Chapter 21

Microbial Diseases of the Skin and Eyes

Part 2: Viral, Fungal, and Parasitic Skin Infections

Lectures prepared by Christine L. Case
Expected Student Learning Outcomes

List the causative agent, mode of transmission, and clinical symptoms of these skin infections:

1. warts
2. smallpox
3. monkeypox
4. chickenpox
5. shingles
6. cold sores
7. measles
8. rubella
Expected Student Learning Outcomes cont.

- Differentiate cutaneous from subcutaneous mycoses, and provide an example of each.
- List the causative agent and predisposing factors for candidiasis.
- List the causative agent, mode of transmission, clinical symptoms, and treatment for scabies and pediculosis.
- Define conjunctivitis.
- List the causative agent, mode of transmission, and clinical symptoms of these eye infections: ophthalmia neonatorum, inclusion conjunctivitis, trachoma.
- List the causative agent, mode of transmission, and clinical symptoms of these eye infections: herpetic keratitis, Acanthamoeba keratitis.
Warts

- Papillomaviruses
- cause skin cell proliferation ⇒ benign growth named **wart** or papilloma.
- Spread by direct contact
- May regress spontaneously or be removed chemically or physically via

<table>
<thead>
<tr>
<th>Method</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Cryotherapy (liquid N\textsubscript{2})</td>
<td>Imiquimod (stimulates interferon production)</td>
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<tr>
<td>Electrodesiccation</td>
<td>Bleomycin</td>
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<tr>
<td>Burn off with acid</td>
<td>Lasers</td>
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Smallpox

- Smallpox virus (orthopox virus). Two types:
  - variola major (> 20% mortality); variola minor (since 1900; < 1% mortality)
- Respiratory transmission. Virus to skin via bloodstream.
- Human only host
- From macules to papules to vesicles to pustules → reminiscent of ______
- Pitted scars = pocks
- Jenner
- Eradicated due to vaccination effort by the WHO
- Bioterrorism
- Monkeypox Prevention by smallpox vaccination
Chickenpox (VZV or HHV-3)

Varicella–zoster or human herpes virus 3 of Hepesviridae family

Respiratory transmission ➔ to blood ➔ to skin (➔ to sensory neuron)

Macule to papule to vesicle to pustule in 24 h

Pruritic (itchy) lesions – scratching may lead to serious 2° infections (S. pyogenes and S. aureus)

Complications: encephalitis and Reye’s syndrome.

After chickenpox, virus can remain latent in nerve cells. Reactivation later ➔ shingles = Herpes zoster (characteristic vesicular rash along affected cutaneous sensory nerves.)

Treatment with acyclovir.
Chickenpox Vaccine

- 1995: attenuated chickenpox vaccine | released in US (Varivax)
- 2001: mandated in CA for kindergarten and school
- 85% effective
- Breakthrough varicella in vaccinated people
- Chickenpox vaccine being proposed for older adults to prevent ______________
Virus may remain latent in dorsal root ganglia

Occurrence of shingles when cell mediated immunity weak.

After healing may result in chronic pain → Post-herpetic neuralgia (may last for years)

(b) Recurrence of infection: shingles (herpes zoster)
Shingles or Herpes Zoster

About 20% of people who have had chicken pox will get zoster at some time during their lives. Most people will get zoster only once.
Herpes Simplex Types 1 and 2

- **Herpes simplex virus 1** (HSV type 1) and 2 (HSV type 2); ds DNA, enveloped; of *Herpesviridae* family
- New name: *Human herpes virus 1* (HHV-1) and 2 (HHV-2)
- HSV-1 can remain latent in trigeminal nerve ganglia
- HHV-2 can remain latent in sacral nerve ganglia.
- **Acyclovir**, vidarabine generally lessen symptoms
- Very common, recurrent infection often during childhood (fever, blisters, cold sores) > 90% of Americans exposed
HSV-1 in the Trigeminal Nerve Ganglion

Trigeminal nerve
Ganglion
Site of viral latency
Site of active lesion

Figure 21.13
1. **Cold sores or fever blisters** (vesicles on lips)
2. **Herpes gladiatorum** (vesicles on skin)
3. **Herpetic whitlow** (vesicles on fingers)
4. **Herpes encephalitis**: Via olfactory nerve. Up to 70% fatality rate with HHV-2
5. **Neonatal herpes** passage though infected birth canal (→ encephalitis). May also cross placenta.
6. **Genital herpes** - Type II may increase risk of cervical cancer

**Transmitted** through contact with oral secretions from an individual infected . . . or asymptomatic(!)
Herpetic Whitlow

- Occupational hazard for health care professionals.
- Intense painful infection of the hand involving 1 or more fingers, typically terminal phalanx (60% HSV-1; 40% HSV-2)
Measles (Rubeola)

- Measles virus
- Transmitted by respiratory route
- Macular rash and **Koplik's spots** on oral mucosa.

