Bacterial & Fungal skin, Soft Tissue & Muscle infections

For Second Year Medical Students

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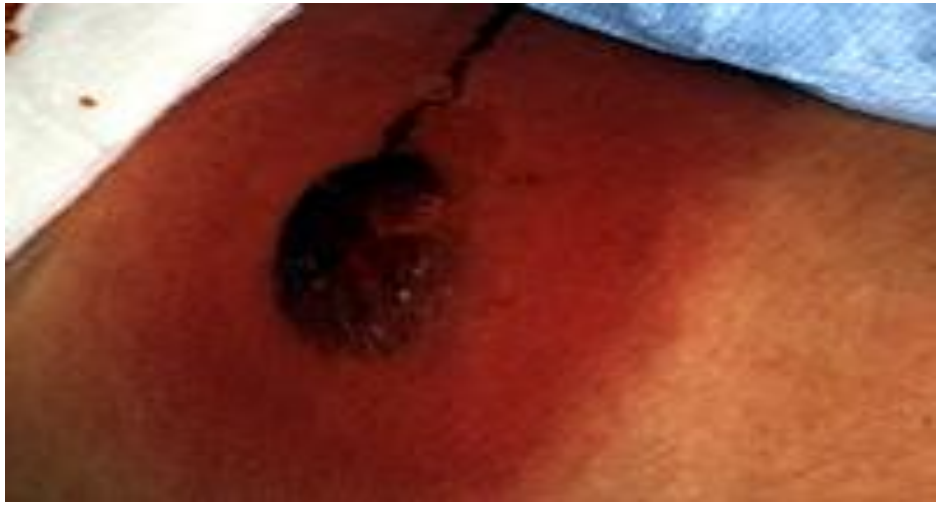
Bacterial Infections of Skin & Soft Tissues

- Skin infections may involve one or several layers of Skin & Soft Tissues (epidermis, dermis, subcutis, muscle).. Mild skin infections may cause rarely chronic lesions and sepsis.

- **Acute Skin Infections** are associated with: swelling ,tenderness, warm skin, blisters, ulceration, fever headache.. Systemic disease involving blood, bones .. Any other body organ.

- Few types Bacteria & Yeast live normally in hair follicles- Skin pores **..** may cause inflammation of Hair follicles /folliculitis or Abscess formation/ Boils..

Types of skin Infections(Abscess, Boil/Furuncle,Follculitis,Impetigo Impetigo



Common Normal Skin Flora & Pathogens

- **Skin infection** increased by presence of minor skin injuries, abrasions.. Increase production Androgenic Hormones after Puberty.. Increase activities Sebaceous ducts.. secretion **Sebum oil** (Fatty Acid Peptides).. Increases keratin & skin desquamation .
- Anaerobic *Propionibacteria acnes* (gram+ve small bacilli) & *Staph spp*. excrete enzymes.. Split sebum ..cause inflammation ..developing Acne.
- *Staphylococci, hemolytic Streptococci* **(** Group A**),** *Micrococci, Propionibacteria, Acinetobacter , Pityrosporum* and other Yeasts/Candida species.

Localized & Systemic Skin Infections

- **Certain Systemic Infection** may be associated with skin inflammation reaction **like** *N. meningitidis (Haemorrhagic Lesions) S. typhi (skin Rash, Rose spots), Treponema pallidum*..Syphilis lesions *P. aeruginosa..* Many fungi + Viruses cause skin Rash

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- ***S. aureus* :** coagulase+ve.. Produce various toxins & enzymes.. Associated with the most common & important cause of human Skin diseases & sepsis in community & hospital (up 50%).
- About 15-40 % healthy humans are healthy carriers of *S. aureus* in their nose or skin, feces..
- **Common Staphylococcal skin infections:**
- Folliculitis / Boils/ Furuncles **..** Hair follicular-infections papules / pustules**..** Erythematous lesions.. affect All ages**..** Can be mixed infection with lipophilic yeast

Impetigo: superficial layers skin.. Epidermis, Blisters, skin sores,crusted lesions**..** Face, hands & legs.. Mostly **young children, minor injury**

- **Toxic Schlock Syndrome:** Caused by localized infection, release TSST-1/2(enterotoxin-1) act as Super-antigens.. activate T-lymphocytes..Cytokines, Rash & Skin Desquamation may be associated with sepsis, high fever, multi-organ failure & death.
- **Scalded Skin Syndrome:** Epidermolytic/ Exfoliative Toxins (A,B) Followed minor skin lesion..causing destruction skin intercellular connection.. Large blisters containing fluid & Skin scaling, Painful common in infants/small children..due to lack specific antitoxins..general massive inflammatory response.. rarely causes kidney failure.

