

Skin and soft tissue infections

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Abstract

Skin and soft tissue infections (SSTI) range from relatively common superficial skin infections to rare but life-threatening infections like necrotizing fasciitis or gas gangrene. They can affect all ages and predisposing factors include trauma, pre-existing dermatoses, diabetes, and immunocompromise. SSTI are often caused by organisms that colonize the skin, such as *Staphylococcus aureus* or group A streptococci, as a result of a breach in the skin's integrity. Community-acquired methicillin-resistant *S. aureus* (CA-MRSA) is becoming increasingly important as a cause of SSTI. Less common causes include a variety of Gram-negative bacteria, fungi, viruses and parasites. Treatment is usually with topical or systemic antimicrobials, directed against the suspected organism, but urgent surgical debridement is sometimes required.

Keywords cellulitis; ecthyma; erysipelas; folliculitis; gas gangrene; group A streptococci, impetigo; necrotizing fasciitis; skin and soft tissue infection; *Staphylococcus aureus*

Introduction

The skin acts as a barrier between the host and the environment. It comprises several layers. The most superficial is the epidermis, a thin avascular layer overlying the dermis, a thicker layer containing hair follicles, sebaceous glands and sweat glands. Subcutaneous fat lies beneath the dermis and is separated from muscle by a tough layer of fascia (see the article by JE Lai-Cheong and JA McGrath, *Medicine*, 2009; **37**: 223–226 for more information). Infections may affect one or more of these layers.

The skin is colonized by micro-organisms that have the potential to invade and cause infection. *Staphylococcus aureus* and Group A streptococci are the most important pathogens,¹ but other organisms such as Gram-negative bacteria, anaerobic bacteria, viruses, fungi, or parasites can also cause infection. Community-acquired methicillin-resistant *S. aureus* (CA-MRSA) has become an important cause of skin and soft tissue infections (SSTI), particularly in the USA.^{2,3}

SSTIs are common and can affect all age groups. Certain conditions may predispose to SSTIs (e.g. trauma, pre-existing

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What's new?

- Increasing drug resistance in the two most common pathogens (*S. aureus* and group A streptococci) is a concern
- The incidence of severe infections such as necrotizing fasciitis appears to be increasing
- Community-acquired MRSA is emerging as an important cause of SSTI, particularly in the USA

skin conditions, diabetes mellitus, alcoholism, malignancy or immune suppression). SSTIs may occur as single or recurrent episodes, and may be mild and self-limiting or severe and progressive, leading to necrosis of adjacent tissues. Clues to potentially severe deep soft-tissue infection include the following: pain disproportionate to the physical findings; violaceous bullae; cutaneous haemorrhage; skin sloughing; skin anaesthesia; rapid progression; gas in the tissue.¹

A detailed history is essential to establish a specific diagnosis and should include the following:

- onset and duration of symptoms
- appearance and anatomical distribution of the lesion
- history of trauma or surgery
- contact with insects and other animals
- recent foreign travel
- pre-existing medical conditions
- previous antibiotic therapy.

Patients who are systemically unwell should be admitted to hospital and have blood taken for full blood count, biochemical profile, inflammatory markers and blood cultures. When the diagnosis of an SSTI cannot be made on clinical grounds, investigations such as needle aspiration, punch biopsy or surgical debridement may be necessary.

Empirical antimicrobial therapy should be directed towards the likely organism(s) and subsequently tailored in the light of microbiological data. Emerging antibiotic resistance among *S. aureus* (methicillin and erythromycin resistance) and group A streptococci (erythromycin resistance) is a concern. If methicillin-resistance is suspected, vancomycin should be part of the initial treatment regimen.

Impetigo

Impetigo is a superficial pyogenic infection of the epidermis, usually caused by *S. aureus* or Group A streptococci. It usually affects young children and is more common in hot, humid climates. It can cause outbreaks in households, institutions and sports teams. Patients often report a history of minor skin trauma, insect bites or pre-existing dermatoses. Lesions typically occur on the face and hands. Impetigo is characterized by intra-epidermal vesicles, which rupture and crust to form a golden-yellow scab. Constitutional symptoms are usually absent. Impetigo is treated by removal of the crusts and application of topical antibiotics such as mupirocin. Widespread infection responds better to oral or intravenous antibiotics (e.g. flucloxacillin or clindamycin).

