



Cellulitis

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Cellulitis is a rapidly spreading infection of the skin characterized by redness, pain, and swelling, and often accompanied by fever, malaise, chills, and headache. Abscess and tissue destruction are common complications when this infection is not treated with antibiotics.

Prevalence

A review of all patients seen by the Boston Health Care for the Homeless Program from January 1996 through August 2002 found that 7% developed cellulitis during that period. Of these patients, 45% were either hospitalized or admitted to BHCHP's Medical Respite Program at the Barbara McInnis House. Nine percent of this group left AMA (against medical advice) before completion of the course of prescribed antibiotics. Of those receiving treatment as outpatients in BHCHP's shelter and hospital clinics, 16% were lost to follow up.

No data could be found to quantify the incidence of cellulitis within the general population of the USA. Cellulitis accounted for 158 consultations per 10,000 persons in the United Kingdom in 1991. Additionally, skin and subcutaneous infections were responsible for 29,820 hospital admissions and a mean occupancy of 664 hospital beds each day.

Symptoms, Predisposing Factors, and Diagnosis

Cellulitis occurs anywhere on the skin. The most common clinical signs and symptoms include redness, generalized swelling, tenderness, and increased warmth. The differential diagnosis is

broad: erysipelas, erythema serpens or erysipeloid (an infection seen in fisherman and meat handlers), deep venous thrombosis, and local skin irritation secondary to radiation treatment.

Cellulitis occurs when bacteria invade the skin, usually through an interruption in the epidermis such as a cut, abrasion, bite, needle injection, surgical incision, fungal infection, psoriasis, eczema, and many other things. The characteristics of the infection depend upon the specific location on the body and the nature of the invading pathogen(s). As the infection progresses, leukocytes infiltrate the area and debris is formed. Suppuration (formation of pus) and necrosis (localized tissue death), can follow when the infection is untreated. Occasionally an abscess is created that encapsulates the infection and theoretically safeguards the surrounding tissue. An abscess can rupture and form a furuncle, which communicates with the outside skin. Fistulas and chronic draining sinuses may also result from this infectious process.

Cellulitis can easily spread and disseminates along the paths of least resistance, especially veins, fascial planes, and the lymphatics. This spread along the lymphatics can cause a visible red streak that is known as lymphangitis. The regional lymph

*Stasis Ulcer with Cellulitis.
This elderly man has venous stasis disease, marked swelling of both lower extremities, and a large stasis ulcer. He has been admitted to McInnis House with frequent episodes of cellulitis.
Photo by James O'Connell MD*

Cellulitis of the Lower
Extremity.
This man with
COPD and chronic
heart failure
has intermittent
edema of his lower
extremities and has
been hospitalized
several times for
severe cellulitis
of his legs.
Photo by
James O'Connell MD



nodes that drain the area of the infection can become red, swollen, and tender. Constitutional symptoms, especially fever, can be present when the infection spreads.

Several factors can place homeless and other individuals at greater risk of developing cellulitis:

- malnutrition, exposure to the elements, lack of adequate rest, communal living with exposure to common communicable diseases, poorly-controlled chronic medical illnesses such as diabetes and peripheral vascular disease, limited access to showers and washing areas, psychiatric illness, and substance abuse are all likely to be associated with a greater risk for developing cellulitis and can hinder prevention and early treatment of this infection;
- swollen or edematous extremities are commonplace among homeless populations. This edema can lead to decreased blood flow to the extremity and cause tissue hypoxia. Changes in the integrity of the skin can result, including ulcers and chronic stasis dermatitis. Such areas of the skin are susceptible to invasion by *Staphylococcus*,

Streptococcus, and other bacteria that exist as normal flora of the skin;

- injection drug use can cause a chemical irritation of the skin or integument. Binswanger and colleagues assessed intravenous drug users in a San Francisco neighborhood and found that 32% had cellulitis or abscesses as a result of needle use.

Treatment

The treatment of cellulitis consists of two phases: eradication of the acute infection and preventive measures to reduce the risk of recurrence. Antibiotics are necessary to treat the acute infection. Admission to an acute care hospital is often necessary for empiric treatment with a broad-spectrum IV antibiotic, particularly for vulnerable individuals. Persons with compromised immune systems and those with chronic diseases such as diabetes are at high risk for complications from cellulitis. Other high-risk individuals include the elderly, injection drug users, and persons who are homeless.