Methicillin Resistant *S. aureus*

- ***S. epidermidis*.. Coagulase-ve, **common** normal inhabitants of the skin, nose.. Less pathogenic. Most its infections occur in normal individuals as mild wound infection.. injury, underlying illness increase the risk of systemic infection in infants & immune-compromised patients
- **Most staphylococci** strains are becoming increasingly resistant to many commonly used antibiotics including: All B-lactamase-resistant penicillins, Methicillin & flucloxacillin, Augmentin (amoxycillin + clavulonic acid) .. Other antibiotics like new carbapenems (imipenem/**cilastatin)**

Worldwide Spread Methicillin-resistance (**MRSA)..** 20-90% .. Jordan about 70 % of clinical isolates (2012)

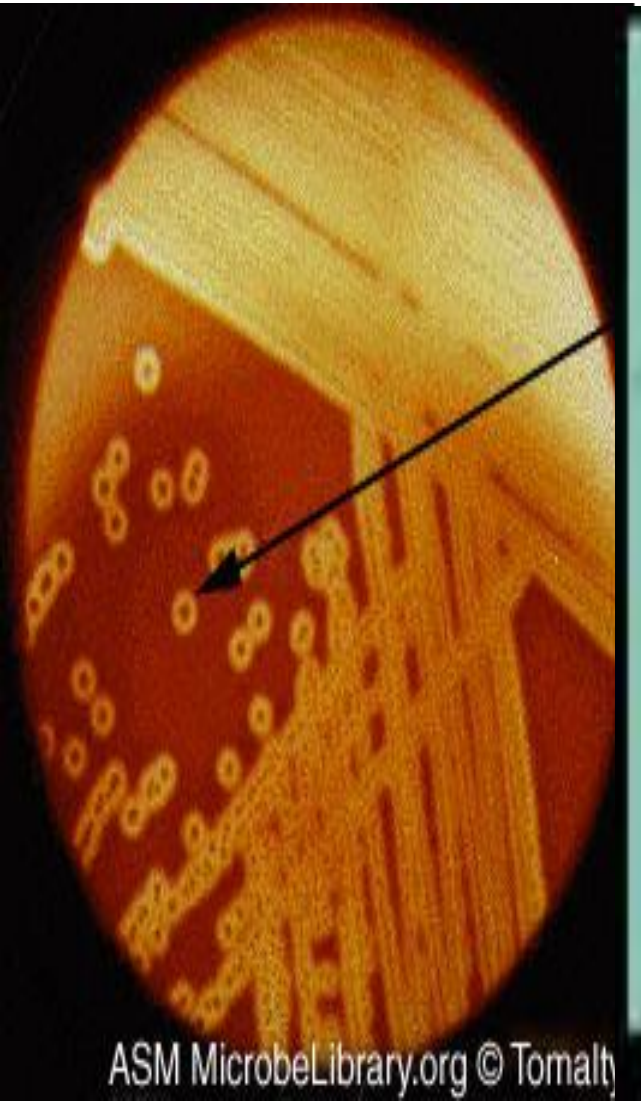
Diagnosis &Treatment of staphylococcal infections

