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## Pyodermas and Bacterial Skin Infections

### Impetigo

#### General Principles

Impetigo is a common, contagious superficial skin infection seen most often in infants and children.

#### Epidemiology

It is caused by *Staphylococcus aureus* and Group A streptococci and presents in two major types: bullous and nonbullous. Bullous impetigo is caused by staphylococci that produce an epidermolytic toxin.

#### Diagnosis

##### Physical Examination

Impetigo begins with small, thin-walled blisters that rapidly coalesce into round or oval-shaped bullae containing a cloudy fluid. The central area of the bullae then collapses, leaving a honey-colored thin layer surrounded by a rim of crusty tissue that continues to expand. In the untreated individual, these will reach 2–8 cm-sized patches that can remain for months. Nonbullous impetigo appears to be more related to Group A streptococcal infection, although staphylococci can also be found. Clinically, the lesions begin most often around the mouth or nose with small vesicles that rupture, producing a serous discharge that dries into a honey-colored crust. The lesions have a red, moist base and often extend by satellite lesions over adjacent skin.

#### Treatment

Treatment with topical 2 % mupirocin ointment is safe and as effective as oral antibiotics in patients with a limited number of lesions. Oral antibiotics are recommended for patients with numerous lesions or for infections that occur during community outbreaks of post-streptococcal glomerulonephritis to help eliminate nephritogenic strains of *Streptococcus pyogenes* [1].

## Erysipelas and Cellulitis

#### General Principles

In contrast to impetigo, cellulitis and erysipelas are deeper skin infections manifested by distinctly painful, red, swollen skin.

#### Epidemiology

The causative agents are predominantly Group A streptococci and *Staphylococcus aureus*, the latter presenting as either methicillin-sensitive (MSSA) or methicillin-resistant (MRSA) strains. Erysipelas is usually caused by Group A streptococci. It is a more superficial form of cellulitis.

#### Diagnosis

##### Physical Examination

Erysipelas has the clinically distinctive feature of a clear-cut margin that visibly demarcates the infected tissue from uninvolved adjacent skin. Lymphatic involvement is common and progression of the infection through the lymphatic chains causes linear “streaks,” especially apparent on the extremities (Fig. 1). It is often associated with a fever of 101–104°, chills, and malaise.



**Fig. 1** Cellulitis in a patient with chronic edema and dry skin. Note the sharp inferior margin and streaking up the medial lymphatics. The skin was red, hot, and tender to touch

## Treatment

Treatment consists of oral or intravenous antibiotics active against streptococci, depending on the severity and location of the infection.

## Cellulitis

### General Principles

Cellulitis differs from erysipelas by involving deeper skin and subcutaneous structures.

### Epidemiology

The past decade has witnessed a significant increase in the number of skin and soft tissue infections (SSTIs) reported worldwide from community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA). The development of such an infection can lead to cellulitis with or without abscess formation.

### Diagnosis

Cellulitis is not clearly demarcated visually, as is erysipelas, but presents with pain, fever, and leukocytosis, usually with a demonstrable portal of entry. Lacking such a portal of entry, patients may report the initial tender papule was thought to be a “spider bite.”

### Laboratory

Neither blood analysis (WBC, CRP) nor cultures of blood or skin aspirates has been found to be clinically useful or cost-effective in determining abscess presence [2].

### Treatment

Treatment of cellulitis has become the subject for many studies related to CA-MRSA. The most recent recommendations are that empiric treatment of outpatient non-purulent cellulitis be initiated with  $\beta$ -lactam antibiotics (cephalexin, dicloxacillin, amoxicillin/clavulanate), finding no significant difference in clinical failure rates between these and non- $\beta$ -lactam alternatives. The Infectious Disease Society of America (IDSA) has

recently updated their guidelines (June 2014) for management of SSTIs. Their recommendations include the adoption of oral  $\beta$ -lactam antibiotics for the mild, non-purulent category and moving to intravenous antibiotics of similar nature for a moderate infection [3]. Individual community susceptibility data should always be considered in antibiotic choices.

### Chemoprophylaxis

The use of prophylactic antibiotics (benzathine penicillin or erythromycin or clindamycin) has been proven effective.

### Prevention

Prevention of recurrent episodes of cellulitis is important, including physical inspection of the feet for interdigital maceration, cracks, or fissures.

## Folliculitis, Furuncles, and Carbuncles

### General Principles

Folliculitis is an inflammatory condition of the hair follicle, either from infection or superficial mild trauma, such as friction from clothing.

### Epidemiology

The bacterial etiology of infection is usually staphylococcal in nature. “Hot tub folliculitis” is a subset of folliculitis caused by *Pseudomonas aeruginosa*, which may be found in unclean hot tubs or jacuzzis.

