

Academic year 2023-2024

Student Selective Components

Mycoses

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Mycoses (plural noun)

Mycosis:- Is a disease caused by infection with fungus, such as ringworm or thrush.

Classification of Mycoses

1. Classification Based on Site

Mycoses are classified as superficial, cutaneous, subcutaneous, or systemic (deep) infections depending on the type and degree of tissue involvement and the host response to the pathogen.

2. Classification Based on Route of transmission

Infecting fungi may be either exogenous or endogenous. Routes of entry for exogenous fungi include airborne, cutaneous or percutaneous. Endogenous infection involves overgrowth of a member of the normal flora.

3. Classification Based on Virulence

Primary pathogens can establish infections in normal hosts. Opportunistic pathogens cause disease in individuals with compromised host defense mechanisms.



The Major Mycoses and Causative Fungi

Category	Mycosis	Causative Fungal Agents
Superficial	Pityriasis versicolor	Malassezia species
Cutaneous	Dermatophytosis	Microsporum species, Trichophyton species, and Epidermophyton floccosum
	Candidiasis of skin, mucosa, or nails	Candida albicans and other Candida species
Subcutaneous	Sporotrichosis	Sporothrix schenckii
Systemic (primary pathogenic)	Coccidioidomycosis	Coccidioides posadasii and Coccidioides immitis
Systemic (opportunistic)	Systemic candidiasis	Candida albicans and other Candida species
	Aspergillosis	Aspergillus fumigatus and other Aspergillus species
	Cryptococcosis	Cryptococcus neoformans and Cryptococcus gattii
	Penicilliosis	Penicillium marneffeii



SUPERFICIAL MYCOSES

- 1. Pityriasis (Tinea) versicolor (*Malassezia furfur*)
- 2. Tinea Nigra – *Hortaea/Exophiala werneckii*
- 3. White Piedia – *Trichosporon*
- 4. Black piedra – *Piedraia*

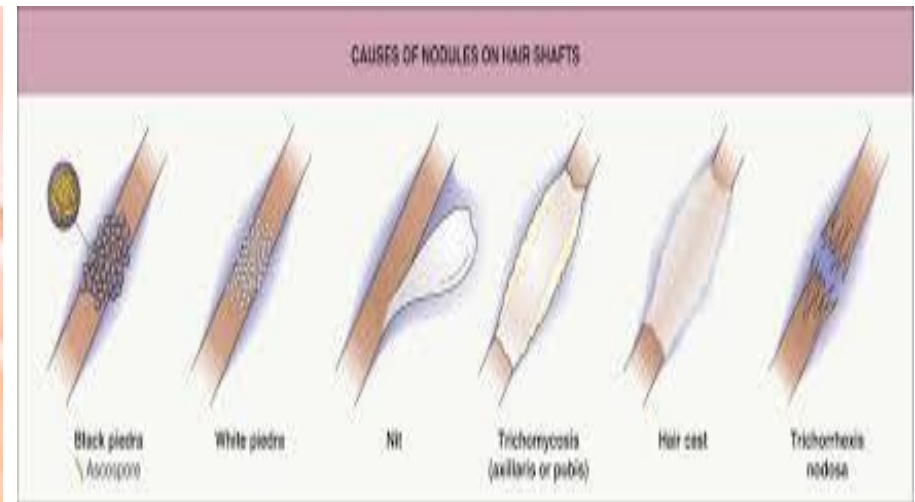
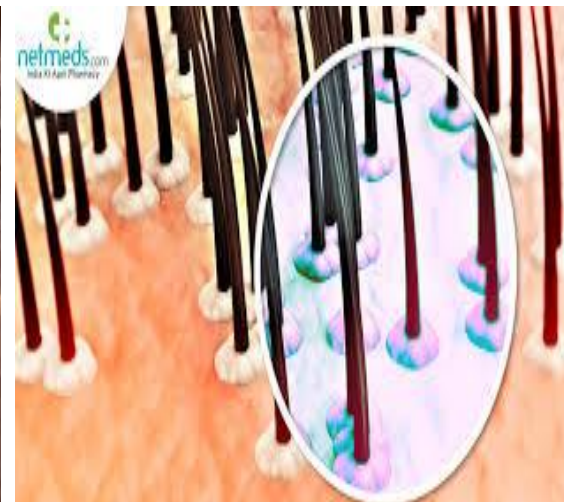
SUPERFICIAL MYCOSES (TYPE)	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
1. TINEA VERSICOLOR (PITYRIASIS VERSICOLOR)	<i>Malassezia furfur</i> (Yeast like fungus) represent phialoconidia	<ul style="list-style-type: none"> ➤ Small hypo (or) hyper pigmented macules ➤ Chronic, mild, infection of stratum corneum 	<ul style="list-style-type: none"> ➤ Skin scraping ➤ Direct observation ➤ Exposure of Wood's lamp. 	<ul style="list-style-type: none"> ➤ Topical azoles ➤ Selenium sulfide shampoo ➤ Imidazole ointments ➤ Miconazole & clotrimazole shampoo ➤ Hot soak bath



