

# Skin and soft tissue infections

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# Why should we deal with them?

- The skin is the biggest barrier, which protect against environmental influences
- Infections are very comon and various
  - Cause by bacterias, fungals, viruses, protozoals
  - They show a varied pathway
- Allergic reactions and immunmediated dieases shown same clinical sings
- The number of superficial skin infections increases  
Their recognition and treatment are general practitioners' competence

# The structure of the skin, or integument, which consists of the cutaneous membrane and accessory structures

## Cutaneous Membrane

The **epidermis** (*epi*, above) consists of a stratified squamous epithelium.

- Papillary layer
- Reticular layer

The **dermis** consists of a papillary layer of areolar tissue and a reticular layer of dense irregular connective tissue.

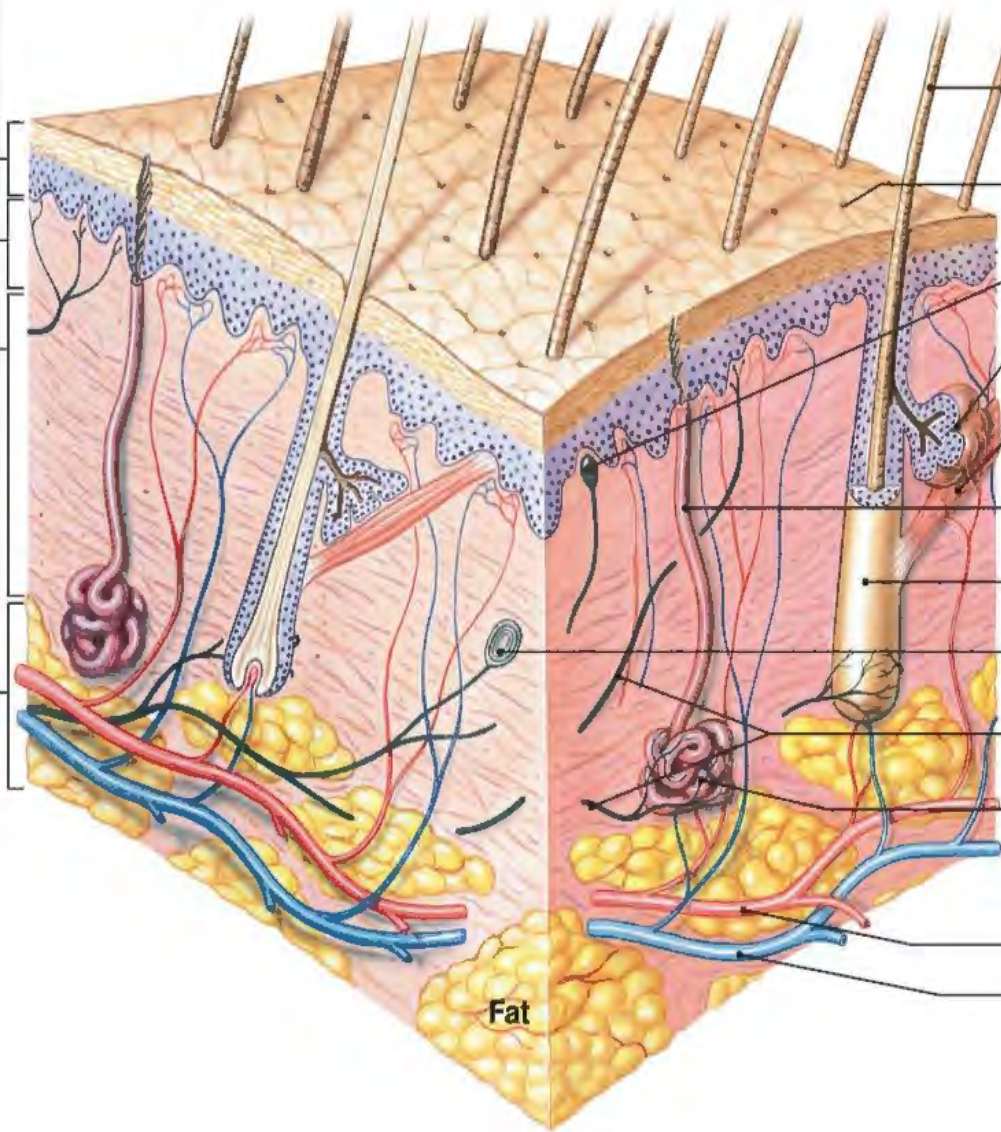
The **hypodermis** (subcutaneous layer or superficial fascia) separates the integument from the fascia around deeper organs. Note that this tissue layer is not part of the integument.