Ecthyma

Ecthyma is a form of impetigo that penetrates deeper into the dermis and may scar. It starts as a vesicle and progresses to form a punched-out ulcer surrounded by a violaceous border (Figure 1). Ecthyma often occurs on the legs and is associated with minor trauma, insect bites, eczema, pediculosis, diabetes, and immunodeficiency. Most cases are caused by group A streptococci. A similar lesion called 'ecthyma gangrenosum' is usually associated with *Pseudomonas aeruginosa* bacteraemia,⁴ but has been reported with other organisms (e.g. MRSA, *Citrobacter freundii*, and *Stenotrophomonas maltophilia*).

Ecthyma may be treated with topical mupirocin for mild cases and oral penicillin or clindamycin for more severe cases. Ecthyma gangrenosum should be treated with appropriate antibiotics, depending on the causative organism.

Folliculitis

Folliculitis is an inflammation of the hair follicles that is characterized by clusters of small, erythematous papules or pustules. Any hair-bearing site can be affected, but the sites most often involved are the face, scalp, thighs, axilla, and inguinal area. Certain conditions make patients more susceptible (e.g. frequent shaving, pre-existing skin conditions, occlusive clothing/dressings, exposure to hot humid temperatures, diabetes mellitus, obesity, long-term antibiotic or corticosteroid use, and immunosuppression).

The most common form of folliculitis is sycosis barbae (barber's itch), which is caused by *S. aureus*. Tinea barbae is a fungal folliculitis, caused by various dermatophytes, that resembles its bacterial counterpart. Other infectious causes include *Enterobacteriaceae* (often associated with prolonged antibiotic therapy), *P. aeruginosa* (associated with hot tubs and wet suits),⁵ *Pityrosporum orbiculare* (*Malassezia furfur*), herpes simplex virus, varicella-zoster virus and *Demodex* mites. Non-infectious causes include eosinophilic folliculitis (thought to be an autoimmune process directed against the sebocytes)⁶ and a papulopustular follicular eruption that occurs after treatment with epidermal growth factor receptor (EGF-R) inhibitors.⁷

For recurrent uncomplicated superficial folliculitis, antibacterial soaps and good hygiene may be all that is required. For refractory or deep infections systemic antibiotics may be required (e.g. oral flucloxacillin for staphylococcal folliculitis; treatment

may need to cover MRSA if the patient is colonized). *Pseudomonas folliculitis* is usually self-limiting but oral ciprofloxacin may be given if lesions are persistent or the patient is immunocompromised. *Pityrosporum* folliculitis usually responds to topical antifungals (e.g. ketoconazole cream). Herpetic folliculitis responds to oral antivirals (e.g. valaciclovir). Eosinophilic folliculitis may respond to isotretinoin, metronidazole, UV-B phototherapy, indometacin or itraconazole. Folliculitis associated with EGF-R inhibitors is usually self-limiting.

Furuncles and carbuncles

Folliculitis may progress to involve the dermis, resulting in the development of a subcutaneous boil or abscess (furuncle). The usual cause is *S. aureus*. A number of furuncles may coalesce, resulting in the formation of a 'carbuncle' (Figure 2). Carbuncles are characterized by inflamed skin with pus draining from several hair follicles. Carbuncles are commonly found on areas of thickened skin such as the nape of the neck, the back and the thighs. Fever and malaise are common. Rarely, recurrent furuncles become a problem. Diabetes mellitus, and rare causes of immunodeficiency, such as hyper-IgE syndrome (Job's syndrome) and chronic granulomatous disease, should be considered.

Small furuncles may burst and heal spontaneously; larger ones may require incision and drainage. Carbuncles usually require incision and drainage along with systemic antimicrobials (e.g. oral or intravenous flucloxacillin). Patients with recurrent furuncles who do not have underlying immunodeficiency should be considered for staphylococcal decolonization using mupirocin 2% nasal ointment and chlorhexidine gluconate 4% shampoo/body wash.

Erysipelas

Erysipelas is a superficial bacterial infection of the dermis that also involves the cutaneous lymphatics. It is characterized by



Figure 1 Ecthyma in an immunocompromised patient.



Figure 2 Carbuncle on the dorsum of the foot.

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