Microbiology

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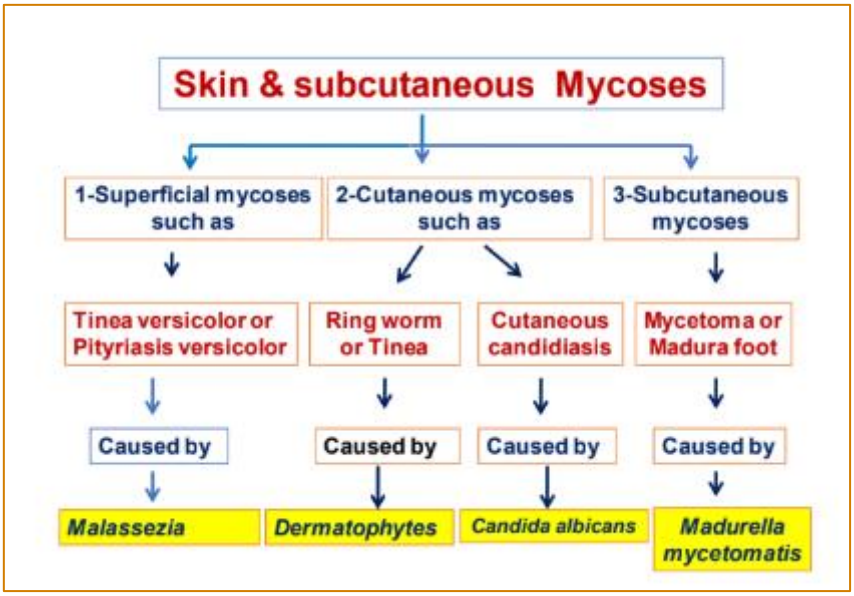
Fungal Infections
Skin & Subcutaneous Mycoses

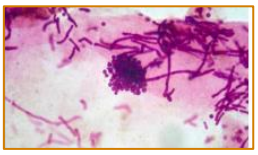


1. Superficial Mycoses

- Examples:
  - ✓ Pityriasis Versicolor (Tinea versicolor) caused by *Malassezia*.

- ***Superficial Malassezia Infections:***
  - Characteristics:
    - ✓ Lipophilic yeast, round in shape.
    - ✓ Normal skin commensals.
    - ✓ Can cause skin infections and catheter-associated infections.
  - **Pityriasis Versicolor:**

    - ✓ Affected Area: Skin (stratum corneum) [skin infection]
    - ✓ Common Locations: Trunk and proximal limbs.
    - ✓ Causes: *Malassezia furfur* and *Malassezia globosa*.
    - ✓ Epidemiology: Common in tropical areas, worsened by sun exposure.
    - ✓ Mechanism: Carboxylic acid produced by the yeast causes depigmentation.
    - ✓ Clinical Presentation:
      1. Asymptomatic, non-itchy macules that are hypo- or hyperpigmented.
      2. Lesions can coalesce to form scaly plaques.
    - ✓ Diagnosis:



      - UV Light: Pale greenish color under Wood's ultraviolet light.
      - Skin Scraping: Ink and KOH staining.
        - Appearance: Thick septate hyphae and clusters of budding yeast cells (resembling "spaghetti and meatballs").
    - ✓ Treatment (if cosmetic reasons):
      - Some cases resolve spontaneously.
      - Topical azoles (cream/shampoo) for 2 weeks or oral azoles for severe cases.
      - Recurrence is common.

- **Seborrheic Dermatitis:**
  - ✓ Description: Skin hyperproliferation with dandruff as a mild manifestation.
  - ✓ Lesions: Red with greasy scales; itching is common, particularly in the scalp.
  - ✓ Cause: *Malassezia furfur*.
  - ✓ Treatment: Azoles.

2. Cutaneous Mycoses

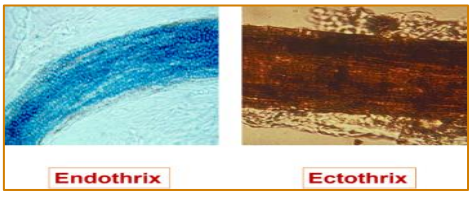
- Examples:
  - ✓ Ringworm (Tinea) caused by Dermatophytes.
  - ✓ Cutaneous Candidiasis caused by *Candida albicans*.

- ***Ringworm (Tinea):***
  - Causes: Dermatophytes (filamentous fungi/molds), which include three main genera:
    - ✓ *Microsporum*, *Trichophyton*, *Epidermophyton*.
  - Target Areas: Keratinized tissues such as skin, hair, and nails.
  - Infection Characteristics: Does not spread to deeper tissues.
  - Sources of Infection:
    1. ***Man-to-man*** via direct contact (Anthrophilic).
    2. ***From animals*** (zoophilic, e.g., dogs and cats).
    3. ***From soil*** (geophilic).
  - Risk Factors:
    - ✓ Intact skin serves as a barrier.
    - ✓ Heat and humidity enhance the infection.