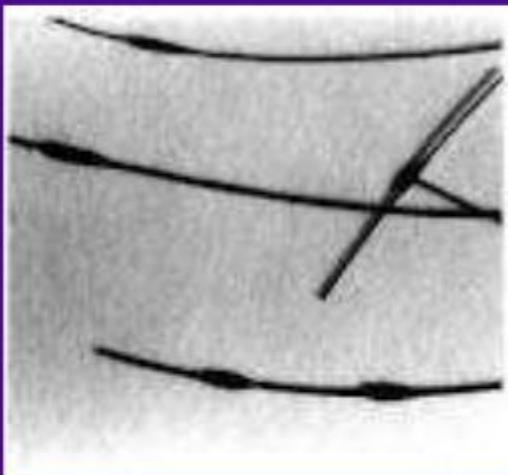
SUPERFICIAL MYCOSES (TYPE)	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
<p>2. TINEA NIGRA</p> <p>Superficial Phaeophypho mycosis</p>	<p>✓ <i>Hortaea werneckii</i>/ ✓ <i>exophiala werneckii</i></p> <p>✓ Black fungus Cladosporium</p> <p>(branched, septate hyphae, arthroconidia & elongate budding cells)</p>	<p>➤ Irregular pigmented macules</p> <p>➤ No scaling (or) invasion of hair follicles</p> <p>➤ Non contagious</p>	<p>➤ Microscopic examination of skin scraping</p> <p>➤ culture</p>	<p>➤ Whitfield's ointment, miconazole nitrate in a cream base</p> <p>➤ Imidazole & triazole</p> <p>➤ Sulfur ointments</p> <p>➤ Tincture of iodine</p> <p>➤ terbinafine</p>



SUPERFICIAL MYCOSES (TYPE)	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
3. WHITE PIEDRA	<p><i>Trichosporon:</i> <i>T. inkin, T. asahii, T. beigeli, T. mucoides</i></p> <p><i>Dolipore septum hyphae</i></p> <p><i>Or budding yeast like cells</i></p>	<ul style="list-style-type: none"> ➤ Hairs of the groin & axillae ➤ White to brown welling along the air strand. 	<ul style="list-style-type: none"> ➤ Culture in mycological media without cycloheximide. 	<ul style="list-style-type: none"> ➤ Topical azoles ➤ Improve hygiene ➤ Shaving of infected hairs



SUPERFICIAL MYCOSES (TYPE)	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
4. BLACK PIEDRA	ASCOMYCETES – <i>Piedraia hortae</i> or <i>hortai</i>	<ul style="list-style-type: none"> ➤ Small, dark nodules – surround the hair shafts ➤ scalp 	<ul style="list-style-type: none"> ➤ Branch pigmented hyphae ➤ Culture ➤ Begin as yeast like colony then hyphae 	<ul style="list-style-type: none"> ➤ Hair cut ➤ Proper and regular washing.





CUTANEOUS MYCOSES

CUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
DERMATO-PHYTOSES	TRICHOPHYTON EPIDERMOPHYTON MICROSPORUM Macro and micro conidia Arthroconidia	➤ Ectothrinx ➤ Endothrix ➤ Favic patterns	➤ Direct microscopic ➤ Skin, hair /nail sample ➤ Culture on scrappings	➤ Tropical Azoles (micronazole, clotrimazole, econazole, etc) Terbinafine and haloprogin ➤ Whitfield ointment (benzoic & salicyclic acids) optical agent.