**Complications of measles:**

- middle ear infections, pneumonia, and secondary bacterial infections.
- **Encephalitis** in 1 in 1,000 cases
- **Subacute sclerosing panencephalitis** in 1 in 1,000,000 cases

Fig 21.14
pathognomic of measles!

Typically involve the buccal and labial mucosa. Irregular, patchy erythema with tiny central white specks → 'grains of salt' appearance.
Measles Prevented by attenuated vaccine (MMR)

Reported U.S. Cases of Measles, 1960–2007:

[Graph showing the decrease in reported measles cases from 1960 to 2007, with a peak in 1964 and a significant reduction after the vaccine was licensed.]
Rubella - German Measles

Caused by rubella virus

Typically mild (macular rash, fever), often unrecognized

Teratogenic during early pregnancy (congenital rubella syndrome)

Attenuated vaccine (MMR)
Diseases in Focus: Vesicular and Pustular Rashes p. 589

- An 8-year-old boy has a rash consisting of vesicular lesions of 5 days’ duration on his neck and stomach. Within 5 days, 73 students in his elementary school had illness matching the case definition for this disease.

- Can you identify infections that could cause these symptoms?
Fungal Diseases of Skin and Nails

- Cutaneous mycosis
- Subcutaneous mycoses
- Candidiasis
Cutaneous Mycoses – Dermatomycoses

Also known as *tineas* or *ringworm*

*Microsporum, Trichophyton, and Epidermophyton* colonize the outer layer of the epidermis

Metabolize keratin $\implies$ grow on keratin-containing epidermis, hair, skin, and nails.

Diagnosis based on microscopic examination of skin scrapings or fungal culture.

Dermatomycoses usually treated with topical chemicals (*e.g.*: Miconazole) or oral griseofulvin.
Tinea unguium
Subcutaneous Mycoses

More serious than cutaneous mycoses

**Sporotrichosis** (rose gardener’s disease)
results from soil fungus (*Sporothrix schenckii*) that penetrates the skin through a wound.

The fungi grow and produce subcutaneous nodules along the lymphatic vessels.

Treated with potassium iodide (KI)

If untreated may persist for years.
Candidiasis

- **Candida albicans** (yeast)
- May result from suppression of competing bacteria by antibiotics
- Occurs in skin; mucous membranes of genitourinary tract and mouth.
- Topical treatment with miconazole or nystatin.
- **Thrush**: An infection of mucous membranes of mouth.
Parasitic Skin Infections

**Scabies** mites
- *Sarcoptes scabiei* burrowing and laying eggs in skin.
- Intimate contact transmission
- Secondary infections common due to scratching
- Treatment with topical insecticides, or oral ivermectin

**Pediculosis**
- caused by louse (*Pediculus humanus*)
- Feed on blood.
- Lay eggs (nits) on hair.
- Treatment with topical insecticides.
Infection of the Eye Membranes: Conjunctivitis (pinkeye)

Various bacteria (e.g.: *Haemophilus influenzae*, *pseudomonas*) and viruses (e.g.: adenovirus)

Inclusion conjunctivitis: caused by *Chlamydia trachomatis*. Transmitted to infants during birth and through unchlorinated swimming water.

Conjunctivitis also associated with unsanitary contact lenses
Neonatal Gonorrheal Ophthalmia

Causative agent: *Neisseria gonorrhoeae*

Transmitted to a newborn's eyes during passage through the birth canal.

Original preventative treatment with silver nitrate. Now replaced with antibiotics due to common coinfection with *Chlamydia*.
Trachoma

Caused by 4 trachoma serotypes of *Chlamydia trachomatis*

Infections of conjunctiva leads to nodule formation

5-10% of the world's population has been infected (esp. in hot, dry regions)

Worldwide leading cause of nontraumatic blindness in children

Typically infected during birth or autoinoculation from extra-ocular sites
Herpetic Keratitis (Inflammation of the cornea)

- Herpes simplex virus 1 (HSV-1)
- Leading cause of infectious blindness in US
- Can recur
- Treated with trifluridine

Acanthamoeba Keratitis

Protozoa transmitted via water, contact solutions
A 20-year-old man had eye redness with dried mucus crust in the morning. The condition resolved with topical antibiotic treatment.

Can you identify infections that could cause these symptoms?