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Review Article

CELLULITIS DISEASE - AN OVERVIEWSatish Mane^{*1}, Sandip Maske², Pavan Konde³, Krushna Bhorgir⁴Loknete Shree Dadapatil Pharate College of Pharmacy, Mandavgan Pharata, Pune,
Maharashtra, India 412211.**Abstract:**

Cellulitis is a bacterial infection of the skin presenting with poorly demarcated edema, warmth, and tenderness in common. Although it can be a diagnostic and therapeutic treatment challenge in world wide. In this review the pathophysiology, Microbiology types, causes, sign and symptoms, diagnosis, prevention and treatment of cellulitis have been discussed. The approach to types, Diagnosis, treatment is review and the importance of clinical mimics of cellulitis is highlighted. An approach to empirical treatment is presented with recent recommendations from the WHO. Cellulitis is an infection of the deep dermis and subcutaneous tissue, presenting with expanding warmth, tenderness, and swelling. Cellulitis is a common global (as well as India) health burden, with more than 1,00000 admissions per year in the India and 85,000 admission in United States of America.

Keywords: *Cellulitis disease, Causes, Sign and Symptoms, Pathophysiology, Diagnosis, Treatment.*

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INTRODUCTION:

Cellulitis is a bacterial infection of the skin and tissues under the skin. Which is a very superficial skin infection. Cellulitis is a bacterial skin infection they cause deep skin layer under the dermis and subcutaneous tissue[16,17]. The main bacteria for cellulitis are Streptococcus and Staphylococcus MRSA (methicillin-resistant Staph aureus) can also cause cellulitis[1]. Sometimes other bacteria like Hemophilus Influenzae, Pneumococcus, and Clostridium species may cause cellulitis as well. Cellulitis is fairly common and affects people of all ages. Men, women and child appear to be equally affected. Although cellulitis can occur in people of any age, it is most common in middle-aged and elderly people. Cellulitis is not contagious[1,17].

PATHOPHYSIOLOGY

Cellulitis is a deep dermal and subcutaneous infection that occurs when pathogens gain entry into the dermis through breaks in the skin. Cutaneous barrier disruption can be caused by toe web space bacteria, fungal foot infections (eg. tinea pedis, onychomycosis), pressure ulcers, and venous leg ulcers[17]. Colonization is reduced by the presence of a low surface pH, low temperature, and commensal microorganisms. The histologic features of cellulitis are nonspecific and include dermal edema, lymphatic dilation and diffuse heavy neutrophil infiltration around blood vessels. Later stages may also feature lymphocytes and histiocytes

along with granulation tissue. Usually cultures performed with needle aspiration or biopsy yield negative results, and when they are positive, the concentration of bacteria is low[1,2]. This suggests that either a very small number of bacteria are responsible for the induction of the robust inflammatory response or the immune system reduces the number of viable bacteria to very low or nonexistent numbers by the time patients present for treatment.

MICROBIOLOGY

Cellulitis in immunocompetent adults is usually thought caused by group A streptococci (Streptococcus pyogenes) and (Staphylococcus aureus)[3] main cause, given the difficulty culturing cellulitis, the specific causative agent is unknown and some studies demonstrate evidence in prevalence of causative organism[2,4]. Blood cultures identified in only 7.9% of 1578 patients in systemic review, 19% of Streptococcus pyogenes 38% of the B Hemolytic Streptococcus, 14% of S Aureus and 28% were gram-Negative bacterial organism[4,7,9,17]. Some cellulitis are unknown causative agent and treatment is difficult occurs because the causative agent is impossible to know the true frequency of bacterial resistance. In bacteria resistance Streptococci Aureus. Which increase use of antibiotics Eg; (Vancomycin, Sulphamethaxazole, Doxycycline, clindamycin and broad spectrum antibiotics. Eg. B-lactum, cetrizone, Levofloxacin in past decade[5,6,8].



Fig. 1- Cellulitis disease infection in body parts

TYPES

Cellulitis can be classified into different types, according to where it appears. This can be

1. Around the eyes, known as periorbital cellulitis
2. Around the eyes, nose, and cheeks, known as facial cellulitis
3. Breast cellulitis
4. Perianal cellulitis, occurring around the anal orifice
5. However, the most common location is the lower legs.[18,19]

CAUSES OF CELLULITIS

Most cellulitis infections are caused by either strep (Streptococcus) or staph (Staphylococcus) bacteria[36]. Streptococcus pyogenes leads to about 75 percent of cellulitis cases today, while Staphylococcus makes up almost 25 percent[37]. Beta-hemolytic streptococci (including groups A, B, C, G and F) are the most common types of strep bacteria that cause cellulitis. Another form of strep bacteria caused cellulitis (which is actually rather superficial in nature) is called erysipelas. This condition is characterized by a bright red circumscribed area on the skin with a sharp, raised border and is warm to the touch. Erysipelas is more common in young children[38]. Staphylococcus aureus bacteria are commonly found on the skin and noses of healthy people[39] so how do you get cellulitis from this type of strain? The problem arises when the bacteria enter your skin through open cracks or tears but aside from causing cellulitis, there is more alarming danger that Staph bacteria pose particularly the Methicillin-resistant Staphylococcus aureus (MRSA) strain[7] Streptococcus pneumonia, Mycobacterium tuberculosis, Escherichia coli Campylobacter, Haemophilus influenzae, Cryptococcus neoformans[21-30].