### Diagnosis

#### Physical Examination

The condition presents as small white pustules at the site of hair follicles on almost any surface of the body. There is often a small ring of erythema around the infected follicle, and the lesion may be painless or variably painful depending on its size and depth. In skin that is repeatedly shaved, spread of the infection can occur quickly to multiple follicles from microtrauma and bacterial implantation.

### Treatment

Treatment is effective with topical mupirocin ointment or with oral antibiotics in more extensive involvement. Razors must be changed frequently and shaving may need to be interrupted during treatment of the lesions. Hot tub folliculitis is usually self-limited and requires only antiseptic care.

### Prevention

Decolonization techniques using mupirocin in the nares may help eliminate reservoirs of staphylococci.

## Furuncles (“Boils”)

### General Principles

Furuncles (“boils”) are localized infections that extend from a follicular site into a deeper, walled-off subcutaneous abscess. They are often found in areas of friction from clothing, such as the belt-line, groin, thighs, or bra-line, but also may occur near the nares or on the face [4].

### Diagnosis

#### Physical Examination

Furuncles are characterized by an initially firm, tender erythematous nodule that subsequently enlarges and develops a fluctuant surface that erodes with spontaneous drainage.

### Treatment

Treatment of furuncles is drainage, which may be encouraged spontaneously by warm compresses or may be accomplished by incision and drainage (I&D) under local anesthesia in the office. Oral anti-staphylococcal antibiotics are useful in the early stages of infection.

## Carbuncles

### General Principles

Carbuncles are multiple furuncles clustered together, characterized by larger areas of involvement and multiple drainage sites.

### Treatment

Oral antibiotics and drainage procedures usually suffice, but surgical consultation may be required for extensive debridement.

## Hidradenitis Suppurativa

### General Principles

Hidradenitis suppurativa is a suppurative process affecting the follicles and apocrine glands in the axillae, groin, and below the female breasts that can seem to be a simple folliculitis early in its course. This disease progresses inexorably with gradual spread to adjacent follicles. After years, areas of scarred remnants remain scattered over the axillae, groin, and inframammary skin (Fig. 2).

### Treatment

Treatment for individual drainage sites is similar to that of folliculitis, but the chronicity of the disease usually requires surgical removal of the affected areas.

### Behavioral

The impact of hidradenitis suppurativa on the emotional and psychological well-being of



**Fig. 2** Hidradenitis suppurativa

patients may require counseling and psychological support [5].

## Abscess of Skin

### General Principles

A skin abscess is the result of the accumulation of pus in the skin or subcutaneous tissues. Recent studies have shown that bedside ultrasonography improves diagnostic accuracy and decision-making regarding the presence of abscess fluid [6].

### Diagnosis

Clinically, an abscess presents as an exquisitely tender, swollen, red, fluctuant mass. The diagnoses may be simple, but if accompanied by significant cellulitis, the indurated, tender tissue may make palpation of the fluctuant area difficult.

### Treatment

The treatment of choice for skin abscesses is incision and drainage (I&D). The Infectious Disease Society of America (IDSA) recommends addition of non-beta-lactam empiric antibiotics only in moderate or severe categories of purulent skin and soft tissue infections (SSTIs) [3]. However, incision and drainage is a painful procedure, and a common mistake is to create an incision of insufficient depth to fully drain the abscess.

### Referrals

If local or regional anesthesia is inadequate, further sedation or anesthesia should be considered, especially for children or adults with abscesses that are unusually large or are in sensitive sites.

### Prevention

Prevention of recurrent skin abscesses follows the rationale for that of recurrent cellulitis. Efforts at decolonization have not been shown in large studies to be statistically reliable. However, if attempted, a 10-day course of twice-daily intranasal mupirocin, daily hexachlorophene washes, and oral antibiotics (TMP/SMX or minocycline) aimed only at the index patient was shown to reduce the rate of methicillin-resistant *Staphylococcus aureus* (MRSA) reinfection in a small study in California [7].

## Necrotizing Fasciitis

### General Principles

Necrotizing fasciitis is an uncommon to rare life-threatening, rapidly progressive infection of the subcutaneous tissues and fascia.

### Epidemiology

It is most often polymicrobial (Type I), although a smaller proportion of patients will have only a single organism, usually group A streptococcus (Type II). A third type, recently described, is caused by vibrio species and is associated with salt water-related minor injuries (fish fin stings or handling raw sea food) in areas with warm seawater [8]. Predisposing factors include diabetes mellitus, cirrhosis, pulmonary disease, end-stage renal disease, immune suppression, or drug injection.

### Diagnosis

Clinical presentation is typically that of a presumed cellulitis. The only indicator that this may be more than a simple cellulitis is the finding of unrelenting pain that is out of proportion to the clinical findings. Without a high index of suspicion, the diagnosis may initially be missed and the patient sent home. As the disease progresses, the affected skin develops yellowish bullae, which become violaceous in color (a strong clue to the diagnosis of necrotizing fasciitis), and the skin becomes “woody” in texture, with loss of sensation. Crepitus may occur. Confusion and sepsis are frequent findings. The fatality rate is 25–70 % from sepsis and multiorgan failure.

