Common Bacterial Skin Infections

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Introduction

Whereas the internal tissues of humans are normally free of microorganisms (save for some viruses), the “external” tissues, including the skin and gut, have a complex flora. The number of microorganisms far exceed the number of human cells, with more than 200 species of bacteria, along with eukaryotic fungi, and protists. Herpes viruses stay with us for life and reside in our nerves; the human papillomavirus also stays with us for life and resides in our skin cells. Generally, the relationship is commensal or mutualistic; however, when there is a breakdown in the integrity of the skin, or our immune defense is compromised, infections can result.

Classification

<table>
<thead>
<tr>
<th>Discrete Lesions</th>
<th>Diffuse Lesions</th>
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<tbody>
<tr>
<td><strong>Superficial Infections</strong></td>
<td><strong>Deep Infections</strong></td>
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<tr>
<td>Impetigo</td>
<td>Ecthyma</td>
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<tr>
<td>Folliculitis</td>
<td>Furuncles</td>
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<tr>
<td>Erysipelas</td>
<td>Carbuncles</td>
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<tr>
<td></td>
<td>Abscess</td>
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</table>

There may be a continuum of these various infections in any one individual.

*Although rare, NF is included for completeness

Most Common Pathogens

<table>
<thead>
<tr>
<th></th>
<th>Impetigo/Ecthyma</th>
<th>Folliculitis/Abscess</th>
<th>Erysipelas/Cellulitis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staphylococcus aureus</strong></td>
<td>Nonbullous</td>
<td>Bullous</td>
<td>Face</td>
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<td></td>
<td>+</td>
<td>+</td>
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<tr>
<td><strong>Streptococcus pyogenes</strong></td>
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</table>
### Impetigo and Ecthyma

- Typically honey-colored crust with erythematous vesicles, papules, pustules, or erosions; common area around nose and face.
- Children with atopic dermatitis are more susceptible.
- Nonbullous – usually *S. pyogenes* +/- *S. aureus*. *S. aureus* is more common in the northern climates; Bullous – usually *S. aureus*.
- Ecthyma is a deeper version of impetigo, more commonly seen in patients with malnutrition and/or poor hygiene – vesicles and bullae progress to punched-out, deep ulcers with adherent, dehydrated, serosanguinous crust; legs are the most common site and healing leaves scars.

**Treatment**
- Nonbullous: fusidic acid (Fucidin® cream) t.i.d. or mupirocin (Bactroban® Cream) t.i.d.
- Bullous: cloxacillin (Cloxapen®) 500mg, po, q6h or cephalexin (Keflex®) 500mg, po, q6h

### Folliculitis, Furunculosis and Carbunculosis (Folliculitis Group)

- A spectrum of infections involving the hair follicles
- Characterized by erythematous follicular-based papules and pustules. Hairs may be visible at the center of them.
- Often asymptomatic or minimally pruritic
- Hot tub folliculitis less common and due to *Pseudomonas aeruginosa* – usually clears spontaneously and is commonly distributed over the trunk, buttocks, and thighs.
- Furunculosis is a deeper infection of the hair follicle presenting with tender, erythematous nodules and suppurative drainage.
- Carbuncles are a coalescence of furuncles presenting as larger, tender, fluctuant, draining, inflammatory nodules.

**Treatment**
- Fusidic acid t.i.d. is indicated for bacterial folliculitis and bacterial paronychia.
- Cloxacillin 500mg, po, q6h or cephalexin 500mg, po, q6h

### Abscess

- Fluctuant cystic nodule, may have a pointing pustule
- Usually tender and occasionally painful or sore
- *S. aureus* is the usual culprit
- Incision and drainage (I & D) is most important as well as taking cultures
- If there is a cellulitic component >5cm; if abscess cannot easily be drained; if location is on face; or if there are systemic symptoms (fever, chills); add a systemic antibiotic.