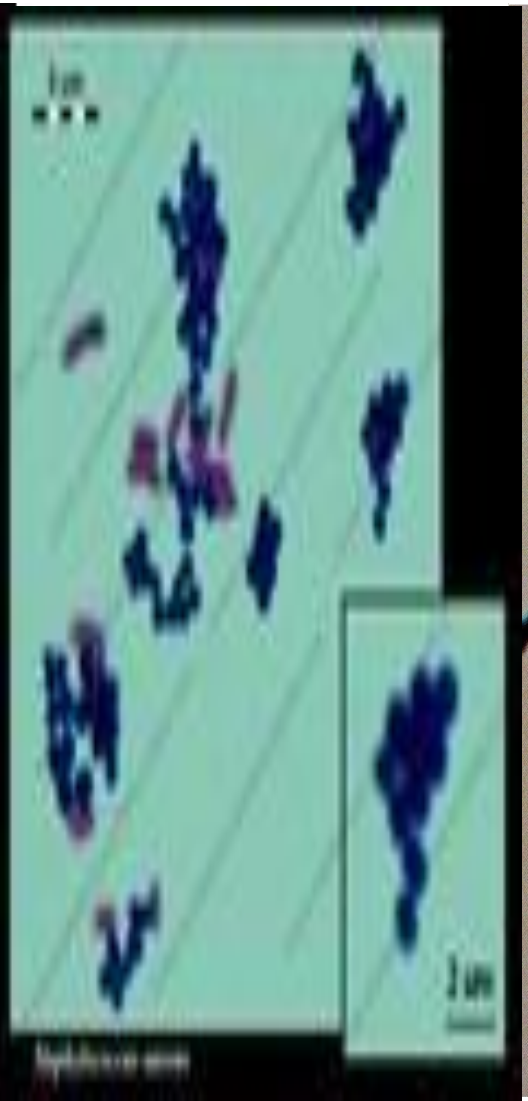
- Lab Diagnosis of staphylococcal infections should be confirmed by: culture, gram-stain positive cocci, +ve catalase , coagulase test .
- Effective treatment For MRSA .. Vancomycin, Teicoplanin, Imipenem, Fusidic acid
- Drainage of pus before treatment /Surgical removal (debridement) of dead tissue /necrosis.
- Removal of foreign bodies (stitches) that may contribute to persisting infection
- Treating the underlying skin disease..Prevent nosocomial infection..No Vaccine available

