Fungal infections

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Objectives

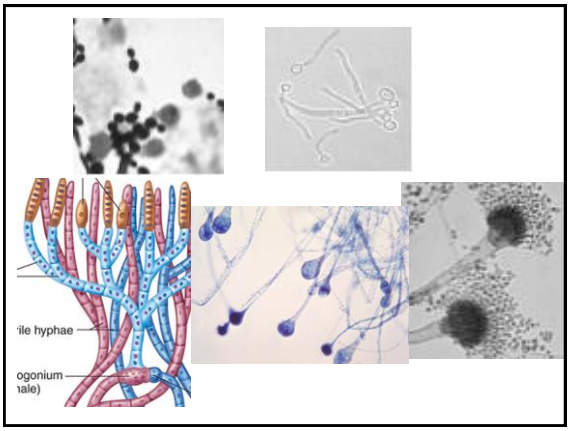
- Classification and properties of fungi
- Types of infections
- Presentation
- Sample collection
- Laboratory diagnosis
- Treatment

Fungi

- Eukaryotes
- More evolutionarily advanced
- Fungi may be unicellular or multicellular
- Have a rigid cell wall composed of chitin and glucan
- Reproduce by means of spores – Sexual/ Asexual
- Fungal taxonomy relies heavily on morphology and mode of spore production
- Saprophytic/ parasitic

Classification of Fungi

- According to basic morphology
  1. Yeast – Ovoid/ spherical
     - reproduces by budding formation of sexual spores
     - do not for mycelium
  2. Yeast like - intermediate
     - may elongate to form sausage-like pseudohyphae
  3. Moulds – form branching filaments (hyphae)
     - form amesh-like structure (mycelium)
  4. Dimorphic – exist in both forms
     - Yeast form in infected lesions
     - Mycelium in environment

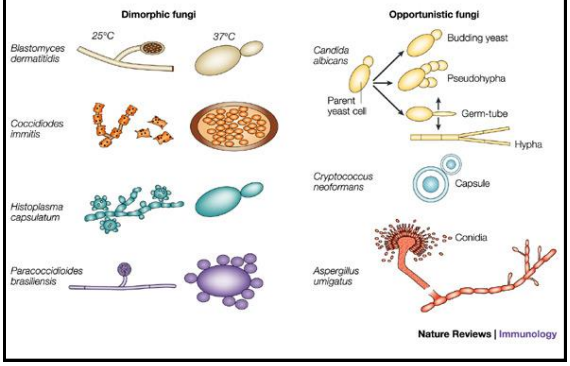


Types of Fungal Infections

- Superficial
  1. Pityriasis versicolor (Alu hung)
  2. Dermatomycoses (Tenia infections- Dermatophytes)
  3. Candidiasis
  4. Tenia nigra
- Sub-cutaneous tissues
  1. Mycetoma
  2. Chromoblastomycosis
  3. Rhinoporidiosis
- Systemic
  1. Aspergillosis
  2. Cryptococcus
  3. *Pneumocystis carinii*
  4. Endemic mycoses

Types of Fungal Infections

- Infections in normal immuno-competent host
  - Pityriasis versicolor (Alu hung)
  - Dermatomycoses (Tenia infections- Dermatophytes)
  - Candidiasis
  - Mycetoma
  - Chromoblastomycosis } Exposure
  - Rhinoporidiosis
  - Endemic fungi
- Infections in immuno-compromised host (oppotunistic)
  - Aspergillus
  - Cryptococcus
  - Penicillium
  - Candida



Factors influencing superficial and subcutaneous mycoses

- Immune status of Host
  - Immunocompitant
  - Immunocompromised
- Age – infants, elderly, young children
- Occupational exposure
- Geographical distribution of fungi

Superficial Fungal infections

- These affect the outer layers of the skin, nails and hair
- Affects the dead cornified layers of the epidermis
- generally cause benign and self-limiting diseases
- The organisms involved in these infections are morphologically diverse
- spread by contact
- Transmitted to man from
  - other humans
  - Animals
  - soil

1. Pityriasis versicolor (Alu hung)

- Commonest fungal skin infection in SL
- Characterized by well-demarcated white, pink, fawn or brownish lesions, often coalescing
- Hypo/ hyper pigmented
- Causative agent – *Malassezia furfur*
  - involves only the superficial keratin layer
  - Lipophylic oval yeast
  - Budding on broad base
  - Short stout filaments

