# Infections in Hair Follicles, Sebaceous Glands, and Sweat Glands

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## Major Causes of Skin and Wound Infections

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**Folliculitis**

- Is a minor infection of the hair follicles and is usually caused by *S. aureus*.
- It is often associated with areas of friction and of sweat gland activity and is thus seen most frequently on the neck, face, and axillae.
- Blockage of ducts with sebum, predisposes to the condition.
- Folliculitis can also be caused by *Pseudomonas aeruginosa*, and this form of the disease has become more common in recent years, with the popularity of **hot tubs and pool baths**.
- Unless these facilities are thoroughly cleansed and adequately chlorinated, they can grow large numbers of pseudomonads at their normal operating temperatures, causing extensive folliculitis on areas of the body that have been immersed.

- Occasionally, folliculitis may be caused by infection with **Candida albicans**. Such cases are particularly common in immunocompromised hosts.

**Acne vulgaris** حب الشباب

- Involves inflammation of **hair follicles** and **associated sebaceous glands**.
- Four key elements of pathogenesis:
(1) follicular epidermal hyperproliferation
(2) excess sebum production
(3) Inflammation
(4) the presence and activity of Propionibacterium acnes.

- Acne results from multiplication of Propionibacterium acnes, the predominant anaerobe of the normal skin, behind and within inspissated sebum.
- Organic acids produced by the organism are believed to stimulate an inflammatory response and thus contribute to the disease process.
- However, the primary cause of the disease is hormonal influences on sebum secretion that occur at puberty, and the disease usually resolves in early adult life.

![Formation of Skin Pimples and Acne](image)

**Furuncles**

- The furuncle is a small Staphylococcal abscess that develops in the region of a hair follicle.
- Spread of infection to the dermis and subcutaneous tissues can result in a more extensive multiloculated abscess, the carbuncle.
- Chronic furunculosis may require attempts to eliminate nasal carriage of S. aureus, which is sometimes the source of the infection.
Infection of Keratinized Layers

- The only organisms that can use the keratin on cells, hairs, and nails are the dermatophyte fungi.
- The dermatophytes are particularly well adapted to these sites, cannot grow at 37°C, and fail to invade deeper layers. The clinical manifestations of these infections result from the inflammatory and delayed hypersensitivity responses of the host, and the desquamation.
- In candidiasis, control involves cell-mediated immune mechanisms, and chronic Candida skin and nail infections are often associated with defects in cellular immunity.

Impetigo Pyoderma

- This disease is caused primarily by group A streptococci.
- The initial lesion is often a small vesicle that develops at the site of invasion and ruptures with superficial spread characterized by skin erosion and a serous exudate, which dries to produce a honey colored crust.
- S. aureus may occasionally produce pustular impetigo or contaminate the lesions caused by streptococci.
- Epidemic impetigo is most common in childhood and under conditions of heat, humidity, poor hygiene, and overcrowding.
- The infection may be spread by fomites such as clothing and towels.
**Bullous Impetigo**

- is a distinct disease caused by strains of *S. aureus* that produce exfoliation. It is most common in small children, but may occur at any age.
- The infection is characterized by large serum-filled bullae (blisters) within the skin layers at the site of infection.

**Erysipelas**

- Erysipelas is a rapidly spreading infection of the deeper layers of the dermis that is almost always caused by group A streptococci.
- It is associated with edema of the skin; marked erythema; pain; and systemic manifestations of infection, including fever and lymphadenopathy. Because the infection is intradermal, the Streptococci cannot usually be isolated from the skin surfaces.
- The disease can progress to septicemia or local necrosis of skin.
**Cellulitis**

- Cellulitis: inflammation of subcutaneous connective tissue
- It is not a skin infection as such, but it can develop by extension from skin or wound infections.
- It can be caused by many pathogenic bacteria, but *S. aureus* and group A streptococci are most common. *Haemophilus influenzae type b* is a cause in infants and children. *Enteric Gram-negative rods, clostridia,* and other anaerobes may also cause cellulitis as a complication of wound infections, particularly in immunocompromised hosts and individuals with uncontrolled diabetes.

![Image of cellulitis](image)

**Skin Ulcers and Granulomatous Lesions**

- Many acute and subacute skin infections are characterized by ulceration or a granulomatous response.
- Some are sexually transmitted and, others derive from systemic infection and are not direct infections of skin.
- *Herpes simplex virus* can invade through the skin to produce a local vesicular lesion followed by ulceration. The lesion may then recur in the infected area.
- *Skin diphtheria,* is remains common in some tropical areas. The organism gains access through a wound or insect bite and causes chronic erosion and
ulceration of the skin, sometimes with evidence of the systemic effects of diphtheria toxin.

- **Mycobacterium marinum** produces a self-limiting granuloma, usually of the forearms and knees. The organism usually enters through superficial abrasions from rocks or swimming pool walls.
- Infections with **M. ulcerans** are more serious and produce progressive ulceration.
- Several rare forms of necrotic spreading skin ulceration tend to develop in immunosuppressed hosts, in diabetics, and as complications of abdominal surgery. These lesions include bacterial synergistic gangrene, caused by mixtures of **peptostreptococcus**, **S. aureus**, and **group A streptococci**.

**WOUND INFECTIONS**

- Wounds subject to infection can be **surgical**, **traumatic**, or **physiologic**. The latter include the endometrial surface, after separation of the placenta, and the umbilical stump in the neonate.
- Traumatic wounds comprise such diverse damage as deep cuts, compound fractures, frostbite necrosis, and thermal burns.
- **Sources of infection include**
  1. The patient’s own normal flora
  2. Materials from infected individuals
  3. Pathogens from the environment that can contaminate the wound through soil, clothing, and other foreign material.
- Examples of such infections include contamination of a **penetrating stab wound** to the abdomen by colonic flora, contamination of a clean surgical wound in the operating room with **S. aureus** spread from the flora of a perineal carrier, and introduction of spores of **Clostridium tetani** into the tissues on a splinter.
Factors Contributing to Wound Infection

- The contaminating dose of microorganisms and their virulence can be critical.
- The physical and physiologic condition of the wound also influences the probability of infection (areas of necrosis, hematomas, excessive edema, poor blood supply all compromise normal defense mechanisms and substantially reduce the dose of organisms needed to initiate infection.
- The general health, nutritional status, and ability of patients to mount an inflammatory response are also major determinants of whether a wound infection develops.
- Infection rates are higher in the elderly, the obese, individuals with uncontrolled diabetes, and those on immunosuppressive or corticosteroid therapy.
- Nutritional deficiencies enhance the risk of infection.

ETIOLOGIC AGENTS

- *S. aureus* remains the single most common cause of infection of clean surgical wounds; however, the number of infections caused by opportunistic *Gram-negative organisms* is increasing.
- Severe invasive *group A streptococcal* infections with the toxic shock-like syndrome often begin with a simple skin or wound infection. *Anaerobic Gram-negative* wound infections have been reported increasingly in the last two decades or so as a result of the higher incidence of such infections in immunocompromised patients and better laboratory recognition.
- Most infecting organisms derive from normal floral sites and the majority are *Bacteroides*, often in combination with *anaerobic Gram-positive cocci* and facultative aerobic bacteria.
- However, *P. aeruginosa* causes particularly serious infections in burns, with loss of skin grafts and a high risk of septicemia and death. If the fluid electrolyte and nutritional deficiencies of a burned patient can be controlled, the greatest hazard to life is infection.