

Providing evidence-based care for patients with lower-extremity cellulitis

Find out how to identify and intervene for this potentially dangerous bacterial skin infection.

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Cellulitis is an acute, painful, and potentially serious spreading bacterial skin infection that affects mainly the subcutaneous and dermal layers. Usually of an acute onset, it's marked by redness, warmth, swelling, and tenderness. Borders of the affected skin are characteristically irregular. Although cellulitis may occur in many body areas, this article discusses the most common location—the lower limb.

In cellulitis, bacteria enter through an

The body reacts to these microbes as foreign, leading to presenting signs and symptoms. On assessment, clinicians may notice a recent insect bite, surgical incision, or trauma to the leg.

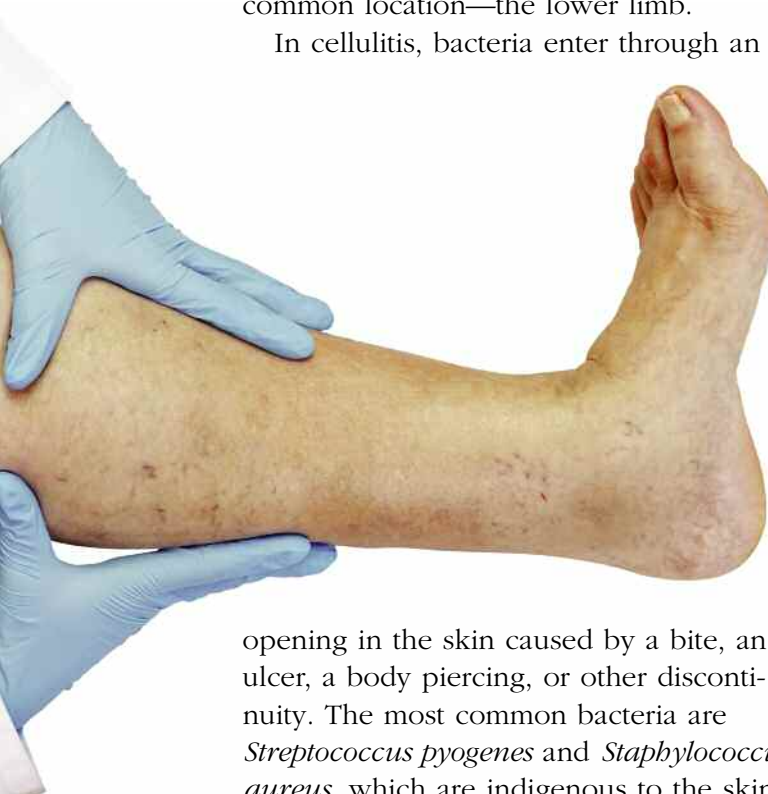
Cellulitis and cutaneous abscesses combined cause nearly 600,000 hospital admissions annually in the United States—an increase of 65% since 1999. Cellulitis and other soft-tissue infections account for up to 10% of hospital admissions. Incidence of cellulitis ranges from 0.2 in 1,000 person-years to 24.6 in 1,000 person-years in different populations.

In 2006, about 14.5 million cases of cellulitis occurred, incurring costs of approximately \$3.7 billion overall. Costs may rise when the condition is misdiagnosed or when antibiotics are used inappropriately, as this may prolong treatment or predispose patients to complications.

What the literature shows

In 2012, Lipsky and colleagues completed a prospective multicenter study of patients with soft-tissue infections to explore the epidemiology, clinical presentation, treatment, and clinical outcomes. Of the 1,033 subjects, 26.9% had cellulitis and the same percentage had diabetic foot infections. In contrast, surgical-site infections affected 16.7% and deep soft-tissue

opening in the skin caused by a bite, an ulcer, a body piercing, or other discontinuity. The most common bacteria are *Streptococcus pyogenes* and *Staphylococcus aureus*, which are indigenous to the skin.



abscesses affected 13.6%. The lower leg was the most common cellulitis site (49.6%). Pain was rated as moderate to severe in 73% ($n = 203$) of patients. Overall, patients with cellulitis had more severe erythema and local warmth than those with other soft-tissue infections. However, abscess, induration, tenderness, and pain were more common and more severe in patients with deep soft-tissue abscess. Leg warmth was absent in only 10 of the 278 cellulitis patients.