The choice of antibiotic for the treatment of acute cellulitis depends upon the most likely organisms to be involved. *Staphylococcus aureus* and group A beta-hemolytic *Streptococcus pyogenes* (GAS) are the most common pathogens in adults, while *Haemophilus influenzae*, GAS, and *S. aureus* are seen in children. Uncommon pathogens include *Haemophilus influenzae* type b (Hib), group B streptococci (GBS) and pneumococci. Diabetics and immunocompromised persons may develop cellulitis from a variety of organisms, including *Escheria coli*, *Proteus mirabilis*, *Acinetobacter*, *Enterobacter*, and *Pseudomonas aeruginosa*. *Staphylococcus aureus* is the most common cause of cellulitis in injection drug users.

Many new antibiotics, as well as new preparations of older ones, allow once or twice a day dosing and may be good choices for homeless patients who have difficulty with TID or QID dosing regimens. These medications are more expensive than the older antibiotics and can potentially cause resistance if used frequently. We urge clinicians to use dicloxacillin (Dynapen™) or cephalexin (Keflex™) whenever possible.

Adjunctive treatment for cellulitis includes rest, hydration, proper nutrition, elevation of the affected limb, warm compresses, pain management, and the appropriate length of antibiotic treatment (usually 10 to 14 days). When the treatment is complicated by edema or excessive swelling, some clinicians have utilized a short course of diuretic therapy in order

Table 1: The Treatment of Cellulitis

ANATOMIC SITE/ MODIFYING CIRCUMSTANCES	PRIMARY REGIMEN	SECONDARY REGIMEN	COMMENTS
Extremities (not associated with venous catheter insertions, and no history of diabetes)	mild, non-toxic, can be easily monitored: dicloxacillin (Dynapen™) 500 mg PO QID X 10-14 days or cephalexin (Keflex™) 500 mg PO QID X 10-14 days	erythromycin (Eryc™, E-mycin™) 500 mg PO QID X 10-14 days or amoxicillin/clavulanate (Augmentin™) 875 mg/125 mg PO BID or 500/125 PO TID X 10-14 days or clarithromycin (Biaxin™) 500 mg PO Q12H X 10-14 days or clarithromycin ER (Biaxin XL™) 1000 mg PO QD X 10 days or azithromycin (Zithromax™) 500 mg PO QD x 1 day, then 250 mg PO QD X 4 days or clindamycin (Cleocin™) 300 mg PO Q6H X 10-14 days	With serious cellulitis requiring hospitalization: nafcillin (Nallpen™) or oxacillin (Bactocill™) 2 gm IV Q4H or cefazolin (Ancef™) 1-2 gm IV Q8H
Cellulitis in diabetics	Early and mild: 2nd or 3rd generation cephalosporins, such as cefotetan (Cefolin™) 1-3 gm IV or cefoperazone (Cefobid™) 2 gm Q12H to 4 gm Q6H		In the presence of a non-healing diabetic foot ulcer: ampicillin-sulbactam (Unasyn™) 3 gm IV Q6H or imipenem cilastatin (Primaxin™) 0.5 gm IV Q6H or meropenem (Merren™) 1 gm IV Q8H
Facial cellulitis (with acute otitis media or sinusitis)	nafcillin (Nallpen™) or oxacillin (Bactocill™) 2 gm IV Q4H	ceftriaxone (Rocephin™) 2 gm IV QD or cefuroxime (Ceftin™) 1.5 gm IV Q8H	
Cellulitis in those with a serious and life-threatening allergy to penicillin allergy	Clindamycin (Cleocin™) 600 mg IV Q8H or Vancomycin (Vancocin™) 1 gm IV Q12H		For those with mild or non-life threatening allergies to PCN, most of the above mentioned medical regimens are well-tolerated.
For suspected or proven MRSA (methicillin-resistant S. aureus)	Vancomycin (Vancocin™) should be used		

to optimize the flow of blood and antibiotics to the affected area of the skin.

Complications

Untreated cellulitis may lead to bacteremia, endocarditis, gangrene, metastatic abscesses, and sepsis. Co-morbid conditions can impede the treatment of cellulitis and increase the likelihood of complications, such as poorly controlled diabetes, peripheral vascular disease with edema and lower extremity ulcerations, and chronic tinea pedis.

Elderly persons and homeless individuals also are at higher risk for complications.

