

# Skin and soft tissue infections

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## Abstract

Skin and soft tissue infections (SSTIs) range from common superficial skin infections to rare but life-threatening infections such as necrotizing fasciitis. They affect all ages. Predisposing factors include trauma, pre-existing dermatoses, diabetes mellitus and immunosuppression. SSTIs are often caused by organisms that colonize the skin, such as *Staphylococcus aureus* or group A streptococci, because of a breach in the skin's integrity. Community-acquired methicillin-resistant *S. aureus* is increasingly recognized as a cause of SSTI. Treatment is usually with topical or systemic antimicrobials, directed against the suspected organism. Outpatient intravenous antibiotics are increasingly used, and new antimicrobials are emerging for use in these infections. Urgent surgical debridement is sometimes required.

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

## Introduction

Skin and soft tissue infections (SSTIs) make up a large proportion of infectious disease presentations to primary and secondary care. Infectious Diseases Society of America guidance<sup>1</sup> suggests classification based on three clinical criteria:

- skin extension (uncomplicated or complicated)
- rate of progression (acute or chronic)
- tissue necrosis (necrotizing or non-necrotizing).

The US Food and Drug Administration (FDA) has introduced the term 'acute bacterial skin and soft tissue infection' to cover lesions >75 cm<sup>2</sup>. Most SSTIs are caused by Gram-positive organisms, particularly *Staphylococcus aureus* and  $\beta$ -haemolytic group A streptococci. However, Gram-negative or anaerobic bacteria, viruses, fungi and parasites can be involved.

## Host factors

SSTIs can affect any age group, with elderly individuals being at higher risk of severe disease. Conditions predisposing to SSTIs include trauma, pre-existing skin conditions, diabetes mellitus,

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## Key points

- The incidence of severe infections, such as necrotizing fasciitis, appears to be increasing
- Outpatient parenteral antibiotic treatment services are increasingly providing a route for avoiding admission with skin and soft tissue infections (SSTIs)
- New antimicrobials are emerging for use in SSTI
- Antibiotic resistance is an increasing concern in both Gram-positive, particularly community-acquired methicillin-resistant *Staphylococcus aureus*, and Gram-negative organisms

alcoholism, intravenous drug use, peripheral arterial or venous disease, malignancy and immunosuppression. SSTIs can be mild and self-limiting or severe and progressive, leading to tissue necrosis. Clues to potentially severe deep soft tissue infection include pain disproportionate to the physical findings, violaceous bullae, cutaneous haemorrhage, skin sloughing, skin anaesthesia, rapid progression and gas in the tissue.

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

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

Systemically unwell patients should be admitted to hospital, with blood sampling for full blood count, biochemical profile, inflammatory markers and blood cultures. If the diagnosis of SSTI cannot be made on clinical grounds, investigations such as needle aspiration, punch biopsy or surgical debridement may be necessary.

## Antibiotic therapy and antimicrobial resistance

Empirical antimicrobial therapy should be directed towards the likely organism(s) and subsequently tailored in the light of microbiological data.<sup>2</sup> Worldwide, antimicrobial resistance is of increasing concern, but the prevalence of resistant organisms varies widely, and a knowledge of local epidemiology is vital to inform optimal treatment.

Community-acquired methicillin-resistant *S. aureus* (CA-MRSA) is a common cause of SSTI in the USA, and is variably seen across Europe, with a relatively low prevalence in the UK. Vancomycin-intermediate and vancomycin-resistant *S. aureus* have been sporadically described, particularly in the USA. Multidrug-resistant Gram-negative organisms are increasingly prevalent, particularly in hospital-acquired infections, for example surgical site infections (SSIs).