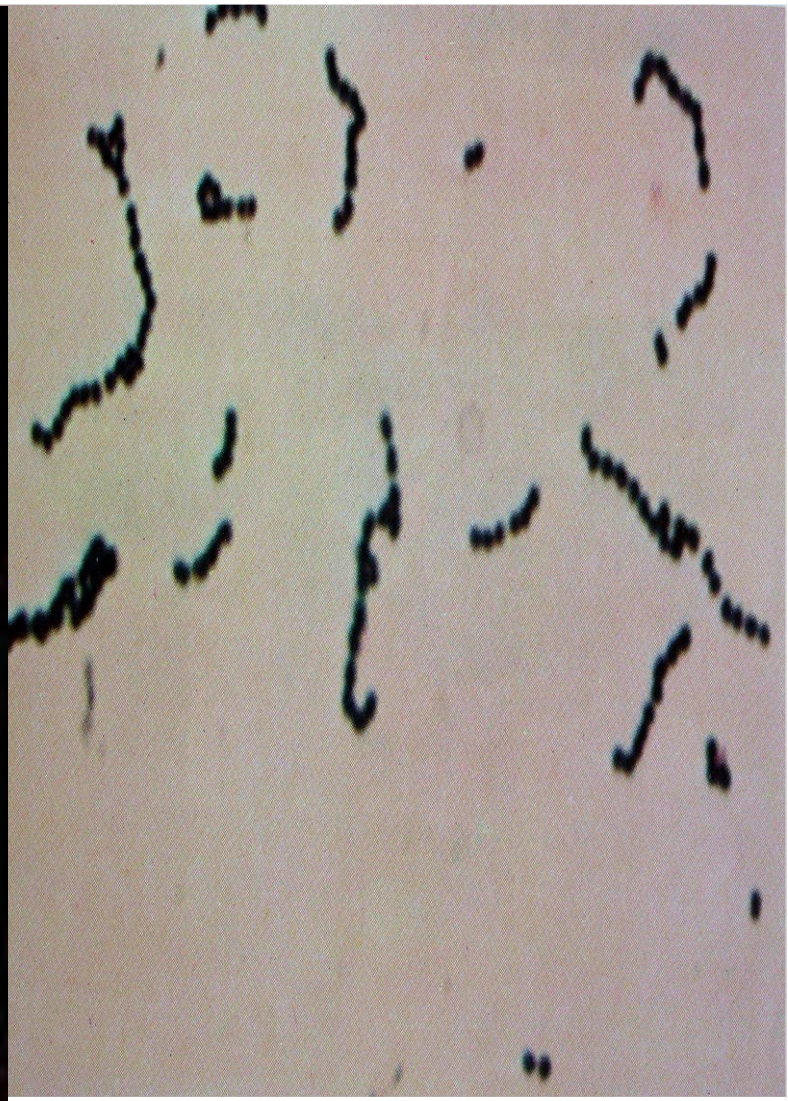
Streptococcal Skin Infections-1

- **Streptococcus pyogenes** / B-H-Group A) ..Major virulence factors: M-Protein, Hemolysin O & S, Streptokinase (Fibrinolysin-digest Fibrin & Proteins in Plasma), Streptodornase (DNA) Erythrogenic (pyrogenic exotoxins A,B,C).. Similar to Toxic Shock Syndrome toxin.
- **Cellulites/ Erysipelas** : Acute rapidly spreading infection of skin & subcutaneous tissues..Following.. Wounds, Burns.. Diffuse skin redness, massive edema, fever, Lymphatic's inflammation/sepsis..mostly children.
- **Impetigo/Pyoderma**: localized & superficial skin face, arms ,legs, children followed Strept. sore throat.

B-H-Streptococci & Staphylococcus







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- **Scarlet fever:** Followed Group A Strept. Sore throat infection.. Erythematous tong-skin rash due to release **Erythrogenic Toxin**.. small children.. Result in development specific immunity.
- **Necrotizing fasciitis(NF) :** Few strains group A , Minor skin trauma.. Invasive infection.. pyrogenic exotoxins A & B.. affect subcutaneous tissues & fascia..Rapid spread necrosis..Sever tissue damage..Pain, Fever, Sever systemic illness.. Fatal without Rapid Antibiotic Treatment and surgery. **Complication:** Patients wit NF May develop **Streptococcal Toxic Shock Syndrome** in associated with bacteremia, vomiting, diarrhea, Confusion,Shock, Respiratory & General organ failure, high fatal (30%) Death.

Skin rash - Scarlet Fever

Diagnosis & Treatment

- Culture on blood, B-Hemolytic reaction, Gram-+ve cocci in chain, catalase-ve, Bacitracin-Susceptible
- Serotyping should used to confirm group of streptococcal infection.. A, B, C etc. using Antisera against group-specific cell wall carbohydrate –Antigens (Lancefield classification)
- Penicillin is the drug of choice.. All Group A streptococci are very susceptible to penicillin.
- Patients with penicillin allergy may be given Macrolide (Erythromycin/ Azithromycin)

Less Common Bacterial Skin Infections

- **Gonorrhea : *N.gonorrhoea*..** Rare Skin rash
- **Soft chancre /chancroid** : *Haemophilus ducreyi*..Gram-ve bacilli, STD.. Painful Skin Ulcer.. Extra Genitalia .. Common in Tropical Region.
- **Syphilis**: *Treponema pallidum*..Genital ulcers & Rash
- Meningococemia: *N. meningitidis*.. Sepsis, Skin rash & hemorrhagic lesions..Thrombosis
- **Rickettsial diseases**: Small obligate intracellular Gram-ve bacteria..human: *R. prowazeki* (Typhus), *R. rickettsii* (Spotted fever).. Transmitted by body lice, ticks. Multiply first in endothelial cells of small blood vessels..vasculitis, rash, systemic diseases,fever,fatal