**Treatment**
- Fusidic acid t.i.d. is indicated and can be used alone or most commonly in combination especially in smaller lesions.
- Cloxacillin 500mg, po, q6h or cephalexin 500mg, po, q6h

### Erysipelas and Cellulitis

- Erysipelas is a superficial infection with a predilection for young children and the elderly.
- Venous insufficiency, alcoholism, diabetes mellitus, and trauma are predisposing factors.
- Tender, well-defined erythematous and indurated plaques, most commonly on the face or legs, are characteristic of erysipelas.
- Cellulitis is a deeper process extending to the subcutis.

**Treatment**
- Face: vancomycin (Vancocin®) 1g, IV, q12h
- Extremities – mild
  - Cloxacillin 500mg, po, q6h OR cephalexin 500mg, po, q6h
- Extremities – severe
  - Penicillin G 1-2mU, IV, q6h OR cloxacillin 2g, IV, q4h
  - Trimethoprim/sulfamethoxazole (Septa® DS) b.i.d. + rifampin 300mg, po, b.i.d. (for diabetics) OR Clarithromycin (Biaxin XL®) 500mg, po, q.d., OR azithromycin (Zithromax®) 500mg, q.d. x 3 days

**Self-Care**
- Antimicrobial washes such as triclosan (Trisan®, Tersaseptic®) and chlorhexidine gluconate (Hibitane®) may be considered 2-3 times/day.
- Warm compresses for 15-20 minutes 3-4 times/day.
- Important to consider I&D for larger furuncles, and carbuncules, and as a primary treatment of abscesses.
Recognition and appropriate treatment of these common bacterial skin infections, while at times challenging, can be very rewarding for both the physician and the patient. Selecting the right therapy from the beginning should help minimize complications, reduce the number of hospitalizations, and may also help reduce the climbing incidence of bacterial resistance.

**Conclusion**

Recognition and appropriate treatment of these common bacterial skin infections, while at times challenging, can be very rewarding for both the physician and the patient. Selecting the right therapy from the beginning should help minimize complications, reduce the number of hospitalizations, and may also help reduce the climbing incidence of bacterial resistance.
Malassezia Infections of the Skin

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The Organism

Malassezia are lipophilic yeasts that are normal commensals on the skin surface. Named after French microbiologist Louis Charles Malassez (1842-1909), there are seven species of these yeasts, which were previously called Pityrosporum. They usually form colonies in the skin in late childhood and adult life, but can be found in some neonates. The conditions described in this article are either caused by the Malassezia itself or from some kind of immunological or toxic reaction to the organism.

Malassezia can cause:

- Dandruff
- Adult seborrheic dermatitis
- Pityriasis versicolor
- Pityrosporum (Malassezia) folliculitis

The treatment recommendations are based on evidence-based medicine, physician experience, and patient preference.

Dandruff

What It Is

- Also known as pityriasis capitis. Caused by M. globosa which produces oleic acid from its action on sebum, it is an irritant to skin.
- This is the mild end of the spectrum of seborrheic dermatitis. It is very common, with white scaling on the scalp but no inflammatory reaction, as seen in true seborrheic dermatitis.

Treatment

- Shampoos active against Malassezia yeasts are usually sufficient for this condition. These shampoos can be either antifungal, keratolytic (salicylic acid), or cytostatic (coal tar). They can be used daily until control is achieved, and then the frequency can be reduced to prn (often 1-3 times a week).

- Antiyeast shampoos - Over-the-counter (OTC)
  - Zinc pyrithione (Head & Shoulders®)
  - Zinc pyrithione shampoos have been developed in recent years to ensure that particle size, shape, and adherence of the therapeutic molecule give improved bioavailability, and therefore greater effectiveness. Cosmetically elegant shampoos are now produced with great acceptance by consumers.

  - Selenium sulfide (Selsun®) – very actively antifungal

  - Ketoconazole (Nizoral®)

- Prescription
  - Ciclopirox shampoo (Loprox®)

Seborrheic Dermatitis

What It Is

- A common (5% prevalence) chronic relapsing rash seen in adults
- Quite well-defined erythematous lesions that do not cross the hair line of the scalp
- Accompanied by a greasy looking scale
- Located on the scalp, medial eyebrows, in and around the ears, central chest, and upper back. It may also be found in the intertriginous areas. Rarely, it is generalized.
- More extensive and inflammatory variants are seen in patients with AIDS.