Comorbidities most often accompanying cellulitis included diabetes, peripheral vascular disease, chronic lung disease, and renal insufficiency. Treatment included initial I.V. vancomycin in 60% of patients, followed by penicillins, beta-lactamase inhibitors, and cephalosporins. For patients hospitalized with cellulitis, the mean stay was 7.1 days (range, 5.8 to 8.1 days).

A 2010 study by Kilburn and colleagues found 25 randomized controlled trials related to cellulitis. The review noted that macrolides reportedly were more effective than penicillins in treating cellulitis and oral antibiotics were more effective than I.V. antibiotics. But due to lack of research-supported findings, reviewers couldn't give specific recommendations for cellulitis treatment; further study is needed to determine the best treatment.

A retrospective epidemiologic and outcomes study by Zervos and colleagues (in 2012) assessed the origin of complicated and soft-tissue infections and the appropriateness of initial antibiotic therapy in hospital patients. In the sample of 1,096 patients, the most common soft-tissue infections were cellulitis and abscess, usually community acquired. *S. aureus* was the most common culture-positive skin infection; 74% of these infections were methicillin-resistant. More work needs to be done to examine the impact of skin infections and use of appropriate initial therapy for such infections.

Risk factors

Cellulitis is common in patients with circulatory problems of the legs, particularly those with venous disease. Anyone who sustains leg trauma, an insect bite, or a surgical wound is at risk. People who are overweight or have leg ulcers or lymphedema are at higher risk. Lymphedema especially increases cellulitis risk because the lymphatic pathways transport immune cells to fight infection; if these pathways are blocked, cellulitis can readily occur.

Cellulitis is common in patients with circulatory problems of the legs.

Cellulitis isn't contagious because it's an infection of the dermis and subcutaneous tissues, which act as a protective layer over the infected tissues. Rarely, it can lead to a deeper, more serious skin infection, such as necrotizing fasciitis.

Diagnosis, staging, and classification

Clinical Resource Efficiency Support Team (CREST) guidelines aid diagnosis. Cellulitis ranges from class I to class IV, with IV being the most severe.

- Class I: Patients lack systemic signs or symptoms.
- Class II: Patients have comorbid conditions that affect recovery.
- Class III: Patients have accompanying limb-threatening conditions or confusion, tachycardia, or other unstable conditions.
- Class IV: Patients have severe, life-threatening infections or septicemia. (See *Classifying cellulitis*.)

Classifying cellulitis

This chart describes characteristics of the four classes of cellulitis.

CLASSIFICATION	CHARACTERISTICS
Class I	<ul style="list-style-type: none">• No signs or symptoms of systemic toxicity• No uncontrolled comorbidities
Class II	<ul style="list-style-type: none">• Systemic illness <i>or</i>• Systemic wellness with comorbid conditions—for instance, peripheral vascular disease, chronic venous insufficiency, or morbid obesity, which may impede resolution of infection
Class III	<ul style="list-style-type: none">• Significant systemic signs and symptoms, such as acute confusion, tachycardia, tachypnea, or hypotension• Unstable comorbidities that may interfere with response to therapy• Limb-threatening infection caused by vascular compromise
Class IV	<ul style="list-style-type: none">• Sepsis syndrome.• Severe life-threatening infection, such as necrotizing fasciitis

Based on Clinical Research Efficiency Support Team (CREST). Guidelines on the Management of Cellulitis in Adults. June 2005. www.acutemed.co.uk/docs/Cellulitis%20guidelines,%20CREST,%202005.pdf

Cellulitis treatment

Treatment of cellulitis depends on its classification.

- **Class I:** oral antibiotics in an outpatient setting
- **Class II:** oral or I.V. antibiotics in an outpatient setting
- **Class III:** hospitalization for I.V. antibiotic therapy
- **Class IV:** urgent hospitalization for intensive multiple therapy and specialist consult

Differentiating cellulitis from similar conditions

Cellulitis is diagnosed definitively based on classic symptoms, which include a unilateral hot, erythematous, nonblanching redness that persists with limb elevation. Skin may be dry and flaking. Commonly, subcutaneous tissue is tender; in severe cellulitis, crepitations may occur.

Differentiating cellulitis from other conditions may prove challenging. One study with a sample of 635 patients who'd been diagnosed with cellulitis found only 425 (67%) actually had the condition. Disorders that can mimic cellulitis include eczema, tinea pedis, and other chronic conditions such as erysipelas. Lipodermatosclerosis also may be mistaken for cellulitis.