Several new antibiotic agents have emerged.<sup>3</sup> These include second-generation lipoglycopeptide antibiotics, for example

dalbavancin, which has broad Gram-positive cover including MRSA and, *in vitro*, has activity against organisms with reduced susceptibility to vancomycin. Dalbavancin is amenable for outpatient settings as it is dosed once weekly. Tedizolid is a second-generation oxazolidinone with enhanced activity against staphylococci and enterococci compared with linezolid. The new topical agent retapamulin has activity against both staphylococci (including MRSA) and streptococci, and has been approved by the FDA for treatment of impetigo.

In patients who are well enough not to be in hospital with SSTIs but require intravenous antibiotics, outpatient parenteral antibiotic treatment<sup>4</sup> services are being used to facilitate earlier discharge or avoid hospital admission. Antibiotics are administered in an outpatient setting, in the patient's own home or, in some cases, by the patients themselves, after appropriate training.

### Impetigo

Impetigo is a highly contagious superficial pyogenic infection of the epidermis, typically affecting young children. It is commonly caused by *S. aureus* or group A streptococci. Two forms are recognized: bullous and non-bullous. Non-bullous impetigo is characterized by coalescing intraepidermal vesicles, often on the face or hands, which rupture to form a golden crust. In bullous impetigo, larger bullae form and rupture, leaving a brown, scaly appearance. Constitutional symptoms are usually absent. Patients often report a history of minor skin trauma, insect bites or pre-existing dermatoses.

Impetigo is treated by removing the crusts and applying topical antibiotics, such as mupirocin. Widespread infection responds better to oral or intravenous antibiotics (e.g. flucloxacillin, clindamycin). It can cause outbreaks in households, institutions and sports teams. Affected children should be excluded from school until the lesions have crusted and healed, or for 48 hours after starting antibiotic treatment.

### Ecthyma

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

Mild cases can be treated with topical mupirocin, and more severe cases with oral penicillin or clindamycin. Debridement of the crusts may be required. Ecthyma gangrenosum should be treated with appropriate parenteral antibiotics, depending on the causative organism.

### Folliculitis

Folliculitis is an inflammation of the hair follicles 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, axillas and inguinal area. Predisposing factors include 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 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),<sup>5</sup> *Malassezia furfur*, herpes simplex virus, varicella-zoster virus and *Demodex* mites. Non-infectious causes include eosinophilic folliculitis seen in advanced HIV and malignancy and a self-limiting papulo-pustular follicular eruption that occurs after treatment with epidermal growth factor receptor inhibitors.

Antibacterial soaps and good hygiene may be all that is required for recurrent uncomplicated superficial folliculitis. Systemic antibiotics can be required in more severe infection (e.g. oral flucloxacillin for staphylococcal folliculitis; treatment may need to cover MRSA if the patient is colonized). *P. folliculitis* is usually self-limiting, but oral ciprofloxacin can be given if lesions are persistent or the patient is immunocompromised. *Malassezia* folliculitis usually responds to topical antifungals (e.g. ketoconazole cream). Herpetic folliculitis responds to oral antivirals (e.g. valaciclovir). Eosinophilic folliculitis may respond to the introduction of antiretroviral therapy in HIV patients or to metronidazole, ultraviolet B phototherapy or itraconazole.

### Furuncles and carbuncles

Furuncles are subcutaneous boils or abscesses. The usual cause is *S. aureus*. If several furuncles coalesce, a 'carbuncle' is formed (Figure 2). Carbuncles are characterized by inflamed skin with pus draining from several hair follicles and 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 hyperimmunoglobulin E syndrome (Job's syndrome) and chronic granulomatous disease, should be considered.

Small furuncles can burst and heal spontaneously; larger ones can 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.

### Panton–Valentine leucocidin (PVL)

In individuals with recurrent abscesses or furuncles, or where there is a cluster of cases within a household, consideration should be given to detection of PVL-producing *S. aureus*. The clinical significance of PVL is debated, but current guidelines recommend using two or three agents, for example oral rifampicin, linezolid and intravenous clindamycin, for severe SSTIs caused by PVL-positive strains.

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