Risk Factors

- Neurological conditions, e.g., poststroke, Parkinsonism
- HIV-AIDS
- Antipsychotic drugs

Differential Diagnosis

Scalp Psoriasis

- Well-defined lesions that may extend beyond the hairline. The scale is more silvery than the greasy yellowish-brown colour seen in seborrheic dermatitis. May have involvement in other typical sites. Central facial involvement uncommon. It may sometimes be impossible to distinguish the two conditions.

Tinea Capitis

- Usually seen in children. There is a spectrum of appearance ranging from mild scaling to boggy plaques.

Atopic Dermatitis

- May be aggravated on the face, neck, and upper chest by Malassezia yeast.

Face

Facial Rosacea

- Central face with papules and pustules. Flushing always present. Nasolabial and paranasal scale not usually present but blepharitis is seen in both. The two conditions quite frequently coexist. Systemic lupus does not exhibit papules and pustules.

Intertriginous Seborrheic Dermatitis

- Erythrasma, intertrigo, psoriasis

Treatment

The selection of therapy depends on the effectiveness, ease of use,
Pityriasis Versicolor

What It Is
- Infection confined to the trunk and proximal limbs when the yeast transforms into hyphae. Hair and nails are never involved.
- Fine scaly patches of varying color, red, brown, and white; usually in young adults. Seen on the upper trunk, neck, upper arms, and occasionally the scalp.
- Hypopigmented patches, caused by the yeast, produce azelaic acid, which inhibits melanin production. The hypopigmentation may last for months after the yeast overgrowth has been controlled. Occasionally the condition remits spontaneously.
- The diagnosis is confirmed by the appearance of spores and hyphae (spaghetti and meatballs) on KOH exam of skin scrapings of the scale.

Risk Factors
- Sun exposure
- Pregnancy
- Sweating
- Cushing’s syndrome
- Interestingly, it is not more common in HIV-AIDS

Differential Diagnosis
Vitiligo is commonly seen on the face, hands and genitals. There is no scale present. Much more complete depigmentation. Frequent hyperpigmentation at the edges of the lesions, which often vary in size. Depigmentation of hair can occur.
- Other conditions to consider are tinea corporis and postinflammatory hypopigmentation.

Treatment
- The erythematous and brown patches tend to respond quickly to therapy.
- Hypopigmented lesions are slow to respond, persisting long after the yeast infection has cleared. Sun exposure may be required to stimulate repigmentation.
- High recurrence rate, especially for those who exercise and sweat regularly. Maintenance treatment is often required, especially in the summer months.

Evidence-Based Therapy
- Topical antifungal creams, i.e., ketoconazole, clotrimazole, and terbinafine have been shown to be effective. Ketoconazole shampoo is also effective.
- Oral itraconazole (200mg daily for 1 week), ketoconazole (400mg single dose, repeated in 1 week) and fluconazole (Diflucan®) (150mg-300mg weekly for 1 month) have been shown to be effective.
- Propylene glycol 50% in water b.i.d. for 2 weeks.
- 1% zinc pyrithione shampoo applied in the shower and left on for 5 minutes.
- Selenium sulfide 2.5% lotion daily and left on for 10 minutes for 1 week.
- A combination of honey, olive oil, and beeswax in equal parts used t.i.d. has been shown to be effective.

Suggested Therapy
- Patients can be given a choice of oral or topical therapy. The surface areas are large, making the application of antifungal creams difficult and costly.
- Most will clear with the OTC shampoos such as zinc pyrithione or ketoconazole applied in the shower and left on for a few minutes before being washed off.
- Selenium sulfide shampoos can be irritating.
- Those with very extensive or resistant involvement can opt for systemic therapy. It must be noted that oral terbinafine is ineffective for this condition. A short course of ketoconazole or fluconazole can be used at the doses shown above. Oral ketoconazole can be hepatotoxic, but is not thought a problem for such short courses.