Chronic liver disease[26,32,33]

- Campylobacter
- Acinetobacter
- Neisseria gonorrhoeae
- Burkholderia cepacia

Chronic kidney disease[25,34,35]

- V alginolyticus
- Neisseria meningitides
- E coli

Aquatic soft tissue injury[31]

Vibrio spp
Aeromonas spp
Mycobacterium marinum
Shewanella spp
Streptococcus iniae
Erysipelothrix rhusiopathiae

SIGNS AND SYMPTOMS [15,17,20]

- ❖ Chills
- ❖ Enlarged Lymph Nodes
- ❖ Enlarging Skin Sore
- ❖ Fatigue
- ❖ Fever
- ❖ Pain
- ❖ Red Streaks on the Skin
- ❖ Reddened Skin
- ❖ Swelling
- ❖ Tenderness
- ❖ Tight or Stretched Appearance of Skin
- ❖ Warm Skin

DIAGNOSIS**Exams and Tests for Cellulitis**

Your doctor will do a medical history and physical exam. Additional procedures include:

- ✓ A blood test- If the infection is suspected to have spread to your blood[17,18,20].
- ✓ An X-ray- If there is a foreign object in the skin or the bone underneath is possibly infected[17].
- ✓ A culture- Your doctor will use a needle to draw fluid from the affected area and send it to the laboratory[17,20].

PREVENTION MEASURES OF CELLULITIS

1. Practice good personal hygiene and keep your skin clean[40].
 2. Wear sturdy, well-fitting shoes or slippers with loose-fitting cotton socks. Avoid walking bare foot outdoors[10,11].
 3. Wash injured skin with soap and water. Make sure it heals over the next few days.
 4. Clean and Protect Open Cuts on Your Skin[12].
Steps you can take to treat open cuts in your skin and prevent bacteria from further proliferating include
- ✓ Gently wash your skin, especially any open wound or cuts, daily with natural antibacterial soap and water. If your doctor performs an incision, always follow directions regarding how to cleanse the wound, plus those for the application of bandages or ointments. Be sure to wash your hands before touching openings in your skin[40].
 - ✓ Look for any signs of an infection forming near wounds, including swelling, redness, heat, tenderness or pain. If you notice any blisters or cysts forming that contain pus (these may look yellow or form a white head), let your doctor know right away[17,20].
 - ✓ When you have any scab, scrape, cut or burn,

- apply a protective cream or ointment to help with healing. Keep skin moisturized to prevent cracking and peeling. You can make your own homemade treatment using natural antibacterial essential oils, which can be used in the same way as most over-the-counter antibiotic ointments (such as Neosporin).
- ✓ Keep damaged or irritated skin cool, damp if necessary (by applying moist bandages if you're doctor recommends this) and elevated if swelling is bad. Keep healing skin away from very hot water or very cold temperatures.
 - ✓ Avoid applying any irritating or toxic chemical products to your skin while it's healing, including perfumes, soaps, lotions, makeup, etc., and instead opt for natural cleaning products.
 - ✓ Keep damaged or sensitive skin out of extreme cold or heat. Avoid sunlight if skin is healing, or consider wearing gloves and a hat depending on the weather[15,16,17].
5. Practice Good Hygiene
- Keeping the skin clean and improving circulation (blood flow) to the skin are important for preventing infections. Here are several steps to practice good skin hygiene as a preventative cellulitis treatment[40].
- ✓ If you have any skin infections that you notice causing symptoms, such as redness and itching, make sure to treat the infection with a natural antifungal cream. This may be due to conditions such as athlete's foot or chickenpox/shingles, which are contagious. Be careful not to touch the skin of anyone else who is infected with a fungal infection, plus carefully wash your hands after leaving any health facility and using shared equipment[20].
 - ✓ Wash and moisturize linens you touch regularly (like your sheets), your skin and clothing using natural products regularly, especially if you've been near anyone who is sick with an infection[20].
 - ✓ Don't share items like razors or other products that touch the skin.
 - ✓ Drink enough water throughout the day, and eat a healthy diet to prevent skin from becoming dehydrated and cracking. This also helps with healing skin rashes.
 - ✓ If you have any medical condition that lowers blood flow/circulation, such as diabetes, check that your skin is not forming patches of dry, peeling or red skin. These can appear on the lower limbs, feet or hands and be a sign of damage that can lead to infection due to poor

drainage[40].