Unlike cellulitis, venous eczema can cause a range of manifestations, such as bilateral symptoms, itching, hemosiderin deposits, and edema. Suspect venous eczema, not cellulitis, in a patient with reddened leg skin, chronic venous disease or an ulcer, and a history of appropriate antibiotics with no improvement.

Dependent rubor from peripheral vascular disease also may resemble cellulitis. But in this condition, further assessment reveals short-distance claudication or “rest” pain, lack of hair growth on the lower limb, and redness that completely disappears on elevation.

Assessing for induration

If you suspect cellulitis, assess for induration—a hardened mass or formation with defined edges, with slight swelling and firmness at the edges or border between normal skin and skin affected by cellulitis. The Bates-Jensen Wound Assessment Tool recommends assessing induration by gently attempting to pinch the affected area; with induration, you won't be able to pinch the tissue. Use a measuring tool to document how far induration extends. Wound care clinicians typically outline the indurated area from visit to visit to

determine if induration has increased or decreased.

Treatment

Guidelines for cellulitis treatment hinge on severity. A triple approach using I.V. antibiotics, I.V. fluids, and pain management is recommended. Light compression is suggested if the ankle-brachial index (ABI) is adequate, but use caution during an acute cellulitis episode. Consider limb elevation and analgesics for comfort.

Treatment should be prompt to help prevent complications. Using the HAMMMER acronym can help you remember the essential elements of treatment. (See *Cellulitis treatment* and *HAMMMER interventions*.)

Antibiotics

Clinicians typically prescribe a 14-day course of antibiotics (unless contraindicated) if they're unsure whether inflammation stems from infection. Advise patients to contact their primary care practitioner if they don't notice a response to therapy within 3 days. Antibiotics are effective in about 90% of cases. If the affected area is quite small and cellulitis isn't severe, it may clear without antibiotics; if exudate is more than minimal, the patient usually needs antibiotics.

Empirical treatment with semisynthetic penicillin, first- or second-generation cephalosporins, macrolides, or clindamycin is advised, primarily because of the increasing incidence of methicillin-resistant *S. aureus* (MRSA) or erythromycin-resistant *S. pyogenes*. When cellulitis surrounds an abscess formation with MRSA, about half of the infections resist clindamycin. Of the *S. pyogenes* cases resistant to macrolides, about 99.5% are susceptible to clindamycin and 100% to penicillin. If the condition doesn't improve, symptoms are extensive, or the patient has a high temperature, hospitalization and I.V. antibiotics may be warranted.

HAMMMER interventions

To help you remember interventions for patients with cellulitis, think HAMMMER.

- H** for *Hydrate*: Urge patients to drink plenty of fluids—about 68 oz per day if possible.
- A** for *Analgesia*: Provide pain relief on a regular basis.
- M** for *Monitor pyrexia*: Is the patient's temperature still rising?
- M** for *Mark off the area*: Is the redness spreading?
- M** for *Measure limb circumference*: Is leg size increasing?
- E** for *Elevate the limb*: Reduce swelling, if possible.
- R** for *Record assessment findings*: Ensure accurate documentation.

Based on Beasley A. Management of patients with cellulitis of the lower limb. *Nurs Stand*. 2011;(26)11:50-5.

I.V. fluids and hydration

As with any systemic infection, I.V. fluids are indicated, as the infection can significantly increase insensible water loss, in turn causing dehydration and possibly multisystemic failure.

Compression

In the past, studies recommended against using compression, assuming it could spread bacteremia. Current best practice includes light compression therapy used cautiously. (Acute infections that lead to swelling can cause higher tissue pressures than normal and compression could fur-

Recurrent cellulitis can damage the lymphatic drainage system of the affected limb, causing lymphangitis, chronic lymphedema, or both.

Cellulitis: A case study

Henry Castillo*, a 68-year-old migrant farm worker, comes to your clinic for diabetes management. On examination, you find a weeping open leg wound with lower-leg redness and swelling. You note early signs and symptoms of chronic obstructive pulmonary disease, including shortness of breath on exertion and bilateral inspiratory wheezes.

Mr. Castillo's history includes type 2 diabetes with peripheral neuropathy and hypertension. He reports he smokes one pack of cigarettes daily and drinks two or three beers a day.