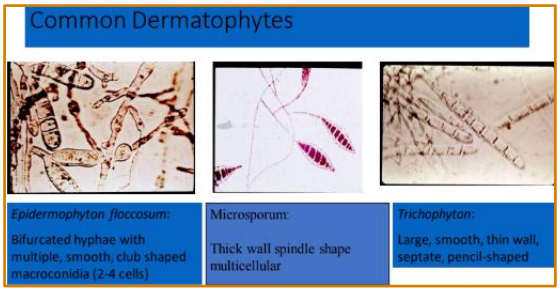

  - Clinical Forms:
    - ✓ ***Tinea Pedis*** (Athlete's Foot): Affects the toes.
    - ✓ ***Tinea Corporis & Cruris:*** Affects the body and groin area.
    - ✓ ***Tinea Capitis:*** Affects the head.
    - ✓ ***Tinea Unguinium:*** Affects nails.


  - Clinical Presentation:
    - ✓ ***Tinea Pedis:*** Red, itchy, scaly rash, often with interdigital scaling.
      - Caused by : *T. mentagrophytes*
    - ✓ ***Tinea Corporis/Cruris:*** Ring-like lesions with raised, inflamed borders.
    - ✓ ***Tinea Capitis:*** Scaling and hair loss, often leaving black dots.
    - ✓ ***Tinea Unguinium:*** Thickened, opaque, yellow nails.

  - Differential Diagnosis (DDx):
    - ✓ Eczema, psoriasis, impetigo, alopecia, drug reactions.
  - Diagnosis:
    - ✓ Microscopic Examination: Skin, hair, and nails after digestion with 10% KOH.
      - Branching hyphae detected among epithelial cells.
      - Hyphae or spores detected in hair (endothrix or ectothrix).



- ✓ Culture: On Sabouraud's dextrose agar (SDA).
  - Colonies examined microscopically after staining with lactophenol cotton blue.



- ➢ Treatment:
  - ✓ Local antifungal creams (e.g., miconazole) or oral terbinafine for weeks to months.

3. Subcutaneous Mycoses

- ➢ **Examples:**
  - ✓ Mycetoma (Madura Foot) caused by *Madurella mycetomatis*.

- **_Mycetoma (Madura Foot):_**
  - ➢ Mycetoma is a chronic granulomatous infection usually affects the lower limbs and hands
  - ➢ Cause: Fungi growing in soil and decaying vegetation, introduced through trauma.
  - ➢ Prevalence: Common in farmers.
  - ➢ Clinical Presentation: Chronic granulomatous infection, swelling after trauma, purplish discoloration, and multiple sinuses that drain pus containing yellow, white, red, or black granules.
  - ➢ Causative Organisms:
    1. Eumycetoma: Caused by *Madurella mycetomatis* (true septate hyphae).
    2. Actinomycetoma: Caused by species of actinomycetes (filamentous aerobic bacteria).

  - ➢ Diagnosis:
    - ✓ Macroscopic Examination: Based on the color of the granules:
      - Black granules indicate fungal infection.
    - ✓ Microscopic Examination
      - Septate hyphae with spores in fungal infections
    - ✓ Culture: On SDA.

  - ➢ Treatment:
    1. Medical:
       - Ketoconazole, Itraconazole, Amphotericin B.
    2. Surgical: May be required in some cases.

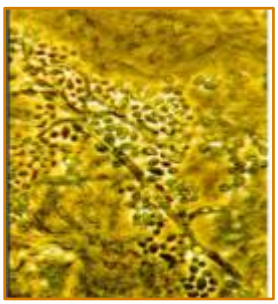
- **Opportunistic Mycoses**
  - ➢ **Description:**
    - ✓ Caused by fungi that are part of the human microbiota (e.g., *Candida*) or environmental yeasts and molds.
    - ✓ They can produce disease ranging from superficial skin or mucous membrane infections to systemic involvement of multiple organs
    - ✓ Patients at risk include those with hematologic dyscrasias (eg, leukemia,neutropenia) , patients with HIV/AIDS with CD4 counts less than 100 cells/μ L, as well as those treated with immunosuppressive (eg,corticosteroid) or cytotoxic drugs

