each type:

- **Type I:** This is a polymicrobial infection caused by both anaerobic and aerobic bacteria. The most frequently encountered aerobes include *Escherichia coli*, *Klebsiella spp.*, *Proteus mirabilis* and *Staphylococcus aureus*. Anaerobes include *Peptococcus spp.*, *Clostridium spp.* and *Bacteroides fragilis*. It typically affects those with peripheral vascular disease, or in whom wounds become fecally contaminated. It can often occur as a complication of intra-abdominal or other "dirty surgeries."
- **Type II:** *Streptococcus pyogenes*, also known as the group A streptococcus, the pathogen for this type which has been called the "flesh eating disease." Although those who are immunocompromised are at greater risk, in reality, it can affect anyone.

- **Type III:** This variant is associated with marine microbes, of which *Vibrio vulnificus* is the most common. This tends to occur when individuals have puncture wounds from fish or insects and are exposed to ocean water or raw saltwater fish or crabs.

### *What do "necrotizing" and "fasciitis" mean?*

The fascia is a fibrous, tough, thin membrane, designed to add support to associated soft tissue. On the trunk and lower extremity it is divided into a superficial and deep layer. The superficial layer lies in the mid-portion of the subcutaneous fat and helps support the overlying skin. The deep layer encloses the underlying muscles and thus separates them from the overlying fat, neurovascular structures and skin.

Necrotizing fasciitis is the rapidly progressive inflammation or infection of the superficial layer or deep layer of fascia and overlying adipose tissue. The bacteria spreads rapidly through the fascia layer and produces a number of chemicals or toxins which leads to tissue injury and destruction, leading to vessel thrombosis and subsequent necrosis of the overlying layers. The vessel thrombosis is a pathognomonic

sign seen at surgery when associated with purulence of the fascial layer.

### *Who gets necrotizing fasciitis?*

Group A streptococcus-related necrotizing fasciitis can occur in any individual, including young, healthy populations. A more frequent occurrence has been noted in the following demographic groups:

- > 65-years-of-age
- Chronic health problems, such as diabetes, hepatitis, renal failure, chronic cardiac disease and peripheral vascular disease
- The immunocompromised, such as those persons using steroids and those with infection with the human immunodeficiency virus (HIV)
- Injection drug users
- Those who have recently had chicken pox or other rashes

There is frequently a history of development that begins with a cut or breach in the skin with any trauma (*e.g.*, insect bite, abrasion, laceration, IV, surgery, *etc.*), serving as a portal of entry for the bacteria to enter. Frequently, however, a meaningful history cannot be found.

## Does this same bacteria cause strep throat?

*S. pyogenes* is a gram positive cocci which is found in short chains when cultured. Its clinical manifestations include pharyngitis (*i.e.*, strep throat), impetigo, scarlet fever, rheumatic fever, poststreptococcal glomerulonephritis, erysipelas and cellulitis. A variety of host and bacterial factors determine the potential severity of disease. This includes type of M protein and exotoxin type, which can induce a septic response via acting as a superantigen. Strep throat is also caused by *S. pyogenes*. Although the bacteria are the same, the strains differ, as the strain causing necrotizing fasciitis is more aggressive. The strain that causes strep throat does not usually cause necrotizing fasciitis.

## What are the signs and symptoms?

Any part of the body may be infected, with the extremities being the most common. The symptoms vary, without any pathognomonic characteristics, explaining why the diagnosis can be easily missed at first. The key clinical finding, however, is pain out of proportion to the clinical manifestations, specifically, during the first 24 hours. Flu-like symptoms, such as fevers, chills, malaise and muscle aches may be present.

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Initially, there are no obvious skin changes or mild associated erythema of the painful body part. But as the infection progresses, inflammation will spread through the superficial layers leading to vessel thrombosis and necrosis of the overlying skin. Initially, this appears as erythematous, edematous skin with numerous bullae. Within hours, the skin will progress to dark purple necrotic patches, signifying full thickness tissue loss.

In later stages, pain will dissipate due to infarction of the superficial nerves. Rarely will the patient be hemodynamically stable at this point. Hypotension frequently starts early in the disease with decreased levels of consciousness due to systemic shock.

Beyond minimizing/preventing cuts, abrasions and punctures of the skin, or cleaning them when they occur, there is little that can be done to prevent necrotizing fasciitis.

## What tests make the diagnosis?

Unfortunately, there is no single diagnostic test which establishes the diagnosis. Investigations, such as culture of blood and open wounds, complete blood count, serum biochemistry, liver enzymes and evaluation of renal function may help establish a microbiologic diagnosis and determine the severity of end organ complications; however, they do not establish the diagnosis. Delays should not occur awaiting radiographic studies, such as plain radiographs, CAT, or MRI scans as they too do not establish the diagnosis. The only way to definitively establish the diagnosis is to incise the affected tissues exposing the superficial fascia and deep fascial layers. The fascia will show signs of vessel thrombosis and there may be a cloudy fluid progressing to frank purulent discharge overlying the fascia. If the fascia

is intact and normal in appearance and not associated with any questionable discharge, the diagnosis is unlikely; however, if present, the patient requires urgent wide surgical debridement in conjunction with empiric parenteral antibiotic therapy.

## How is necrotizing fasciitis treated?

This condition is a medical and surgical emergency, as it is potentially fatal without prompt recognition and treatment. Treatment of group A streptococcus mediated necrotizing fasciitis includes aggressive fluid resuscitation, parenteral penicillin G (4 million units q.6.h.) and clindamycin (600 mg q.8.h.). Aminoglycosides or third generation cephalosporins may be added for additional anti-gram negative coverage if a polymicrobial infection is suspected. Surgical debridement of all devitalized tissue is necessary. Multiple daily dressing changes are completed until a second-look surgery is performed to ensure that the disease is not progressing. Management of the streptococcal toxic shock syndrome may also require inotropes and IV immunoglobulin therapy, but a discussion of this issue is beyond the scope of this brief review.

## What else should be done?

Infection control precautions are the same as for other communicable conditions, specifically hand washing and standard wound precautions. Isolation is necessary if secretions cannot be contained and there is risk of contamination of other patients. It is important to speak with the local Medical Officer of Health to establish whether and what type of post exposure prophylaxis may be necessary for close contacts of a case of group A streptococcus necrotizing fasciitis.