Initial laboratory tests show a glycosylated hemoglobin (HbA1c) level of 9.7, white blood cell count of 13,000, hemoglobin level of 11.7 g/dL, low-density lipoprotein level of 187 mg/dL, high-density lipoprotein level of 50 mg/dL, and total cholesterol level of 252 mg/dL.

Further assessment is warranted. You observe induration and dry, flaky skin on his lower leg, but no obvious signs of peripheral arterial disease. You stage his cellulitis as class II and document absence of peripheral

arterial disease. Oral antibiotics and increased fluids are ordered. Although Mr. Castillo is treated at home, he will require hospitalization if his inflammation spreads while on oral antibiotics, if he has a suspected systemic infection, or if he shows objective signs and symptoms of infection, including an elevated temperature or a red streak spreading up toward the trunk.

Mr. Castillo is prescribed oral antibiotics with analgesics and moisturizing lotions to increase his comfort. He is referred to the wound care center for ankle-brachial index measurement, which reveals adequate circulation. The clinician marks the affected leg area to help determine if induration is increasing or decreasing, cleans the wound with normal saline solution, and carefully applies an antimicrobial absorbent dressing.

The clinician correctly applies compression wraps, and teaches Mr. Castillo how to protect the compression wraps and what to do if they seem too tight. She instructs family members to make sure he keeps his

leg elevated properly to relieve the accompanying edema. She also advises him when to return to the clinic and teaches him how to do ankle exercises to increase blood flow. She instructs family members how to support the limb carefully when moving and turning him.

To ensure comprehensive care, the clinician refers Mr. Castillo to a nutritionist for dietary management of his low hemoglobin value and high cholesterol and HbA1c levels. The treatment plan includes physical therapy, wound care, compression therapy, foot exercises, and routine monitoring after his clinic visit.

When Mr. Castillo returns to the clinic, the clinician notes improvement. Induration and redness have decreased, no signs or symptoms of fever are present, and his wound has healed. She fits him for compression stockings to decrease the risk of cellulitis recurrence. For this patient, comprehensive, holistic management resulted in a positive outcome.

*Fictitious name

ther compromise the limb.) Teach the patient how to apply and care for the compression hose. Before considering compression in any form, perform a vascular assessment, including ABI measurement. (See *Cellulitis: A case study*.)

Pain management and skin comfort

Assess the patient's pain level and provide pain management as needed. Nonsteroidal anti-inflammatory drugs hasten healing when combined with antibiotics. Moisturizing the limb can reduce skin dryness and flaking and ease discomfort.

Limb elevation

Elevating the affected leg above heart level is a key intervention for cellulitis. Raise the ankle higher than the knee, the knee higher than the hip, and the entire leg higher than heart level. Continue elevation for the first 24 to 48 hours while I.V. antibiotics are infusing.

Monitoring for complications

Measure the patient's temperature on an ongoing basis. Expect to obtain blood cultures as a standard of care. For complex patients with peripheral arterial disease, as-

sess for complications, such as gangrene and poorly healing wounds.

If cellulitis doesn't respond to ordinary treatment, suspect complications, such as septicemia. This condition arises when bacteria spread to the lymph system and bloodstream. Rarely, the infection may spread to deeper fascial tissues (resulting in necrotizing fasciitis) or to the bone (causing osteomyelitis). Signs and symptoms of systemic infection include chills, sweating, fatigue, general malaise, muscle ache, and a sensation of heat. These require prompt attention.

Recurrent cellulitis can damage the lymphatic drainage system of the affected limb, causing lymphangitis, chronic lymphedema, or both. Also, abscesses may form if the infection becomes highly localized in a small area.

Innovations in therapy

In England, a nurse-led "Red Legs" service has been established to help meet the needs of patients with conditions that can be misconstrued as cellulitis. A team of healthcare professionals established integrated care pathways for cellulitis diagnosis and treatment. Results were promising and included a significant cost savings. Another group of British researchers reported on the effectiveness of training caregivers about cellulitis using simulation methods. In a 2011 simulation study by Unsworth and colleagues, nurses who participated in patient simulation scenarios had a 45% increase in confidence levels regarding diagnosing and managing cellulitis and recognizing patient deterioration. Further research is needed so healthcare professionals can provide cost-effective, evidence-based treatment for the many individuals affected by cellulitis. ■

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