Pitysporum (Malassezia) Folliculitis

Seen in Three Scenarios
- Back and upper chest involved with itchy papules and pustules.
- Associated with seborrheic dermatitis on the upper trunk.
- Multiple pustules on the face and trunk in HIV+ individuals

Treatment
- Treat the underlying condition.
- Topical antifungal creams are recommended.
- If no response to oral antifungals, treat as discussed for pityriasis versicolor.
Scaly Rashes of the Feet: Could It Be Fungal?

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This article will deal with the diagnosis and treatment of common eruptions on the feet. These conditions include:

<table>
<thead>
<tr>
<th>Area of Foot</th>
<th>Condition</th>
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<tbody>
<tr>
<td>Soles</td>
<td>Tinea pedis</td>
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<tr>
<td></td>
<td>Dyshidrotic eczema (pompholyx)</td>
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<tr>
<td></td>
<td>Psoriasis</td>
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<tr>
<td></td>
<td>Juvenile plantar dermatosis</td>
</tr>
<tr>
<td>Web spaces</td>
<td>Tinea pedis</td>
</tr>
<tr>
<td></td>
<td>Dyshidrotic eczema</td>
</tr>
<tr>
<td>Dorsal surfaces</td>
<td>Contact dermatitis</td>
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</tbody>
</table>

Useful tests include:
- KOH (Potassium hydroxide) exam of scale for fungus from skin and nail
  - Use a No. 15 blade and gently scrape scale from the edge of the plaques into the black transport paper, usually supplied by a diagnostic lab.
- Bacteriology culture swab
- Patch testing

Tinea Pedis (Skin and Nail)

- One of the most common dermatologic conditions
- Seen more often in men
- Almost always involves the lateral web spaces
- Soles involved and may spread onto the dorsal aspects, usually asymmetrically
- Nail involvement may follow from a skin infection or vice versa
- Cracking of the skin may create an entry site for bacterial infection producing secondary cellulitis
- Often asymptomatic but can be itchy
- Feet may be malodorous
- Painful if fissured

Tests
- KOH examination from the skin, subungual debris, or nail clippings confirms the diagnosis.
- Culture determines specific name of fungus. Check the dry scale or roof of blister. May be negative if significant inflammation.

Clinical Subtypes
- Web-space scaling and maceration. May have significant bacterial colonization.
- Dry type. Scaling can involve skin creases or the whole sole that has a powdery scale (moccasin type).
- Acute blistering. Small blisters often on instep
- Soggy white skin changes with cracking
- Nails can become involved and act as a reservoir for reinfection.

Treatment
- General measures, such as changes in footwear to reduce heat and sweating
- Wear cotton or absorbent socks.
- Relapses are very common with any type of tinea infection of the feet, so intermittent maintenance using topical antifungals should be considered after clearance has been achieved. Antifungal powders are only of value as prophylaxis.

Topical Therapy for Tinea Pedis

<table>
<thead>
<tr>
<th>Area of Foot</th>
<th>Topical Therapy</th>
</tr>
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<tbody>
<tr>
<td>Web spaces</td>
<td>Ciclopirox (Loprox®) and terbinafine cream (Lamisil®) have been shown to be particularly effective. Clotrimazole has also been shown to be effective but may be slower acting. Ciclopirox may have the added benefit of antibacterial action.</td>
</tr>
<tr>
<td>Dry type of infection</td>
<td>Confirm with KOH and culture first. Topical therapy as above. Oral antifungal therapy can be used if unresponsive to topicals. Monitor appropriate blood work.</td>
</tr>
<tr>
<td>Acute type of infection</td>
<td>Confirm with KOH and culture first. Compressing the blisters will be necessary. Use tap water or 1oz household vinegar in 2 cups of water. Apply for 20 minutes q.i.d. to try to dry the blisters. This may take many days. Topical antifungals should be applied after compressing. Oral antifungals are often required. Monitor appropriate blood work.</td>
</tr>
<tr>
<td>Nail involvement</td>
<td>Early or mild fungal nail infection can be treated by ciclopirox 8% nail lacquer (Penlac®) to be applied once daily for 48 weeks, with nail debridement performed by a health professional. Systemic therapy can be added for more advanced infection.</td>
</tr>
</tbody>
</table>
Oral Therapy for Tinea Pedis