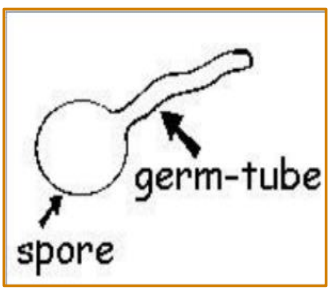
***Candida Infections*:**

- ✓ Cause: *Candida albicans* (a gram-positive, oval, budding yeast that produces pseudohyphae).
- ✓ It colonises the mucous membranes of the upper respiratory, GIT & female genital tracts.
- ✓ It causes superficial infections but can predominate with lowering in immunity causing infection so it is one of the opportunistic fungi.
- ✓ Predisposing Factors:
  - Diseases: AIDS, diabetes mellitus.
  - Medications: Prolonged use of broad-spectrum antibiotics or corticosteroids.
  - General debility or indwelling urinary catheters.
- ✓ Common Sites of Infection:
  - Skin: Red, weeping lesions (affects moist areas like axilla or infra mammary folds), Mostly in obese and diabetics and appear as Pseudo diaper rash
  - Mouth: White patches (oral thrush or moniliasis), oral leukoplakia, esophagitis gastritis.
  - Vulvovaginitis: Itchy, thick discharge (common in diabetics women and prolong use of antibiotics, IUCD, Pregnancy).
  - Nails: Painful redness, swelling, and thickening of nails (paronychia)
    - Repeatedly immersing in water (dish washing).
  - Systemic candidiasis**:** Occur in diabetics & Immuno suppressed persons.
  - Candida fingerweb erosion**:** related to fatness, occupation etc.

- ✓ **Diagnosis:**
  - Microscopic Examination:
    - Specimens from skin, vaginal discharge orexudates from mucous surfaces are examined.
    - Oval, gram-positive budding yeast cells with pseudohyphae.
  - Culture: On nutrient agar, corn meal agar, SDA. Colonies are creamy in color and identified by:

1. Morphology: oval budding gram +ve yeast cells.
2. Differentiation tests:
   A. Germ tube test: germ tube is formed when colonies incubated with human serum at 37 C for 30min.
   B. Chlamydospore formation on corn meal agar.
   C. Biochemical reactions: C.albicans ferments glucose & maltose with acid & gas production.





- ✓ **Treatment:**
  - Oropharyngeal or oesophageal thrush: Nystatin, Fluconazole ont
  - Skin Lesions: Nystatin ointment.
  - Systemic Candidiasis: Caspofungin (IV), Ketoconazole (oral), Amphotericin B (IV).

- ***Other Opportunistic Fungi:***
  - Cryptococcus neoformans: Causes cryptococcosis, particularly in AIDS patients. Can lead to severe neurological disturbances.
    - ✓ A widespread encapsulated yeast that inhabits soil around pigeon roosts
    - ✓ Infection of lungs leads to cough, fever, and lung nodules
    - ✓ Dissemination to meninges and brain can cause severe neurological disturbance and death.
    - ✓ Diagnosis:
      - Microscopic
        - India Ink for capsule stain (50-80% + CSF)
      - Culture
        - Bird seed agar
        - Routine blood culture
      - PCR
  - Aspergillosis: Caused by *Aspergillus* species, especially *A. fumigatus*. Affects immunocompromised individuals, causing :
    - ✓ Infection usually occurs in lungs – spores germinate in lungs and form fungal balls; can colonize sinuses, ear canals,eyelids, and conjunctiva
    - ✓ Bronchopulmonary allergy or Invasive aspergillosis in preformed cavitis can produce necrotic pneumonia, and infection of brain, heart, and other organs.
    - ✓ Treatment: Amphotericin B and nystatin, Surgery.
  - Zygomycosis: Caused by *Rhizopus*, *Absidia*, and *Mucor*. Common in diabetics and malnourished individuals.
    - ✓ Zygomycota are extremely abundant saprophytic fungi found in soil, water, organic debris, and food.
    - ✓ Usually harmless air contaminants invade the membranes of the nose, eyes, heart, and brain of people (Rhinocerebral mucormycosis) with diabetes and malnutrition, with severe consequences.
    - ✓ main host defense is phagocytosis
    - ✓ Diagnosis: Direct smear and by isolation of molds from respiratory secretions or biopsy specimens.
    - ✓ Treatment: Surgery, Amphotericin B, and control of diabetes. [Prognosis: very poor]
  - Pneumocystis jirovecii: Causes pneumonia in immunocompromised individuals, especially those with AIDS.
    - ✓ Diagnosis: Sputum or BAL for typical morphology.
      - Definite diagnosis of pneumocystosis depends on finding organisms of typical morphology in appropriate specimens (Sputum, BAL)
      - The organism has not been grown in culture
    - ✓ Treatment: TMP-SMX.

- **Endemic Mycoses**
  - Caused by thermally dimorphic fungi and the infections are initiated in the lungs following inhalation of the respective conidia.
  - Geographically restricted to specific areas of endemicity. (Four primary systemic mycoses—coccidioidomycosis, histoplasmosis, blastomycosis, and paracoccidioidomycosis).
  - Most infections are asymptomatic or mild but in a small but significant number of patients develop pulmonary disease.

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