Treatment

- Topical – Azoles eg; micanazole , ketoconazole,clotrimazole
  Selinium sulphide 2.5%
  Sodiumthiosulphate
  Zinc pyrithion
- oral – ketaconazole
  itraconazole
  fluconazole

2. Dermatophytes (Ring Worm)

- A group of filamentous fungi
- Infect only skin, hair and nails
- Causative organisms- 3 genera
  - *Trichophyton*
  - *Microsporum*
  - *Epidermophyton*
- Anthropophilic - acquired from other humans
- Geophilic - acquired from soil
- Zoophilic - acquired from animals

Dermatophytes (Tinea infection)

type	site	Clinical features
Tinea corporis	body	Circular itchy spreading lesions with a raised edge and central healing May have vesicles and pustules
Tinea pedis (athlete's foot)	Soles and toe webs, nails	Thickened white skin, itchy, peeling with offensive smell , blisters
Tinea cruris	groin	Similar to Tenia corporis
Tinea capitis	Scalp and hair	Scaling, erythema, Kerion (large, tender lesions) Itching, hair loss
Tinea unguium	Nails	Yellow, brittle, thickened, powdery subs. under nail
Tinea barbae	Beard	superficial circular patches, scarring hair loss

Tinea corporis

Tinea pedis

Tinea cruris

Tinea capitis

ectothrix

endothrix

Tinea unguium

Tinea barbae

Treatment - ring worm

- Mild disease – topical micanazole/ clotrimazole/ econazole

  (cream/ nail solutions)
- Extensive /poor response to topical therapy/ nail/ scalp

  -oral antifungal

  eg; Griseofulvin

  Itraconazole

3.Candidiasis (Intertrigo)

- Candida
  - Yeast
  - *C. albicans* is the commonest
  - Others- *C . tropicalis, C. glabrata, C. krusei*
  - Normal flora – on skin, *GIT, vagina*
  - Predisposing factors for infection
    - Ex. Steroids, DM, pregnancy, neutropeania, AIDs, malignancies antibiotics, frequent handling of water, obesity dentures

Candida infections

- Superficial
  - Skin
    - at moist and macerated areas (Groins, axillae, intermammary, interdigital, gluteal and perineum)
    - Intensely red, macerated, moist, itchy, glistening rash with scaling on the edges (weepy lesions)
  - Nails – onychomycosis, paronychia
  - Mucosa
    - Mouth, GIT, vagina
- Systemic
  - Cystitis, pyelonephritis
  - Endocarditis
  - Sepsis
  - Lung
- Occular- endophthalmitis

Candidal Paronychia onychomycosis

Oral thrush

vaginitis

Treatment

- Topical antifungals
  - Ex: Nystatin, micanazole, clotrimazole
- Oral antifungals
  - Flucanazole, itracanazole, flucytosin, voricanazole
- IV antifungals
  - Flucanazole, amphotericin B, voricanazole, caspofungin

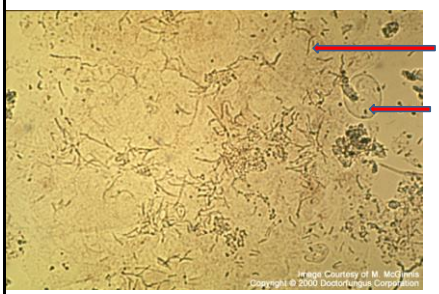
Samples for Dx of superficial mycoses

- **Skin scrapings**
- **Nail clipping**
- **Hair clippings**

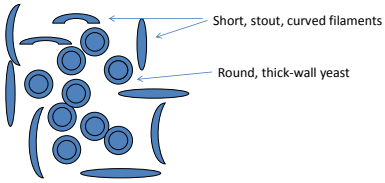
Lab diagnosis

1. Direct smear – in 10% KOH
   - Leave the specimenfew minutes in a drop of KOH to digest keratin
   - Observe under microscope for branching/ short hyphae or yeast
2. Culture – in Sabourod's Dextrose Agar
   - Dermatophytes, Candida
   - Not done for Malassezia furfur
   - Identified by - Colony morphology, needle mount with Lactophenol cotton blue and /or slide culture
   - Other tests for candida – Rice agar plate, sugar assimilation