## Accessory Structures

- Hair shaft
- Pore of sweat gland duct
- Tactile corpuscle
- Sebaceous gland
- Arrector pili muscle
- Sweat gland duct
- Hair follicle
- Lamellated corpuscle
- Nerve fibers
- Sweat gland

- Artery
- Vein

The network of arteries and veins connected to smaller vessels servicing the tissues of the integumentary system is the **cutaneous plexus**.



# Natural Defenses of the Skin

- Keratin
- Skin sloughing
- Sebum: low pH, high lipid
- Sweat: low pH, high salt, and
  - Lysozyme, which digests peptidoglycan

# Normal Skin Flora

- *Propionibacterium acnes*
- *Corynebacterium sp.*
- *Staphylococci*
  - *Staphylococcus epidermidis*
  - *Staphylococcus aureus*
- *Streptococci sp.*
- *Candida albicans (yeast)*
- *Many others*

# Classification

- Simple uncomplicated (mostly Gram +)
  - Cellulitis
  - Impetigo
  - Erysipelas
  - Simple abscess
  - Furuncles (boils)
- Complicated: (Gram – & Gram + )
  - Decubitus ulcers
  - Necrotising fasciitis
  - Cellulitis
  - Gangrene

# Impetigo

- Superficial cellulitis
  - Group A streptococci
  - *S. aureus* 10% of patients
- Small, fluid-filled vesicles, pus-filled blisters
- Lesions dry to form golden-yellow crusts
- Treatment:
  - Penicillin (drug of choice)
    - Benzathine penicillin G IM x1
    - Penicillin VK PO
  - PCN-allergic: erythromycin PO x 7 to 10 days
  - Mupirocin: topical less effective than oral therapy



# Treatment

Duration 7 to 10 days

- Penicillins:
- Penicillin (group A streptococcus only): orally/IM
  - Nafcillin (MSSA or streptococcus)
  - Dicloxacillin orally
- Cephalosporins: (1st generation)
  - Cefazolin IV
  - Cephalexin/cefprozil orally
- Macrolides:
  - Erythromycin/Azithromycin/Clarithromycin
  - Clindamycin
- Vancomycin IV: PCN allergic
- Linezolid IV/PO



# Folliculus

- Etiology
  - Infection of hair follicle that results in pustule formation
  - Generally the result of a staphy. infection
- Signs and Symptoms
  - Pustule that becomes reddened and enlarged as well as hard from internal pressure
  - Pain and tenderness increase with pressure
  - Most will mature and rupture
- Management
  - Care involves protection from additional irritation
  - Referral to physician for antibiotics
  - Keep athlete from contact with other team members while boil is draining

# Carbunculus

- Etiology
  - Similar in terms of early stage development as furuncles
- Signs and Symptoms
  - Larger and deeper than furuncle and has several openings in the skin
  - May produce fever and elevation of WBC count
  - Starts hard and red and over a few days emerges into a lesion that discharges yellowish pus
- Management
  - Surgical drainage combined with the administration of antibiotics
  - Warm compress is applied to promote circulation