6. Treat Infection with Natural Products
- To help ease discomfort caused by the infection, including blisters and inflammation, some of the following methods can be used
- ✓ Press a warm compress against the rash once or twice daily using a fresh, clean wash cloth or towel.[40]
 - ✓ Soak inflamed skin under a warm shower (but not too hot) or in a warm bath.
 - ✓ Very gentle stretch stiff areas to keep them from getting even more stiff.
 - ✓ Wear loose, breathable clothing made from natural fibers.
 - ✓ Keep any chemical products or skin irritants off the affected area (perfume, scented body soaps, detergents, lotions, etc.).
 - ✓ With clearance from your doctor first, apply soothing essential oils, such as a rash cream with lavender oil, to irritated or swollen skin, combined with a moisturizing carrier oil, such as coconut oil, several times daily. Chamomile oil and tea tree oil are also beneficial for helping the skin heal and feel less inflamed[17,20].

TREATMENT

Cellulitis is a treatable condition, but antibiotics are necessary to eradicate the infection and prevent its spread. Most cellulitis can be effectively treated with oral antibiotics at home. Hospitalization and IV antibiotics are sometimes required if oral antibiotics are not effective. If not properly treated, cellulitis can occasionally spread to the bloodstream and cause sepsis; a serious bacterial infection[5]. Antibiotic regimens to treat cellulitis are effective in more than 90% of patients. Regardless of the pathogen, all but the smallest of abscesses require drainage for resolution. If the abscess is relatively isolated, drainage only-without antibiotics-may suffice[5,8]. In cases of cellulitis without draining wounds or abscess, streptococci continue to be the likely etiology, and beta-lactum antibiotics are appropriate therapy. In mild cases of cellulitis treated on an outpatient basis, dicloxacillin, amoxicillin, or cephalexin may be used. In patients who are allergic to penicillin, clindamycin or a macrolide (clarithromycin or azithromycin) may be appropriate. An initial dose of a parenteral antibiotic with a long half-life (e.g. ceftriaxone) followed by an oral agent may also be called for[5,8,17,20]. In cases of recurrent disease, most often due to *Streptococcus* species (usually related to venous or lymphatic obstruction), penicillin G, amoxicillin, or erythromycin may be effective. If tinea pedis is suspected to be the predisposing cause, treatment

with topical or systemic antifungal is necessary[5,8,20]. Patients with severe cellulitis require parenteral therapy with broad gram-positive, gram-negative, and anaerobic antibiotics, including cefazolin, cefuroxime, ceftriaxone, nafcillin, or oxacillin for presumed staphylococcal or streptococcal infection. Until culture and sensitivity information becomes available, these medications are also warranted as coverage for MRSA for severe cellulitis apparently related to an abscess. In patients who are allergic to penicillin, vancomycin and clindamycine are appropriate[5,8]. For cellulitis

involving wounds in water, recommended antibiotic regimens vary with the type of water involved. For freshwater involvement, a third or fourth generation cephalosporin (e.g. ceftazidime or cefepime) or a fluoroquinolone (e.g. Ciprofloxacin or Levofloxacin) is used. In cases of saltwater exposure, Doxycycline and ceftazidime or a fluoroquinolone (e.g. Levofloxacin) is called for. Lack of response to an appropriate antibiotic regimen should raise suspicion for Mycobacterium marinum infection and suggests wound biopsy for mycobacterium stains and culture[5].

Standard Antimicrobial Dosing

Table No.1: Standard Antimicrobial Dosing for Staphylococcal and Streptococcal Skin Infections[17]

Antibiotic	Adult Dosing / Route of administration
Amoxicillin/clavulanate	875 mg 2 times/d orally
Cefazolin	1 g every 8 h intravenously
Ceftaroline	600 mg every 12 h intravenously
Ceftriaxone	1-2 g/d intravenously
Cephalexin	500 mg 4 times/d orally
Dicloxacillin	250-500 mg 4 times/d orally Oral agent of choice
Meropenem	1 g every 8 h intravenously
Nafcillin	1-2 g every 4 h intravenously Parenteral
Oxacillin	1-2 g every 4 h intravenously Parenteral
Tazobactam	3.375 g every 6 h intravenously
Clindamycine	300-450 mg 4 times/day oral

CONCLUSIONS:

Cellulitis is a common and expensive problem worldwide. It generally responds to relatively simple and inexpensive antibiotic regimens; however, recurrent disease is common and can be minimized by optimizing risk factors for cellulitis, such as lymphedema and skin damage. When cellulitis does not respond to treatment, other conditions that mimic it should be considered. Additional research on the diagnosis and management of cellulitis is needed.

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