### Laboratory and Imaging

Ancillary testing is nonspecific. Demonstration of gas or deeper tissue infection should prompt surgical consultation and immediate exploration to confirm or exclude necrotizing fasciitis.

## Erythrasma

### General Principles

This uncommon skin infection is characterized by brownish pigmentary change in a plaque-like

area, usually in the groin, interdigital toe spaces, or inframammary areas.

### Epidemiology

The infection is caused by the bacteria *Clostridia minutissimum*, but is often confused with tinea, especially in the groin. It may remain for years if not treated appropriately. It can be distinguished by virtue of its less inflammatory presentation, relative lack of symptoms, and its coral red fluorescence with Wood's lamp [9].

### Treatment

Treatment can be accomplished with oral erythromycin, or clarithromycin.

## Cutaneous Leishmaniasis

### General Principles

Cutaneous leishmaniasis is one of three forms of disease caused by an intracellular protozoa of the *Leishmania* species.

### Epidemiology

Leishmaniasis is transmitted by the sandfly, which is only 1/3 the size of a mosquito. Because it makes no sound, is small, and the bite may not be painful, patients often do not realize they have been bitten. Over 90 % of the cutaneous leishmaniasis originates in countries that are most often visited by military personnel, missionaries, or tourists. While the infection is rare in the United States, a persistent nodule or plaque on the torso, extremities, or face should prompt questions about exposure by travel to the Middle East, or to Central or South America.

### Diagnosis

#### Physical Examination

The patients present several weeks (or in some cases up to several months) after exposure with one or more non-pruritic nodules. The lesions progress to a nodular plaque and then often ulcerate with raised circular borders and a central depression. The lesions last for months and are usually painless.

### Differential Diagnosis

Diagnosis can be made by a combination of clinical presentation and smears or biopsies from the active edge of a lesion [10].

### Treatment

Treatment decisions should involve consultation with CDC and infectious disease consultants.

## Viral Diseases of the Skin

### Herpes Simplex

#### General Principles

Herpes simplex virus (HSV) is a neurotropic virus causing infections of the mucous membrane and skin.

#### Epidemiology

The virus enters the tissues through a portal of entry on the skin or mucous membrane, replicates in the local site, and by retrograde axonal flow reaches the dorsal root ganglia, establishing a life-long latency state. The primary infection can range from completely asymptomatic to a syndrome with significant pain and tissue change. Recurrent infections, always occurring at the same anatomic site, recapitulate the primary infection in a much-shortened course of about 1 week. The recurrences appear when the latent virus is reactivated by some stimulus, such as illness, fever, chapping, menses, or UV light exposure. Herpes simplex in wrestlers is called *Herpes gladiatorum* and is transmitted by direct contact during wrestling bouts. *Ocular herpes* is a rare cause of keratoconjunctivitis and can cause blindness. Emergent ophthalmologic referral is indicated if it is suspected. *Herpetic whitlow* is the infection by HSV of the distal phalanx around the nail or on the pulp of the finger tip. It occurs when the digit involved is exposed to HSV, either by thumb-sucking or digital-oral or digital-genital contact, in the presence of a portal of entry. *Eczema herpeticum* occurs when an atopic individual, often just recovering from an episode of herpes labialis, develops widespread HSV lesions over an area of recent eczema. This constitutes a dermatological emergency [11].

### History

The initial symptoms are a tingling pain or burning sensation at the site of infection, followed within days by local swelling and the appearance of uniform-sized groups of vesicles on a red base. These progress to umbilicated pustules, which then rupture and form crusts. The entire site is often very tender to touch.

### Diagnosis

#### Physical Examination

Herpes simplex labialis (“cold sore”) is very common, and patients often do not seek the physician’s care for recurrences (Fig. 3). Initial infections, particularly in infants and children, may cause enough oropharyngeal pain on swallowing to make fluid intake difficult.

#### Treatment

Treatment of primary and recurrent episodes on skin surfaces can be undertaken with topical creams such as acyclovir cream or n-docosanol cream (OTC Abreva) or with oral medications such as acyclovir, valacyclovir, or famciclovir.

### Genital Herpes

#### Diagnosis

#### Physical Examination

Genital herpes in the female can cause pain, itching and burning, dysuria, and discharge.



**Fig. 3** Recurrent herpes on upper lip

In the male, pain and burning of the lesions may be associated with local lymphadenopathy.

#### Treatment

Treatment regimens are similar to that for oral lesions, but in pregnant females, the presence of an active HSV infection at or near delivery prompts concerns about vertical transmission to the fetus.