# Folliculitis

- Etiology
  - Inflammation of hair follicle
  - Caused by non-infectious or infectious agents
  - Moist warm environment and mechanical occlusion contribute to condition
  - Psuedofolliculitis (PFB)
- Signs and Symptoms
  - Redness around follicle that is followed by development of papule or pustule at the hair follicle
  - Followed by development of crust that sloughs off with the hair
  - Deeper infection may cause scarring and alopecia in that area
- Management
  - Management is much like impetigo
  - Moist heat is used to increase circulation
  - Antibiotics can also be used depending on the condition

# Acne vulgaris

- Etiology
  - Inflammatory disease of the hair follicle and the sebaceous glands
  - Sex hormones may contribute
- Signs and Symptoms
  - Present with whiteheads, blackheads, flesh or red colored papules, pustules or cysts
  - If chronic and deep = may scar
  - Psychological impact
- Management
  - Topical and systemic agents used to treat acne
  - Mild soaps are recommended

# Paronychia and Onychia

- Etiology
  - Caused by staph, strep and or fungal organisms that accompany contamination of open wounds or hangnails
  - Damage to cuticle puts finger at risk
  - Paronychia – inflammation / infection of the surrounding tissue
  - Onychia – infection of the nail.
- Signs and Symptoms
  - Rapid onset; painful with bright red swelling of proximal and lateral fold of nail
  - Accumulation of purulent material w/in nail fold
- Management
  - Soak finger or toe in hot solution of Epsom salt 3 times daily
  - Topical antibiotics, systemic antibiotics if severe
  - May require pus removal through skin incision

# Celulitis

- Acute, spreading infectious process affecting epidermis and dermis
- Inflammation with little or no necrosis, edema
- Lymphatic involvement
- Fever, chills, leukocytosis ☐ Bacteremia up to 30% of cases
- Complications:
  - Abscess and osteomyelitis

# Microbiology

- Majority of infections:
  - *Staphylococcus aureus*
  - streptococci
- Considerations:
  - Methicillin resistant *S. aureus* (MRSA)
  - Vancomycin resistant enterococci (VRE)
  - Gram negatives: pseudomonas, *E. coli*
  - Anaerobes:
    - Clostridium, Bacteroides, peptostreptococcus

# MRSA cellulitis

Methicillin resistance: Penicillin binding protein (PBP-2A)  
(Resistance to all beta-lactam and penicillin antibiotics)

- Vancomycin
- Linezolid
- Clindamycin (confirm sensitivity) +/- Vancomycin
- Daptomycin
- Trimethoprim-sulfamethoxazole
- Synercid

# Erysipelas

- Superficial cellulitis with extensive lymphatic involvement
- *S. pyogenes* (group A streptococci)
  - 30% of pts. have had a streptococcal respiratory infection.
- Treatment:
  - Penicillin
  - 1st gen. cephalosporin
  - macrolide

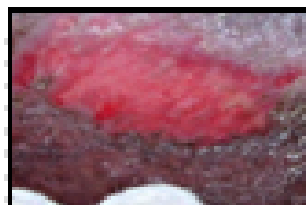
# Skin ulcer

**Stage: I**



Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area.

**Stage: II**



Partial thickness loss of dermis presenting as a shallow open ulcer with a red wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.

**Stage: III**



Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.

**Stage: IV**



Full thickness tissue loss with exposed tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often includes undermining tunneling.

**Suspected Deep Tissue Injury<sup>a</sup>**

Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, shiny, boggy, warmer or cooler as compared to adjacent tissue.

**Unstageable<sup>a</sup>**

Full thickness tissue loss in which the base of the ulcer is covered by (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed.

<sup>a</sup> Not pictured.

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## Polymicrobial:

- 3 to 5 organisms per infection in hospitalized patients
- Staphylococci most common, 2nd most common Streptococcus
- Gram negative bacilli and/or anaerobes occur in approx. 50% of cases

### Gram Negative

Proteus spp.

E. coli

Klebsiella pneumoniae

Pseudomonas aeruginosa

Enterobacter spp.