Pityriasis versicolor (Alu hung) – KOH mount

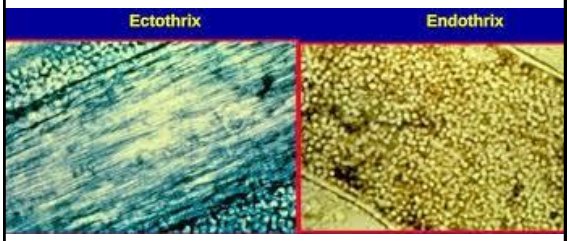


Pityriasis versicolor (Alu hung) – Parker's stain



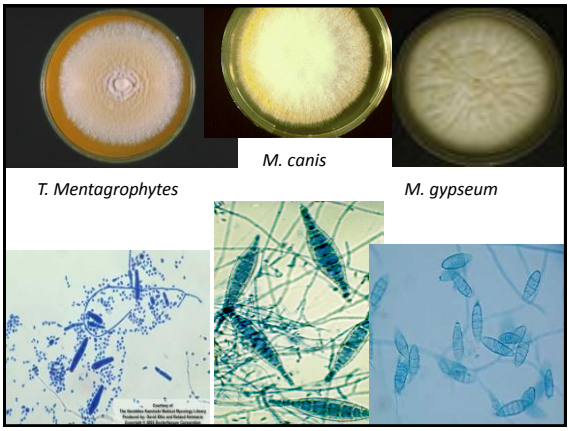
"spaghetti and meat balls appearance'

Dermatophytes in KOH



Arthrospores are outside the hair shaft

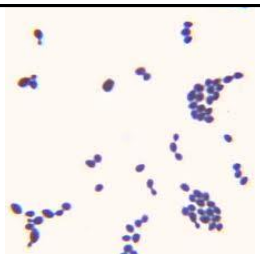
Arthrospores are inside the hair shaft



T. Mentagrophytes

M. canis

M. gypseum



Sub-cutaneous Fungal Infections

- involve fungal infections of deeper skin layers
- Transmitted through inoculation by prick injuries
- Chronic infection

Sub-cutaneous Fungal Infections

1. Mycetoma – chronic granulomatous infection

papule of the skin → fixed nodule →
Abscess with pus containing granules →
Ulceration → spread inwards to muscles and bones
→ sinus formation → Destruction of tissues

Causative organisms – filamentous fungi (Madurella spp)

Tx – innoculation through skin by penetrating injury

Rx – Ketaconazole/ Itraconazole/ surgery

Fungal Sub-cutaneous Infections

2. Chromoblastomycosis – chronic warty mycosis of skin and s/c tissues

Innoculating injury → painless papule/ nodule
→ warty growth with abscesses and crusting →
satellite lesions spread along lymphatic →
progress slowly

Causative organisms - filamentous fungi

Rx - Itraconozole, terbinafine

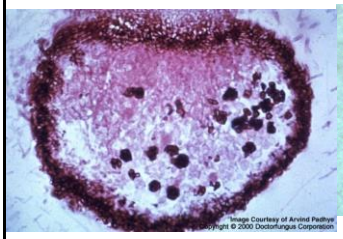
Fungal Sub-cutaneous Infections

3. Rhinoporidiosis-

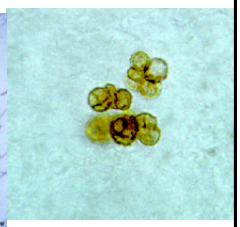
- chronic granulomatous infection with polyp formation in mucous membranes (nasal,nasopharynx, eye)
- Endemic in India and SL
- Causative organism- *Rhinosporidium seeberi*

Lab diagnosis

- Specimens- Biopsy / exudate/ pus with grains
- Direct mic. – crushed grains / exudate
- Histology
- Culture in SDA and identification