#### Prevention

A Cochrane review has shown that prophylaxis which begun with acyclovir or valacyclovir at 36 weeks gestation significantly reduces herpetic recurrences at delivery as well as reducing viral shedding [12].

### Herpes Zoster

#### General Principles

Herpes zoster, commonly known as shingles, is a viral infection of the skin along the dermatome served by a dorsal root ganglion which was infected during a childhood episode of chicken pox. The virus remains latent until reactivated and then travels back down the sensory nerve and prompts the rash, which can occur anywhere along the dermatome.

#### History

Clinically, the patient reports an initial sense of the skin itching or burning in the affected dermatome 4 or 5 days prior to the onset of the rash. Occasionally the area is so painful it can mimic more serious, internal diseases such as pleurisy, myocardial ischemia, or an intra-abdominal process, causing diagnostic confusion.

#### Diagnosis

#### Physical Examination

The appearance of the classic erythematous rash, associated with the formation of variably sized blisters, along the course of the affected dermatome resolves any diagnostic dilemmas. The rash can continue to be painful in varying degrees as crops of blisters occur for a week. The thin-walled

blisters rupture and form a crust, which gradually heals in 2–3 weeks [4].

### Treatment

Treatment of zoster is most successful when begun within 72 h of the onset of symptoms. Good results have been obtained with three oral medications: acyclovir (Zovirax), famciclovir (Famvir), and valacyclovir (Valtrex). Acetaminophen and nonsteroidal anti-inflammatories are useful for mild to moderately severe pain, whereas narcotic analgesics may be required in others. For postherpetic neuralgia, which occurs in a minority of patients but can be a serious problem, treatment options include tricyclic antidepressants, tramadol, long-acting opioids, or pregabalin (Lyrica). Topical capsaicin (Zostrix) or a lidocaine patch (Lidoderm) may also be of benefit.

### Prevention

Prevention of herpes zoster by vaccination is indicated for patients over age 60 years [13].

## Viral Warts

### General Principles

Warts are caused by infection of the epidermis by the human papilloma virus (HPV), creating a variety of benign neoplasms. Most warts resolve spontaneously within months, but recalcitrant ones can last years. Cell-mediated immunity response is a key element in wart resolution, as witnessed by the more frequent and longer-lasting occurrences of warts in patients with AIDS, lymphomas, or immune suppressive drugs. There are a variety of treatments available, signaling that no single treatment regimen is always effective for cure.

### Diagnosis

#### Physical Examination

Common warts (*verruca vulgaris*) occur mostly on the hands and present as smooth, round papules that develop into typical dome-shaped round or ovoid lesions with hyperkeratotic, dry surfaces and loss of skin lines. Black dots, representing thrombosed vessels, may be seen on the surface

or when exposed by paring down the keratinaceous surface with a #15 knife blade. Plantar warts occur on the soles of the feet in large, hyperkeratotic lesions that cause pain with walking. Trimming the thick keratin accumulation with a #15 knife blade relieves much of the discomfort. Condylomatous warts are found in moist, intertriginous inguinal tissues and on mucous membranes, especially in the vaginal area. These warts are sexually transmitted and may occur on the urethra, penile shaft, and rectum in males. Untreated lesions enlarge, developing cauliflower-like vegetation that can become quite large. They may remain for years and can be difficult to treat.

### Treatment

Topical salicylic acid applied at home or cryotherapy at the physician's office are the most reliable and cost-effective treatments for common and plantar warts. Imiquimod may be a useful agent for facial lesions or for recalcitrant common warts. Injection of candida antigen (immunomodulation) intralesionally also appears to be an effective option. Pulsed dye laser therapy may be reserved for recalcitrant or hard to reach (periungual) warts [14]. Treatment options for condylomas include patient-applied therapies such as imiquimod and podofilox, along with cryotherapy and surgical excision [15].

## Hand-Foot-Mouth Disease

### General Principles

#### Epidemiology

Hand-foot-mouth disease (HFMD) is a contagious, usually benign, enterovirus disease caused mainly by Coxsackievirus A16 in the United States. It is most common in children, but can be seen in adults. HFMD is spread by contact with saliva, mucus, blister fluid, or fecal material from an infected person.

#### History and Physical Examination

There may be a prodrome of malaise, loss of appetite, fever, and sore throat. One or two days



later, tender aphthous sores appear in the mouth and a rash follows within 24 h. The self-limited rash is found especially on the palms and soles, but may occur on the face, buttocks, and legs. The skin lesions begin as small red macules, but develop into white 3–5 mm vesicles with a red periphery.

### Treatment

Treatment of HFMD is supportive and symptomatic care. Cool fluids in small amounts help alleviate pain and swallowing in the eruptive phase. Infected patients should be kept at home until the rash clears and careful personal hygiene observed to prevent spread [16].