Prevention and Control

Cellulitis can become a recurrent infection unless preventive measures are taken. Tinea pedis is often the portal of entry for the bacteria that cause cellulitis and should be aggressively treated (see chapter on Tinea Pedis). The use of support stockings can be very helpful in preventing the chronic lower extremity edema that leads to ulcers

Cellulitis of the Lower Extremity. Marked swelling, redness, and warmth are characteristic of cellulitis. Photo by James O'Connell MD



and skin breakdown. Individuals with tinea pedis, chronic venous stasis dermatitis, as well as those who have undergone coronary artery bypass surgery and harvesting of the saphenous vein, should be instructed to wash their feet daily with a benzyl peroxide bar followed by an antifungal cream. All homeless individuals should receive the pneumococcal vaccine.

Special Considerations for Homeless Populations

Skin and foot problems are common among homeless people. People who live on the street are particularly prone to develop cellulitis or other skin conditions. Predisposing factors, such as onychomycosis, tinea pedis, corns, calluses, and immersion foot, are usually the result of inadequate footwear, prolonged exposure to moisture, long periods of walking and standing, and repetitive minor trauma.

Salit and colleagues compared lengths of stay and reasons for hospitalization among homeless and other low-income persons in New York City to estimate costs associated with homelessness. Skin disorders, including cellulitis, accounted for 8.4% of homeless admissions, but only 4% of admissions for poor housed patients and 3.7% of admissions to private hospitals in NYC. The mean length of stay for the homeless patients was 3.4 days more than for private patients and 1.8 days more than for the poor housed patients.

When available, medical respite care for homeless persons can be an important component of the treatment of cellulitis. Many hospitalizations can be avoided by admission to a facility where bed rest and elevation of the extremity are possible, medications can be administered, and the clinical course

carefully monitored by physicians, mid-levels, and nurses. For those homeless persons who have been admitted to the hospital for cellulitis, the length of stay can be shortened by early transfer to a respite care facility.

Summary

Cellulitis and its potential complications are seen frequently among the homeless population. Common signs of cellulitis in the lower extremities include redness, generalized swelling, pain, tenderness, and increased warmth. It can easily spread to veins, facial planes, and the lymphatics. Fever is often present if the infection spreads. Primary recommended treatment of uncomplicated infection includes either dicloxacillin (Dynapen™) or cephalexin (Keflex™). If intravenous antibiotics are needed, nafcillin (Nallpen™), oxacillin (Bactocill™), or cefazolin (Ancef™, Kefzol™) are the drugs of choice. Adjunctive treatment includes rest, hydration, proper nutrition, elevation of the affected limb, warm compresses, and pain management.

Factors that may predispose homeless persons to develop lower extremity cellulitis include chronic malnutrition, lack of adequate rest, communal living with exposure to communicable diseases, limited access to showers, and poorly controlled chronic medical illnesses. Early detection is often impeded by lack of access to health care, untreated psychiatric illness, and/or substance abuse.

Homeless persons are more often admitted to an acute care hospital for treatment, with a resultant longer length of stay than the general population. Respite facilities can aid in the timely discharge of a homeless patient or can prevent an acute care admission if the infection is noted early and treatment can be given on an outpatient basis. ■■

Cellulitis Medication List

Generic	Brand Name	Cost
dicloxacillin	Dynapen	\$
cephalexin	Keflex	\$
erythromycin	Eryc, E-mycin	\$
amoxicillin-clavulanate	Augmentin	\$\$\$
clarithromycin	Biaxin	\$\$\$
ceftriaxone	Rocephin	\$\$\$\$
nafcillin	Nallpen	\$\$\$\$
oxacillin	Bactocill	\$
cefazolin	Ancef, Kefzol	\$\$\$
azithromycin	Zithromax	\$\$
clindamycin	Cleocin	\$\$
cefotetan	Cefotan	\$\$\$\$
cefoperazone	Cefobid	\$\$\$\$
ampicillin-sulbactam	Unasyn	\$\$\$\$
imipenem-cilastatin	Primaxin	\$\$\$\$
meropenem	Merrem	\$\$\$\$
cefuroxime	Ceftin, Kefurox, Zinacef	\$\$\$
vancomycin	Vancocin	\$\$\$\$

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*BHCHP nurse Trish Bowe offering care to a backstretch worker outside the stables at Suffolk Downs Racetrack in Boston.
Photo by Stan Grossfield*