### Gram positive

S. aureus

S. epidermidis

Streptococci spp.

Enterococcus spp.

### Anaerobes

Peptostreptococcus

Clostridium spp.

Bacteroides spp.

# Treatment

## Empiric oral:

Amoxicillin/clavulanic acid

TMP/SMX

Clindamycin

Clindamycin + Quinolone

Dicloxacillin

Cephalexin

Levofloxacin

Gatifloxacin

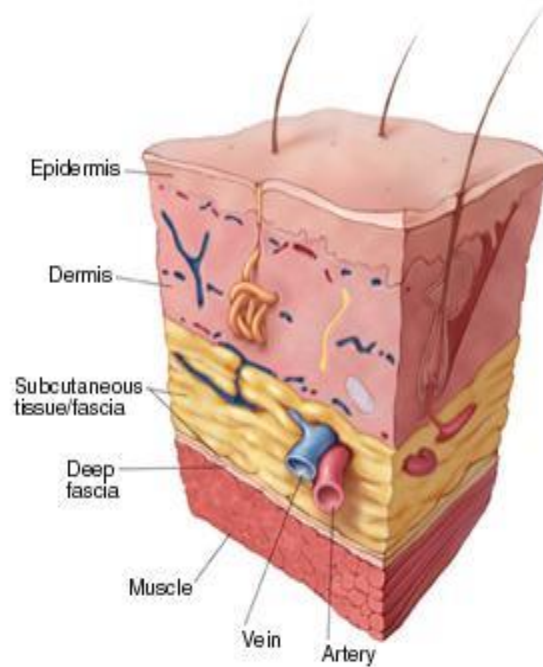
Moxifloxacin

(if no clinical improvement in 48 to 72 hrs, IV abx)

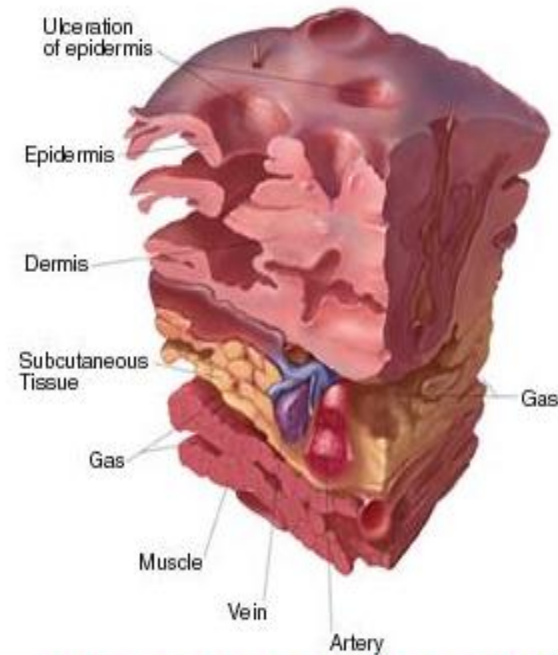
## Empiric intravenous:

- Ampicillin/sulbactam + aminoglycoside
- Piperacillin/tazobactam + aminoglycoside
- Imipenim/cilastatin (meropenem) + aminoglycoside
- Ampicillin + clindamycin + aminoglycoside
- Levofloxacin or Gatifloxacin + aminoglycoside (includes Pseudomonas coverage)

# Fasciitis necrotisans



Normal Skin



Necrotising Fasciitis

- Disease starts as localized infection
- Pain in area, flu-like symptoms
- Invasive and spreading
- May lead to toxic shock (drop in blood pressure)
- Incidence 1-20/100,000
- 30-70% mortality
- Surgical removal, antibiotics