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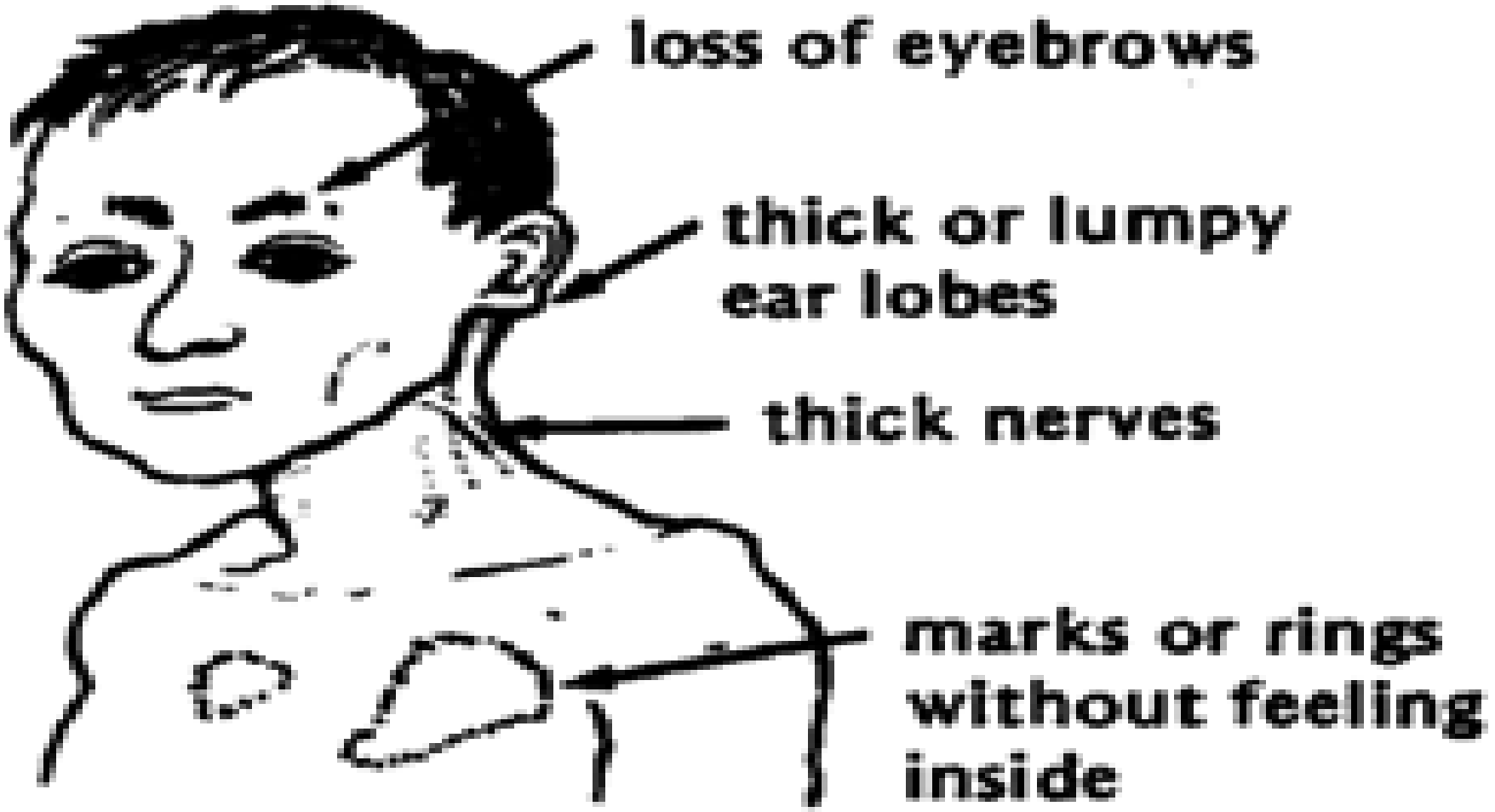
- ***Bacillus anthracis***.. Cutaneous Black Lesions..
- ***Clostridium perfingens*** and other sp. : Necrotizing Fasciitis.. Myonecrosis.. Cellulitis ..Gas gangrene.. Surgical/Traumatic wound.. Skin- Subcutaneous (Mixed Infection).. Specific Enzymes..Exotoxins
- ***Borrelia Burgdorferi*** : Lyme disease .. Transmitted by Tick/ Insect bites.. Incub. up 3 weeks.. Annular Rash.. Chronic Skin Lesion.. Cardiac & Neurological Abnormality.. Arthritis.. Endemic USA, China, Japan
- ***Bartonella species***: G-ve bacilli Bartonellosis Cat Scratch Fever..Cat Scratch or bite..Skin lesions.. Subacute regional lymphadenitis..Septicemia.