## Fungal Infections and Yeast Infections

### Dermatophytoses

#### General Principles

The group of dermatophytes includes fungi (tinea, ringworm) that are the most common fungal infections seen by primary care physicians. They survive in superficial keratin found on the skin, hair shafts, and nails. At times, they may be confused with eczema or other skin disorders.

#### Epidemiology

Tinea capitis is most often seen in children, presenting as one or more round patchy areas of hair loss. These grow larger untreated and in some instances may cause an inflammatory reaction deeper into the scalp called a kerion. Kerions are boggy and indurated and can cause scarring alopecia. “Black dot tinea,” the appearance of tinea in the scalp when the infected hair shaft breaks off at the scalp surface, is usually caused by *Trichophyton tonsurans*.

#### Diagnosis

Tinea barbae is a less common hair infection than tinea capitis. It may occur in those who work with or milk animals and thus lay their face on the side of the animal (such as dairy farmers). The hairs of a fungal-infected beard can be plucked painlessly and examined for hyphae. Tinea corporis and

tinea faciei are common in children and adults. These are the classic “ringworm” appearing lesions, with the annular shape, clearing center, and a superficial active border. Untreated, they can achieve a large area with an irregular, serpentine border. In wrestlers, this form of infection is called tinea gladiatorum. Tinea cruris, or “jock itch,” occurs mostly in adult males, and is more common in the warm summer months (Fig. 4). Like tinea pedis, this lesion can be extremely pruritic. Tinea pedis, also known as “athlete’s foot,” most classically presents in the toe web between the fourth and fifth toes in a young adult male, although any interdigital spaces can be affected. The warm, moist environment in the toe webs, the common exposure to locker room floors and communal baths, and the tightly fitting shoes over a sweating foot all combine to create this most common of tinea infections. Intense itching is most noticeable when the socks and shoes are removed. “Two feet-one hand” syndrome is occasionally noted, when both feet and the dominant hand the patient uses to scratch or pick at the infected site become infected [17]. Tinea incognito is the name given to any tinea infection which has been treated erroneously or inadvertently with topical steroids. The steroid blunts inflammation and disguises the usual active border. A careful history and review of



**Fig. 4** Tinea cruris

medications will suggest the correct diagnosis, and KOH examination and culture will confirm the diagnosis.

### Treatment

For small areas of infection, topical antifungal creams are effective and available over the counter. These should be continued for at least 1 week after apparent resolution to prevent recurrence. Larger areas are more efficiently treated with oral antifungals. For children, griseofulvin is the drug of choice [18]. In adults, fluconazole (Diflucan), itraconazole (Sporanox), or terbinafine (Lamisil) are recommended. In Athlete's Foot, treatment is aimed at drying the moist areas with cool Burrow's solution soaks and use of over-the-counter topical antifungal creams. In severe cases, oral antifungals can be used as for tinea corporis.

### Prevention

Tinea gladiatorum in high school wrestlers can be prevented by use of prophylactic fluconazole [19].

## Nail Infections

### General Principles

Tinea unguium (onychomycosis) is an infection of the nails by dermatophytes, most often Trichophyton species. Patients may complain of discomfort walking due to the distorted nail and



**Fig. 5** Onychomycosis of nail plate beginning at the distal subungual area. Note characteristic streaks toward proximal nail matrix as channels

may suffer social embarrassment or loss of self-esteem from the cosmetic appearance [20].

### Epidemiology

The fungus may attack the nail proximally (less common, except in immune deficiency patients), distally (most commonly), or from a superficial surface invasion (white superficial onychomycosis) (Fig. 5).

### Diagnosis

Diagnosis can be made with KOH of subungual scrapings and histologic exam of distal nail clippings. Culture to confirm the species of fungus is desirable to guide treatment choices.

### Treatment

Treatment of nail infections is more difficult than other tinea, requiring longer treatment intervals and accompanied by a higher failure rate. For toenails, terbinafine (Lamisil) given in a continuous dose of 250 mg/day for 12 weeks yields 70–88 % cure rate and is inexpensive in generic form. Pulse dosing at 500 mg/day 1 week per month for 3 months is less effective at 58.7 % cure rate [4]. Fingernails need be treated only 6 weeks at the same dose. Fluconazole and itraconazole have also been used with lesser success. For prolonged treatment options, baseline CBC and liver function tests with rechecks every 4–6 weeks are recommended.

## Yeast

### General Principles

Yeast organisms thrive in moist, warm environments, and infections are therefore most common in the interdigital spaces of those who work around water (dishwashers, cooks, bartenders) or in areas of the body where skin overlap provides warmth and moisture. These include the oral mucosa (especially in infants), the groin and genitalia, and inframammary or sub-pannus skin areas.