# Gas gangrena

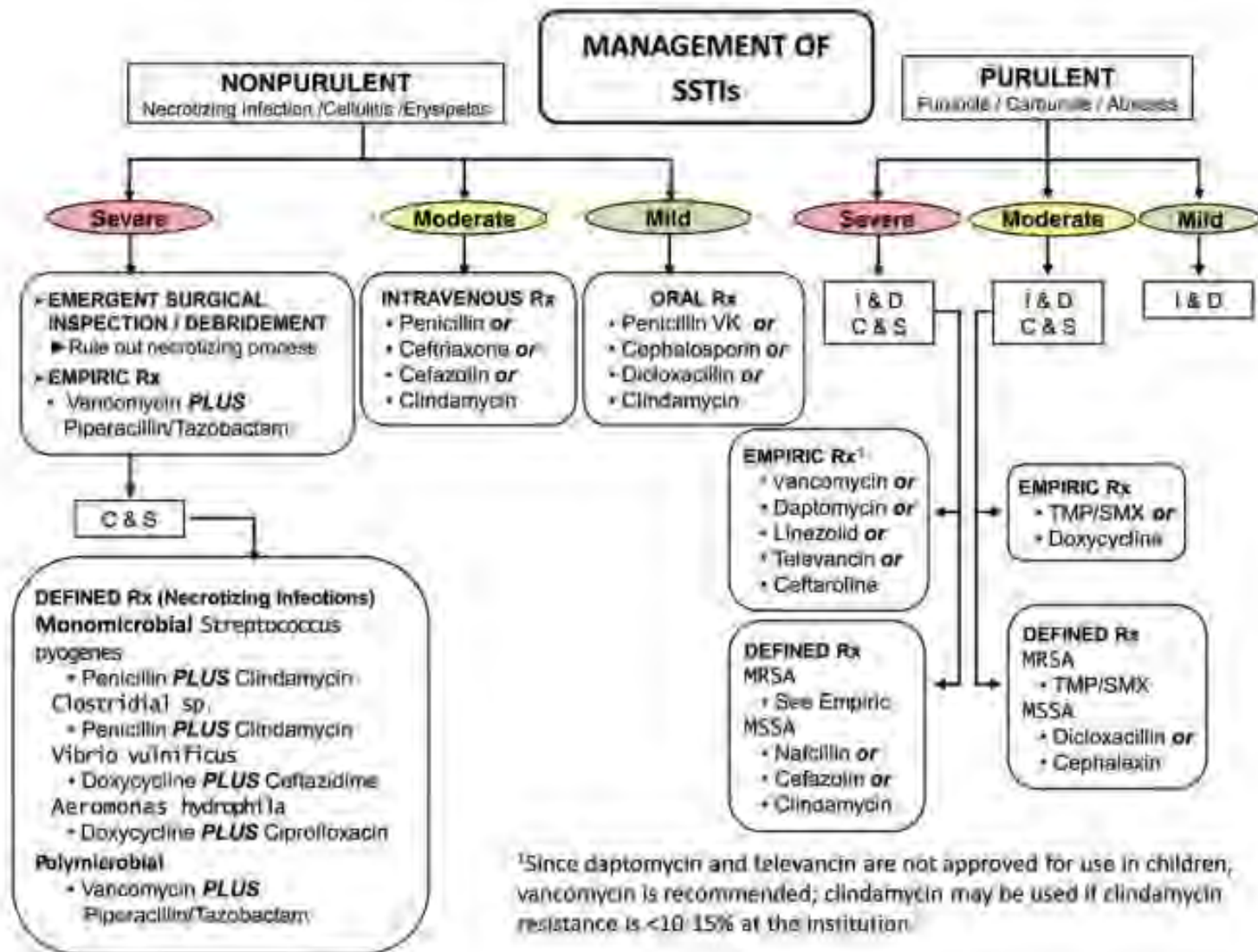
- Signs and symptoms
  - Blackening of infected muscle and skin
  - Presence of gas bubbles
- Pathogens and virulence factors
  - Caused by several *Clostridium* species
  - Bacterial endospores survive harsh conditions
  - Vegetative cells secrete 11 toxins