Tuberculosis-Leprosy-1

- **Cutaneous Tuberculosis** (TB), Cutaneous TB is a relatively uncommon form of extra-pulmonary TB.
- *M. marinum-ulcerans*.. Found in water with Low Temperature, Skin Lesions.. Chronic cutaneous ulcer.. Granuloma.. Followed skin injury.
- **Leprosy:** *M. leprae..* primarily infection affects cold body sites skin, mucous membranes.. peripheral nerves ..nose, ears, eye brows and testes.
- characterized by chronic multiple lesions accompanied by first by sensation loss/ anesthesia.. sensory loss in the affected areas, toes, finger tips.. intensive tissue destructions & liquefaction.

Leprosy


loss of eyebrows
thick or lumpy ear lobes
thick nerves
marks or rings without feeling inside

Tuberculosis-Leprosy-2

- Infection incubation period range from 6 months - 40 years or longer.
- **Leprosy forms** depend on the person's immune response to the infection.
- There are several forms of leprosy:
- **Mild Form:** Tuberculoid form.. Few AF Bacilli, Lepromin test +ve, Presence of nerve sensation
- **Severe form:** lepromatous type.. Numerous AF Bacilli, Loss of nerve sensation.. Lepromin test -ve

Leprosy-3

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- **Lebrosy** can affect people of all races around the world. it is most common among people with low standard of hygiene in warm, wet areas in the tropics and subtropics.
- In most cases, it is spread through long-term contact with an infected person who has not been treated.
- Most people will never develop the disease even if they are exposed to the bacteria..due to a natural immunity.
- Worldwide prevalence is reported to be around 5.5 million, with 80% of these cases found in 5 countries: India, Indonesia, Myanmar, Brazil and Nigeria.

Diagnosis & Treatment

- Lab Diagnosis: A skin biopsy may show characteristic granulomas ..mixed inflammatory cell infiltrate in the deeper layers of the skin, the dermis and involvement of the nerves.
- Presence few AFB.. number of bacilli visible depending on the type of leprosy.. No routine culture or protected vaccine is available.. BCG may help & reduce the severity of disease
- Treatment: Dapsone, Rifampin, Clofazimine. Life-long Treatment ..No cure but Less tissue Damage and spread of infection.

Common Fungal Skin Infection

- Superficial & Cutaneous Mycosis: Invade only dead tissues of the skin or its appendages.. keratinized tissues.. Skin, Hair, Nails.
- **Dermatophytes:** Trichopyhton, Microsporum, Epidermatophyton spp., Normal skin flora (Yeast Piytrosporum, Trichosporons)
- Transmission: Directly from person to person or animal to person.. Skin scales & dust particles
- Tinea corporis: Skin Annular Lesion, Erythematic lesions, Vesicles, Scaling.. Itching.. Rash.. All Ages
- **Tinea Versicolor/Pityriasis**: *Malassezia furfur /* Piytrosporum folliculitis.. Lipophilic Yeast.