### Epidemiology

*Candida albicans* and other species of *Candida* live within the normal skin and mucous

membrane flora, but cause infection with triggers such as pregnancy, oral contraceptives, topical or oral steroid use, oral antibiotics, diabetes, skin maceration, or any process interfering with cell-mediated immunity.

Thrush is oral candidiasis in infants or children. It is frequently seen in healthy newborns, where it may be asymptomatic or may cause some fussiness.

## Diagnosis

### Physical Examination

Thrush in place of it appears as a creamy exudate or white adherent plaques from the accumulation of desquamated superficial epithelium. If removed, a raw, reddened tender epithelium is found. Candidal vulvovaginitis is a common infection in women, causing itching, burning, dysuria, and vaginal discharge. The vaginal tissues are red, swollen, and tender, and often a whitish curdy discharge is found. The vaginal pH is normal ( $\text{pH} < 4.5$ ), distinguishing this discharge from other common causes of vaginitis. Candidal balanitis in the male presents with raw, red skin over the glans penis and skin of the shaft, especially in uncircumcised men. Candidal intertrigo is common, especially in warm climates and in obese or diabetic patients. Overlapping skin surfaces are ideal for monilial growth, and the resultant infection causes an area of bright red, superficially raw skin that is moist and confluent with peripheral “satellite” colonies. Candidal diaper rash causes red, raw, macerated, or fissuring skin in the diaper area of infants (or adults).

### Treatment

Thrush is treated in children with nystatin oral suspension. In adults this is most efficiently accomplished by oral fluconazole. For patients with cancer or HIV, prophylactic dosing can help prevent relapses. Treatment of vulvovaginitis with oral fluconazole (150 mg PO, one dose only) is usually effective. Alternatively, vaginal and intravaginal creams and troches are available (terconazole and miconazole). As in the female, a single oral dose of fluconazole 150 mg is as effective as topical antifungal creams applied daily for



**Fig. 6** Powdery scale noted on scraping with #15 knife blade. KOH shows “meatballs & spaghetti”

7 days (clotrimazole and miconazole) for treatment of balanitis in the male. Treatment of intertrigo is aimed at removing the moist environment using Domeboro’s solution for soaks several times a day and at eliminating the actively growing yeast with antifungal creams. For candida diaper rash, excess moisture can be addressed by frequent diaper changes or intervals of open-air exposure without a diaper. Antifungal creams are applied twice daily for 7–10 days. Avoidance of formulations containing both antifungal and steroid creams is usually prudent, as the steroid component may cause prolonged duration of the moniliasis [4].

## Tinea Versicolor

### General Principles

Tinea versicolor is a commonly encountered infection of the skin, whose name originates from the fact that the affected skin has a different color in the summer than in the winter.

## Epidemiology

It is caused by dimorphic lipophilic yeast, *Pityrosporum ovale* and *Pityrosporum orbiculare*, together previously called *Malassezia furfur*, that thrives best in the stratum corneum and hair follicles of sebaceous-rich skin.

## Diagnosis

### History and Physical Exam

The characteristic appearance of the rash is an area of cape-like confluence, usually over the shoulders and upper chest, with a reticular border of multiple oval macules of varying size. In the winter months, Caucasians will be found to have a slightly scaly, light brown rash; in the summer, the same individual will present with white oval to circular patches that stand out against the tanned skin – hence the name “versicolor.” While the upper chest is most often involved, the rash may extend to the upper arms, neck, and abdomen. The rash may be slightly itchy, but is usually asymptomatic.

### Laboratory

The clinical diagnosis can be confirmed by lightly scraping the lesions with a #15 knife blade, producing a powdery scale (Fig. 6). A potassium-hydroxide preparation of the scale will demonstrate the classic “meatball and spaghetti” appearance of the hyphae and spores.

### Treatment

For limited disease, topical antifungals, such as ketoconazole 2 %, are highly effective and still the treatment of choice. For extensive rashes or failures of topical treatments, oral antifungals of the azole class have proven to be effective.

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## Infestations

### Lice/Pediculosis

#### General Principles

Lice are obligate human ectoparasites that feed by piercing the skin with their claws and ingesting the blood, causing an itchy reaction in the skin of

the patient. They live at the border of skin and hair and are visible as a 1–2-mm mobile insect. Females lay 0.8-mm eggs (nits) that are glued firmly to the hair shaft. After an 8–10 day incubation, the larvae hatch and mature. Live nits will be found within the first ¼ inch of a growing hair, but empty nits will remain attached to hairs for months.

### Epidemiology

There are three main species of lice: *Pediculosis capitis* or head lice, *Pediculosis corporis* or body lice, and *Pthirus pubis* or pubic lice. Pubic lice are the most contagious of sexually transmitted diseases, with a 90 % chance of acquisition with only one exposure. Head lice are most commonly seen in school children and are the focus of greatest attention by parents, school nurses, and physicians.