Tinea pedis
- Confirm with KOH and culture first.
- Terbinafine 250mg daily for 2 weeks
- Itraconazole (Sporanox®) studies suggest 400mg daily for 1 week or 100-200mg daily for 2-4 weeks.
- Studies comparing these two drugs and using itraconazole at 100mg showed terbinafine to be much more effective. However, it is now known that a higher dose of itraconazole is required.
- Monitor appropriate blood work.

Nail
- Confirm with KOH and culture first and monitor appropriate blood work, i.e., CBC and LFTs at baseline and at 1 month.
- Ciclopirox 8% nail lacquer is effective in the milder forms of nail infection. Mycological cures in the range of 52% can be achieved. Adding ciclopirox 8% nail lacquer to terbinafine significantly increases cure rates.
- Terbinafine is thought to be the treatment of choice at a dose of 250mg daily for 3 months. Using this drug for 1 week every month for 3 or 4 cycles is almost as effective, reducing both costs and worries about side-effects.

Dyshidrotic Eczema (Pompholyx)
- A recurrent eruption affecting hands and feet seen mostly in young adults
- Associated with atopy, hyperhidrosis, stress and an allergic contact dermatitis
- Acute
  - Intensely itchy
  - Tiny blisters, which may become multilocular on soles and toes
  - Less commonly found in the web spaces
  - If pustules are present, swab for bacterial infection such as Staphylococcus.
  - Once the blisters settle there may be a dry, chronic, scaly, fissured rash.

Treatment
  Acute
  - Compress blisters with saline, tap water, or 10% aluminum acetate for 20 minutes q.i.d. Large blisters can be drained.

  Moderate-to-high potency topical steroid creams should be used after compressing.
  - Studies show that immunomodulators, such as pimecrolimus (Elidel®) and tacrolimus (Protopic®), could be added with benefit.
  - Use oral antibiotics if there is a suspicion of bacterial infection, such as Staphylococcus or Streptococcus.
  - Oral antihistamines can help with itch (sedation).
  - In severe cases, oral prednisone (Deltasone®) for approximately 2 weeks should be utilized.

Chronic
  - Change to moderate-to-high potency topical steroid ointment rather than cream.
  - Using a topical corticosteroid intermittently, such as on weekends only, and using topical immunomodulators on weekdays has been reported.

Juvenile Plantar Dermatosis
- Seen in childhood up to the age of 15
- A tender, glazed erythema on the weight-bearing forefoot and toes
- Nonscaly and sometimes fissured
- No vesicles are observed
- Worsened by sweating; may be caused by alternating sweating and drying as experienced by those who wear ‘sneakers’.
- Rule out fungus by KOH exam.
- 30% of patients have psoriasis elsewhere
  - In children, especially infants, vesicopustules on the soles could suggest scabies.

Treatment
  - Mild disease can be controlled with medium-to-potent topical steroids.
  - Long-term risk of atrophy. Some may respond to calcipotriol combined with a corticosteroid (Dovobet®).
  - Topical UVB/PUVA is useful in some patients.
  - Acitretin (Soriatane®) or methotrexate (Trexall®) for resistant disease

Pustular Psoriasis of the Palms and Soles
- Although irritant dermatitis can be seen, allergic contact is a more significant problem.
- Itchy eczematous dermatitis on the dorsal aspect of the feet raises the possibility of a contact dermatitis, especially to footwear.
- The rash may be well defined at the area of contact, e.g., shoe tongue. The condition worsens with conditions that increase sweating, and in the summer months.

Contact Dermatitis
- Identify and avoid the allergen.
- Patch testing is a must if there is clinical suspicion.
- Topical corticosteroids are the treatment of choice, but will not clear the condition if the allergen contact is still present.
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