- Pathogenesis and epidemiology
  - Traumatic event must introduce endospores into dead tissue
  - Mortality rate exceeds 40%
- Diagnosis, treatment, and prevention
  - Appearance is usually diagnostic
  - Rapid treatment is crucial
    - Surgical removal of dead tissue
    - Administration of antitoxin and penicillin
  - Prevent with proper cleaning of wounds

# Bite wounds

- 4 million people bitten by dogs annually.
- 40% cat bites/scratches become infected
  - *Pasteurella multocida* (most common), *S. aureus*, *Streptococcus*
- Anaerobes: *Bacteroides* and *Fusobacterium*
- Treatment:
  - Penicillin
  - Augmentin
  - Tetracycline
  - TMP/SMX
  - levofloxacin



<sup>1</sup>Since daptomycin and televancin are not approved for use in children, vancomycin is recommended; clindamycin may be used if clindamycin resistance is <10-15% at the institution.

# Mycoses

- **Mycoses are diseases caused by fungi**
- **Most are opportunistic pathogens**
- **Mycoses are classified by infection location**
  - **Superficial** – occur on the hair, nails, and outer skin layers; most common fungal infections
  - **Subcutaneous** – in the hypodermis and muscles
  - **Systemic** – affect numerous systems

# Superficial Mycoses

- Signs and symptoms
  - **Piedra**
    - Irregular nodules on the hair shaft
  - **Pityriasis versicolor**
    - Hypo - or hyper pigmented patches of scaly skin
- Pathogens and virulence factors
  - *Piedraia hortae* causes black piedra
  - *Trichosporon beigelii* causes white piedra
  - Pityriasis caused by *Malassezia furfur*

- Pathogenesis and epidemiology
  - **Superficial fungi produce keratinase, which dissolves keratin**
  - Fungi often transmitted via shared hair brushes and combs
- Diagnosis, treatment, and prevention
  - Piedra diagnosed by appearance and treated by shaving infected hair
  - Pityriasis identified by green color under ultraviolet light and treated with topical or oral drugs

# Cutaneous Mycoses

- Some fungi that grow in the skin manifest as cutaneous lesions
- **Dermatophytoses** are cutaneous infections caused by dermatophytes
  - Cell-mediated immune responses damage deeper tissues

# Tinea of the Scalp (tinea capitis)

## – Signs and Symptoms

- Ringworm of the scalp begins as a small nodule that spreads peripherally
- Appears as small grayish scales resulting in scattered balding
- Easily spread through close physical contact

## – Management

- Topical creams and shampoos are ineffective in treating fungus in hair shaft
- Systemic antifungal agents are replacing older agents due to increased resistance
- Some topical agents are used in conjunction



Tinea capitis  
(Ringworm of the scalp)

# Tinea of the Body (tinea corporis)

- Signs and Symptoms
  - Commonly involve extremities and trunk
  - Itchy red-brown scaling annular plaque that expands peripherally
- Management
  - Topical antifungal cream



# Tinea of the Nail (tinea unguium/ onychomycosis)

- Signs and Symptoms
  - Fungal infection of the nail -- found commonly in those engaged in water sports or who have chronic athlete's foot
  - Nail becomes thick, brittle and separated from its bed
- Management
  - Some topical antifungal agents have proved useful
  - Systemic medications are most effective
  - Surgical removal of nail may be necessary if extremely infected



# Tinea of the Groin (tinea cruris)

- Etiology
  - Symmetric red-brown scaling plaque with snake-like border
- Signs and Symptoms
- Mild to moderate itching
- Management
  - Treat until cured
  - Will respond to many of the non-prescription medications
  - Medications that mask symptoms should be avoided
  - Failure to respond to normal management may suggest a non-fungal problem (such as bacteria) and should be referred to a physician
  - May require additional topical medications and oral prescriptions