Mycetoma Grain shown in skin biopsy



Copper penny appearance Of chromoblastomycosis in direct smear

Treatment for S/C infections

- Radical surgery
- Systemic antifungals
  - Itracanazole, amphotericin B

Systemic Fungal infections

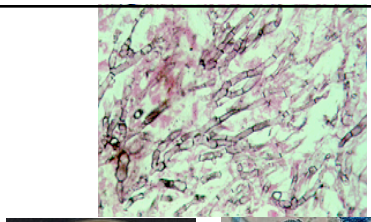
- Aspergillosis – *Aspergillus fumigatus, A. niger*
- *Cryptococcus neofomans*
- *Pneumocystis carinii*
- Endemic mycoses
  - Histoplasma
  - Blastomyces
  - coccidiodomycosis

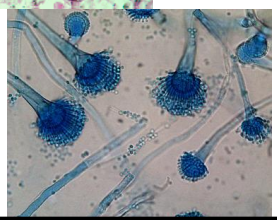
Aspergillosis

- Opportunistic
- Lungs
  - Pneumonia -Chronic nodular pneumonia ("microgranulomatous aspergillosis") or "mulch pneumonitis" (life threatening)
  - ABPA –Acute Bronchopulmonary Aspergillosis
- Others
  - Osteomyelitis
  - CNS – brain abscess
  - skin (erythematous papules or macules with progressive central necrosis)
  - endophthalmitis

Diagnosis of IA

- Visualization of hyphae in tissue / Isolation in cultutre
  - BAL, percutaneous/ open lung biopsy
- Imaging
  - HRCT
  - CXR
- Detection of *Aspergillus galactomannan Ab*
  - *Serum/ BAL* –
  - may have low sensitivity compared to other immunocompromised populations
- Real-time (PCR) - pan-*Aspergillus PCR*
  - *Serum/ BAL/ tissues*





Cyptococcocus neoformans

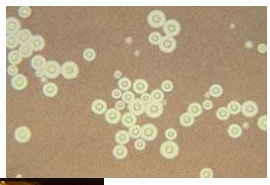
- Acquired by inhalation
- Pulmonary infections have no diagnostic symptoms and are usually subclinical
- Shows a predilection for the central nervous system

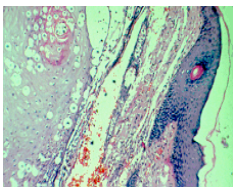
Clinical presentations

- Pulmonary
  - Asymptomatic initially
  - fever, dry cough and dyspnoea that can progress to acute respiratory distress syndrome (ARDS)
- CNS
  - meningitis, meningoencephalitis or expanding cryptococcoma
  - Symptoms usually develop slowly over several months, and initially include headache, followed by drowsiness, dizziness, irritability, confusion, nausea, vomiting, neck stiffness and focal neurological defects
  - Cryptococcoma is characterized by localized, solid, tumor-like masses, usually found in the cerebral hemispheres or cerebellum

Diagnosis

- Microscopy/ Isolation
  - CSF, BAL, blood
- Cryptococcal antigen (capsular PS) test (latex agg)
  - Meningitis, Disseminated but not in isolated pulmonary infection
  - CSF, serum – high sensitivity and specificity





Pneumocystis carinii

- Seen in immune deficient patients
- Initially misidentified as a protozoa
- Life threatening opportunistic fungal infection

Clinical presentation

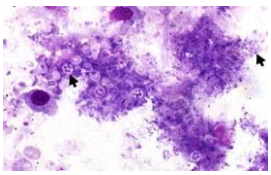
- Pulmonary
  - Typically presents in a subacute manner with progressive dyspnea, nonproductive cough, and low-grade fever, chills and LOW, tachypnoea, tachycardia, ARDS
- Extra-pulmonary
  - Central nervous system
  - Bone marrow (may have necrosis with resultant pancytopenia)
  - Lymphadenopathy
  - Eyes (may have retinal cotton-wool spots)
  - Thyroid (may present as a rapidly enlarging thyroid mass)
  - Gastrointestinal tract

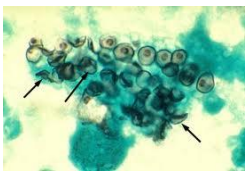
Diagnosis

- Chest imaging
  - Can be normal early in the disease
  - Diffuse bilateral infiltrates extending from the perihilar region
  - Less commonly patchy asymmetric infiltrates pneumatoceles and pleural effusions

Diagnosis

- Microscopy of stained specimens (Cresyl violet, Giemsa, Diff-Quik, Methylamine silver, toluidine blue)
  - Induced sputum, BAL, lung biopsy





Thank you