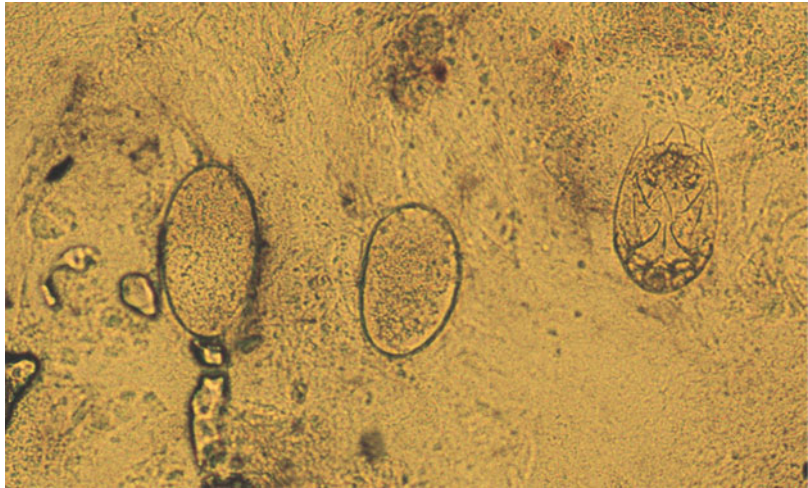
### Diagnosis

The diagnosis is made by demonstrating lice or by combing the hair with a fine-toothed “nit comb.”

### Treatment

Growing resistance of lice has occurred to the most commonly used chemicals, permethrin 1 % (Nix) and pyrethrins 0.3 % and piperonyl butoxide 4 % shampoo (RID). These over-the-counter preparations are now often effective in only about 45 % of patients. Permethrin is considered the first choice, can be used in patients 2 months and older, and is least expensive. Malathion (Ovide) 0.5 % lotion is used in treatment failures but is much more expensive and cannot be used in children under 6 years of age [21]. Parents uneasy with insecticide use can utilize the nonpharmacologic techniques of wet-combing or application of Cetaphil in a dry-on suffocation-based treatment plan. While questions have been raised about study design, Pearlman reported a 95 % eradication rate in patients who had failed other treatments using this simple and inexpensive technique [22]. Treatment for body and pubic lice is similar. Ivermectin (Stromectol) 200 mcg/kg orally with a second dose repeated in 10 days is also effective for all types of lice and can be used on patients  $\geq$  15 kg at a cost of approximately \$10–\$30 per dosage [23].

**Fig. 7** *Sarcoptes scabiei*, wet mount of KOH prep



## Scabies

### General Principles

Scabies is an intensely pruritic infestation caused by the mite *Sarcoptes scabiei*. It is the most common of infestations and is highly contagious. Close personal contact, as within households or nursing homes, will result in rapid spread. The initial symptoms begin insidiously with one or two mildly itchy sites. The fertilized female mite burrows into the stratum corneum and, through her 30-day life cycle, continues to burrow up to several centimeters. Along the way, she leaves a path strewn with eggs (at a rate of 1–3 per day) and fecal pellets (scybala). The eggs hatch and the larvae mature within 2 weeks. The adult forms mate, and the cycle is repeated. Meanwhile, the discarded scybala and egg casings prompt an extremely pruritic allergic rash at the sites of infestation. The deceptively slow start of the disease, lasting up to a month, is rapidly replaced by a widespread, intensely itching rash as the mites multiply exponentially causing papules, vesicles, and burrows.

### Diagnosis

The diagnosis can be confirmed by scraping a burrow and finding egg casings, eggs, scybala, or mites (Fig. 7). Mites are less frequently seen in the usual cases of scabies. Only in crusted (Norwegian) scabies are there hundreds or thousands of mites. It is an uncommon form and is

found in patients with immune deficiencies, mental disorders, or the elderly.

### Physical Examination

Sites of infestation are classically the hands, feet, wrists, axilla, waistline/abdomen, and genitalia. Infants and children may have greater number on the palms and soles. Nocturnal itching is classic, and if left untreated, the infestation can last for years.

### Treatment

Scabies is treated with permethrin 5 % (Elimite) cream, the drug of choice. All members of the household should be treated, regardless of symptom presence. One application is considered curative, although many practitioners repeat the treatment in 1 week. Oral Ivermectin (Stromectol) is another first-line treatment option. It is usually chosen for treatment failures, the elderly, or those unable to complete topical therapy. Treatment for crusted scabies requires dual regimens of topical permethrin and oral Ivermectin as well as special environmental measures [21].

### Patient Education

All clothing and personal items should be washed in hot water and dried in a hot dryer. It is important to inform patients that itching usually improves shortly after treatment, but persists for 3–4 weeks thereafter.

## Chiggers

### General Principles

Chiggers, also known as the harvest mite or red bug, are bites from the barely visible *Trombicula* mites causing an irritating and very itchy rash.