Tinea Corporis

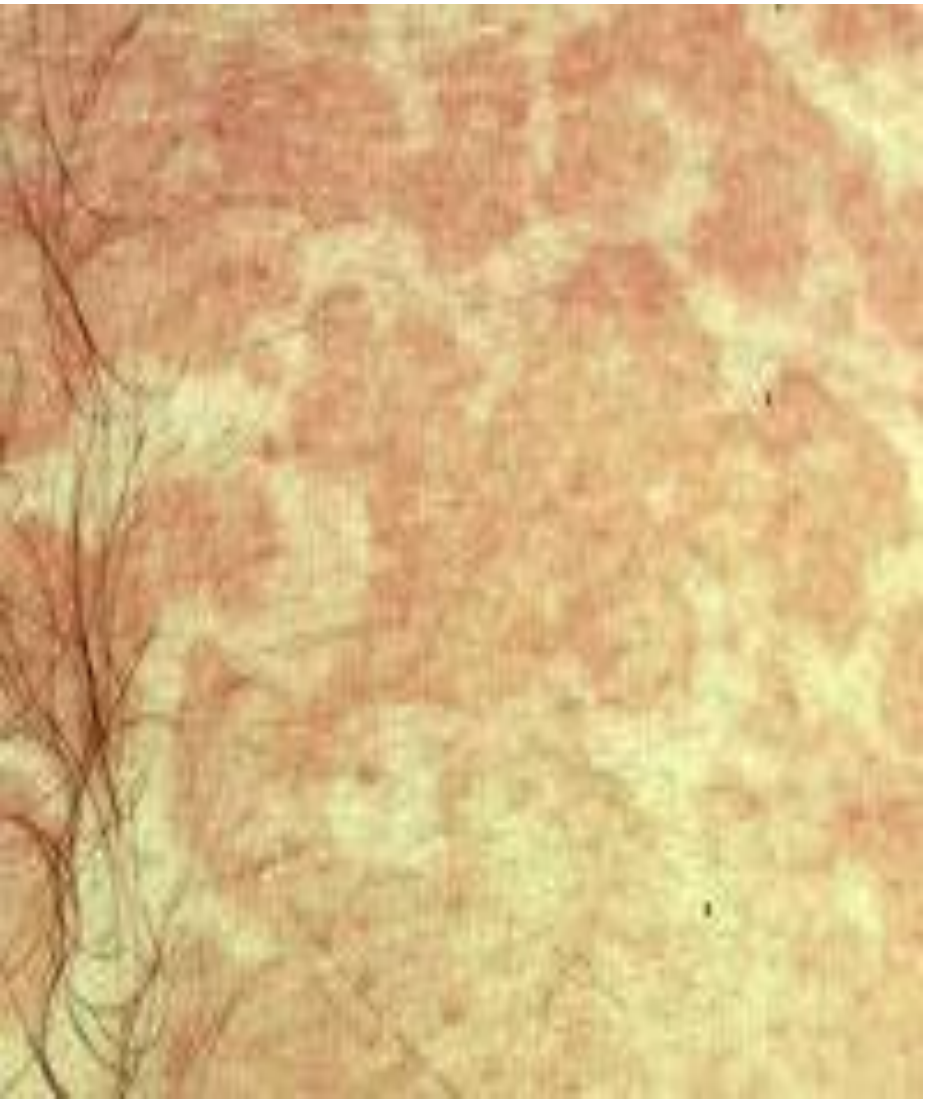
Tinea pedis -Tinea capitis kerion

Skin Fungal Infection-2

- **Tinea pedis** : Red itching vesicles.. chronic mild-sever erythematic lesions.. Interdigital toe spaces, Plantar skin surface.. Feet skin peeling.. All types.
- **Tinea cruris**: Pelvic area.. Groin.. Erythematic lesions, Itching, Chronic forms.. more common in male young adults.. Epidermophyton spp
- **Tina unguium** /Onychomycosis: Often caused by *Trichophyton* ,*Microsporum*, Candida..fingernails & toenails. Nails become colorless/colored, thicken, disfigure and brittle..Diabetes, Suppressed immunity.
- **Psoriasis** is a chronic not infectious skin condition.. can affect the nails, scalp, skin and joints.. Causing erythematic lesions.. Inherited in some families.

Onychomycosis-Psoriasis

Tinea Pityrisis / versicolor
Seborrheic dermatitis



Skin Fungal Infection-3

- Tinea capitis: Hair shaft/follicles.. Scalp. Children
- **Head dundruff, Seborrheic dermatitis.**
- White & Black Piedra..Trichosporon spp., Soft to hard nodules. scalp hair & hair shaft , skin face
- **Candidasis**: C. albicans & other species. Moist skin Lesions, Nails, Finger webs, Diabetes, immunocompromessed
- **Blasmycosis**: Blastomyces dermatitidis & **Histoplasmosis** : Histoplasma capsulatum.. Dimorphic sol Fungi, Spore Inhalation.. Asymptomatic Respiratory infection.. Rare systemic Infection.. Skin Ulcerations.. Granulomas..

Lab diagnosis-4

- Direct microscopic examination of skin scales dissolved in a 10 % solution potassium hydroxide (KOH).. demonstrating the fungus as small Filaments / Yeast like structures.
- **Culture:** Sabouraud Dextrose agar, Incubation at room temperature & 37 C for 2-6 Weeks. . Slow growth
- ChromCandida agar.. used for rapid identification of common *Candida species*.
- **Treatment :** Most skin infections respond very well to topical antifungal drugs **..** interact with Ergosterol ..causing Fungal cell membrane disruption.. **Imidazole drugs** ..miconazole, clotrimazole, econazole, ketoconazole, fluconazole