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. They may cause inflammation of Hair follicles/folliculitis or Abscess formation/Boils.
Types of skin Infections (Abscess, Boil/Furuncle, Follculitis, 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.

- **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

- **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

Skin rash - Scarlet Fever
Diagnosis & Treatment

• **Culture on blood**, B-Hemolytic reaction, Gram-+ve cocci in chain, catalase-ve, Bacitracin-Susceptible

• **Serotyping** should be 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
- **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
• **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.
• **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
• 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 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, Trichosporon)
- **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 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

- **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.