### Diagnosis

#### History and Physical Examination

Bite sites are most often near the ankles and legs, but can occur in skinfolds, especially in the groin, axilla, or waistline. The itching is most severe for the first 1–2 days and resolves spontaneously in 1–2 weeks afterwards.

### Prevention

Bites can be prevented by use of proper clothing and any DEET-containing repellants.

## Delusional Parasitosis

### General Principles

Delusional parasitosis is a psychodermatologic condition in which the patient is firmly convinced of an infestation with some type of organism and uses destructive measures (scratching, gouging, shaving) on the skin to combat the problem. The condition may last for years, and others within the patient's orbit (spouse, child) may also become convinced of its existence (termed *folie à deux*).

### Diagnosis

#### History and Physical Examination

The patient classically presents to their PCP with symptoms of a crawling or itchy sensation for months or years. They usually bring with them "evidence" of the infestation, called the "matchbox sign," in which pieces of skin and debris they have removed are placed in tissue paper and placed in a container, such as a matchbox or plastic baggies. Skin exam reveals numerous active and healing excoriations in reachable anatomic sites and no lesions in unreachable areas.

### Treatment

Treatment requires the investment of time to listen attentively and empathetically to the patient's complaint to establish rapport. A systematic evaluation is required to ensure there really is no infestation. Often the symptoms persist, and the use of low-dose atypical antipsychotic medications is required for resolution [24].

### Referrals

Referral to psychiatry may be a useful adjunct, but the patients often refuse the referral as unnecessary and an implication of the physician's lack of belief in their symptoms and needs.

## Cat Scratch Disease (CSD)

### General Principles

Cat scratch disease is an illness caused by *Bartonella henselae* and characterized by unilateral adenopathy, malaise, anorexia, aches, and a moderate to low-grade fever. It is most often seen in children, but can be present in adults. It is usually a benign, self-limited disease, although rarely it can cause ophthalmic complications or neurologic symptoms. Over 90 % of patients have a history of contact with a cat or kitten. The bacteria is passed from pet to owner by scratches or bites.

### Diagnosis

The diagnosis of cat scratch disease can be confirmed by the combination of a history of exposure to cats, lymphadenopathy, and elevated antibodies to *B. henselae*.

### Physical Examination

A red papule or vesicle is often found on the hand, which, in contrast to insect bites, is non-pruritic. As the vesicle heals, regional adenopathy (usually ipsilateral) occurs. Persistent lymphadenopathy, which is often the presenting symptom, usually resolves in 1–6 months.

### Treatment

Treatment is usually unnecessary [4].

## Bedbugs

### General Principles

Bedbugs (*Cimex lectularius*) are small, light-averse insects that hide near beds and obtain blood meals from humans while they sleep. They are found worldwide and have undergone a significant resurgence in the past decade, most likely due to expanded travel and increasing resistance to current insecticides. *Cimex saliva*, which incites the post-bite rash and evokes a wide variety of responses from their victims, is injected into the skin at the bite site. The host reaction is usually an intensely pruritic maculopapular rash, although papules, wheals, and vesicles have been reported.

### Diagnosis

Confirmation requires a careful examination of the sleeping premises. Molted exoskeletons, dark granular feces, eggs, and debris all can be found within a few feet of the sleeper. These sites are often in mattress seams, headboards, wall hangings, peeling wallpaper, or other similar sites [25].

### Physical Examination

Bite sites are found on exposed skin. The classic linear three-bite presentation, “breakfast, lunch, and dinner,” should suggest the diagnosis of bedbugs.

### Treatment

Bite treatment is aimed at relief of the itching with topical steroids or oral antihistamines. The rash is self-limited, resolving in 1–2 weeks.

### Patient Education

Eradication of an infested site can be frustrating and costly. An integrated pest management strategy is recommended by the Centers of Disease Control and Prevention (CDC) as well as the Environmental Protection Agency (EPA) to eliminate infested sites. The EPA and CDC have web sites with features that answer frequently asked questions (FAQs) as well as information on the life cycle of the insects and methods of control.

## Myiasis (Botfly)

### General Principles

Cutaneous myiasis (botfly infestation) occurs when eggs of a human botfly, *Dermatobia hominis*, are deposited into the skin of the host. The botfly itself does not bite, but uses other biting insects to transmit its eggs by a process called phoresis. Infestation is most commonly seen in late summer or fall, frequently in travelers who have visited Central or South America.

### Diagnosis

#### History and Physical Examination

Clinically, the patient presents with a red papule that can appear on any exposed skin surface. As the larvae grows in the subcutaneous tissue, an air vent into the skin is created and the larvae rise up every minute or so for oxygen, causing a sensation of movement within the skin.

### Treatment

Treatment consists of recognition of the condition and removal of the larvae [4].

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