Virtual Mentor
American Medical Association Journal of Ethics
December 2006, Volume 8, Number 12: 831-833.

Clinical pearl

Cellulitis: definition, etiology, diagnosis and treatment

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Cellulitis is an acute inflammatory condition of the dermis and subcutaneous tissue usually found complicating a wound, ulcer or dermatosis. Spreading and pyogenic in nature, it is characterized by localized pain, erythema, swelling and heat. The involved area, most commonly on the leg, lacks sharp demarcation from uninvolved skin. Erysipelas, a superficial cellulitis with prominent lymphatic involvement, does have an indurated, raised border that demarcates it from normal skin. These distinctive features create what is known as a "peau d'orange" appearance [1].

Etiology

Cellulitis may be caused by indigenous flora colonizing the skin and appendages, like *Staphylococcus aureus* (*S. aureus*) and *Streptococcus pyogenes* (*S. pyogenes*), or by a wide variety of exogenous bacteria. Bacteria gain entry into the body in many ways: breaks in the skin, burns, insect bites, surgical incisions and intravenous (IV) catheters are all potential pathways. *S. aureus* cellulitis starts from a central localized infection and spreads from there. An abscess, folliculitis or infected foreign body, such as a splinter, prosthetic device or IV catheter, may serve as a possible focus for this condition.

Cellulitis due to *S. pyogenes* follows a different pattern. It spreads rapidly and diffusely and is frequently associated with lymphangitis and fever. Recurrent streptococcal cellulitis of the lower extremities, seen in conjunction with chronic venous stasis or with saphenous vein harvest for coronary artery bypass surgery, often comes from organisms of group A, C or G. Cellulitis is also seen in patients with chronic lymphedema resulting from elephantiasis, Milroy's disease or lymph node dissection such as that associated with mastectomy. Staphylococcal and streptococcal species are also the most common pathogens in bacterial infections among drug-users [2], and infections that implicate an unusual organism are often related to a specific drug or drug-use behavior.

Many other bacteria cause cellulitis. *Haemophilus influenzae* was once a major pathogen in facial cellulitis in young children, but these infections are now rare due to the type B vaccine. *Pasteurella multocida* is the pathogen in cellulitis associated with animal bites, mostly those of cats. *Aeromonas hydrophila* can cause an aggressive form of cellulitis in a laceration sustained in fresh water. *Pseudomonas aeruginosa* is the source of three types of soft tissue infection: ecthyma gangrenosum

in neutropenic patients, hot tub folliculitis and cellulitis following a penetrating wound, like that sustained from stepping on a nail. Gram-negative bacillary (rod) cellulitis, like *P. aeruginosa*, is common among hospitalized, immunocompromised patients and may have multidrug resistance. Culture and sensitivity tests are very important in this setting.

Diagnosis

Diagnosis of cellulitis is generally based on the morphologic features of the lesion and the clinical setting. If drainage or an open wound is present, or there is an obvious entry portal, Gram's stain and culture can provide a definitive diagnosis. In the absence of culture findings, the bacterial etiology of cellulitis is difficult to establish. In some cases staphylococcal and streptococcal cellulitis have similar features and are indistinguishable from each other. Culture of needle aspirates is not indicated in routine care because the result rarely alters the treatment plan. Even when taken from the lead edge of the inflammation, cultures from needle aspiration and punch biopsy are positive in only 20 percent of cases [3, 4]. This suggests that low numbers of bacteria may produce this condition and that the expanding symptomatic area within the skin may be an effect of extracellular toxins or of the mediators of inflammation elicited by the host. In spite of the low yield from aspiration for individual patients, studies have produced findings of import for overall treatment strategies: data from numerous studies, examining both needle aspiration and punch biopsy, indicate that antimicrobial therapy for cellulitis should focus on Gram-positive cocci in immunocompetent hosts, *S. aureus* and *S. pyogenes* in particular [1].

Treatment

Since most cases of cellulitis are caused by staphylococcal and streptococcal species, beta-lactam antibiotics with activity against penicillinase-producing *S. aureus* are the drugs of choice. Cefazolin, a first-generation cephalosporin, nafcillin, an antistaphylococcal synthetic penicillin and ceftriaxone, a third-generation cephalosporin, are all initial treatment options. If methicillin-resistant *S. aureus* (MRSA) is suspected or the patient is highly allergic to penicillin, then vancomycin and linezolid are the drugs of choice and have similar cure rates. Initial treatment should be given by IV in the hospital if the inflammation is spreading rapidly, if there is a significant systemic response (chills and fever) or if there are complicating coexisting conditions like immunosuppression, neutropenia, cardiac failure or renal insufficiency. Diabetic foot infections require special care since they often involve multiple pathogens. A recent study showed that ampicillin-sulbactam and imipenem-cilastatin have similar cure rates (81 percent and 85 percent, respectively); the former combination was more cost-effective [5]. The list of other organisms that can produce cellulitis is long. These cases usually present in such characteristic ways that anatomical location and the patient's medical and exposure history aid with diagnosis and guide appropriate antibiotic therapy.

Supportive care measures include the elevation and immobilization of the involved limb to reduce swelling and application of sterile saline dressings to remove

purulence from open lesions. Dermatophytic infections should be treated with topical antifungal agents until cleared. Prompt use of antifungals either prophylactically or at the earliest sign of recurrence can reduce the risk of spreading. Patients with peripheral edema are predisposed to recurrent cellulitis, and support stockings, good skin hygiene and prompt treatment of *tinea pedis* (athlete's foot) can help prevent recurrences. Despite these measures, some patients continue to struggle with frequent episodes of cellulitis and may benefit from prophylactic use of penicillin G or erythromycin.

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