# Athlete's Foot (*tinea pedis*)

## – Etiology

- Most common form of superficial fungal infection
- Tricophyton species are most common cause of athlete's foot
- Webs of toes may become infected by a combination of yeast and dermatophytes

## – Signs and Symptoms

- Extreme itching on soles of feet, between and on top of toes
- Appears as dry scaling patch or inflammatory scaling red papules forming larger plaques
- May develop secondary infection from itching and bacteria

## – Management

- Topical antifungal agents and good foot hygiene

# Candidiasis (Moniliasis)

## – Etiology

- Yeast-like fungus that can produce skin, mucous membrane and internal infections
- Ideal environment includes hot humid weather, tight clothing, and poor hygiene

## – Signs and Symptom

- Infections w/in body folds
- Presents as beefy red patches and possible satellite pustules
- White, macerated border may surround the red area; deep painful fissures may develop at skin creases

## – Management

- Maintain dry area
- Use antifungal agents to clear infection



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# Tinea Versicolor

## – Etiology

- Caused by a yeast
- Appears commonly in areas in which sebaceous glands actively secrete body oils

## – Signs and Symptoms

- Fungus produces multiple, small, circular macules that are pink, brown, or white
- Commonly occur on chest, abdomen, and neck
- Do not tan when exposed to sun and usually are asymptomatic

## – Management


- Straightforward treatment - recurrences are common
- Use selenium shampoo (Selsun) and topical econazole nitrate (or something similar)
- When microorganism has been eradicated, re-pigmentation of the area will occur


Fair skin





Dark skin



Rare 

Uncommon 

Common 

Most common 

# Viral Infections

- Ultramicroscopic organisms that require host cells to complete their life cycle
  - May stimulate cell chemically to produce more virus until host cell dies
  - Lies within bud-like structure that does not damage cell or virus, w/out causing infection
- A number of skin infections are caused by viruses

# Herpes Simplex Labialis, Gladiatorum, and Herpes Zoster

## – Etiology

- Highly contagious and is usually transmitted directly through a lesion in the skin or mucous membrane
- Resides in sensory nerve neurilemmal sheath following initial outbreak
- Recurrent attacks stimulated by sunlight, emotional disturbances, illness, fatigue, or infection
- Type I vs. Type II

## – Signs and Symptoms

- Early indication = tingling or hypersensitivity in an infected area 24 hours prior to appearance of lesions
- Local swelling followed by outbreak of vesicles
- Athlete may feel ill w/ headache, sore throat, swollen lymph glands and pain in area of lesions

- Signs and Symptoms (continued)
  - Vesicles generally rupture in 1-3 days spilling serous material
  - Heal in generally 10-14 days
  - If an athlete has an outbreak they should be disqualified from competition due to contagious nature of condition
- Management
  - Herpes simplex lesions are self limiting - reduce pain and promote early healing
  - Use of antiviral drugs can reduce recurrence and shorten course of outbreak
- Complications
  - Can lead to secondary infection



# Verruca Virus and Warts

- Varied of forms exist
  - verruca plana (flat wart), verruca plantaris (plantar wart), and condyloma acuminatum (venereal wart)
- Different types of human papilloma virus have been identified
  - Uses epidermal layer of skin to reproduce and growth
- Wart enters through lesion in skin

# Common Wart

## – Signs and Symptoms

- Small, round, elevated lesion with rough dry surfaces
- Painful if pressure is applied
- May be subject to secondary bacterial infection



## – Management

- If vulnerable, they should be protected until treated by a physician
- Use of electrocautery, topical salicylic acid or liquid nitrogen are common means of managing this condition

# Molluscum Contagiosum

## – Etiology

- Poxvirus infection which is more contagious than warts (especially during direct body contact)

## – Signs and Symptoms

- Small, flesh or red colored, smooth-domed papules with central umbilication

## – Management

- Physician referral is necessary
- Cleansing and destructive procedure (counterirritant such as cantharidin, surgical removal or cryosurgery)



Thank you for your patience!