DERMATOPHYTOSIS	CAUSITIVE ORGANISMS	CLINICAL SYNDROME
TINEA CAPITIS (Scalp ringworm)	Trichophyton Microsporium	<ul style="list-style-type: none"> ➤ Small scalling patches to entire scalp ➤ Scalp, eyebrows & eyelashes
TINEA BARBAE		<ul style="list-style-type: none"> ➤ Beard
TINEA CORPORIS (Ring worm)	E. floccosum Trichophyton Microsporium	<ul style="list-style-type: none"> ➤ Annular rings with scaly centers
TINEA CRURIS (Jock itch)	Epidermophyton T. rubrum	<ul style="list-style-type: none"> ➤ Moist groin area
TINEA PEDIS (Athlete's foot)	T.rubrum/mentagrop hytes E.fluccosum	<ul style="list-style-type: none"> ➤ Toes then nails becomes yellow and brittles
TINEA UNGUIUM (Onychomycosis)	T. rubrum	<ul style="list-style-type: none"> ➤ Nails thickned, discolored & brittle



SUBCUTANEOUS MYCOSES

- Main
 - Lymphocutaneous sporotrichosis
 - Chromoblastomycosis
 - Eumycotic mycetoma
 - Subcutaneous zygomycosis
 - Subcutaneous phaeohyphomycosis
- Additional
 - Lobomycosis
 - Rhinosporidiosis

SUBCUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
1. LYMPHOCUTANEOUS SPOROTRICHOSIS	<i>Sporothrix schenckii</i> – <i>thermophilic dimorphic Mold – narrow, hyaline, septate – conidiophores</i> <i>Yeast – spherical, oval (or) elongated</i>	<ul style="list-style-type: none"> ➤ Skin by truma ➤ Small nodule – ulcerate ➤ Then discharge pus 	<ul style="list-style-type: none"> ➤ Culture of pus / tissue ➤ Immunologically – exoantigen test 	<ul style="list-style-type: none"> ➤ Oral potassium iodide ➤ Itraconazole, terbinafine /potassium iodide ➤ Fluconazole ➤ Local application of heat

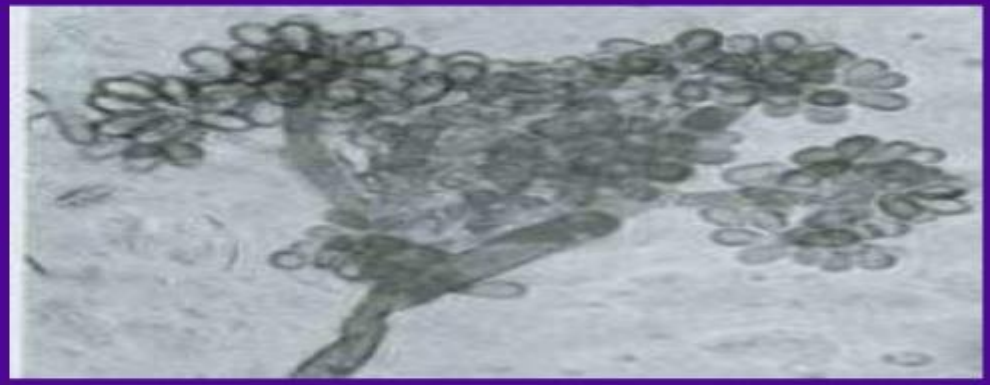


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SUBCUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
2. CHROMOBLASTOMYCOSIS (Chromomycosis)	<p><i>Pigmented septated (dematiaceous) fungi</i></p> <p><i>Fonsecaea, Cladosporium, Exophiala, Cladophialophora Rhinocladiella Phialophora</i></p> <p><i>Form muriform cells (Sclerotic bodies, Medlar bodies)</i></p>	<ul style="list-style-type: none"> ➤ Legs & arms/ shoulds, neck, truck, face, ears. ➤ Chronic, pruritic, progressive, resistant to treat. ➤ Verrucous lesions to flat plagues ➤ Cauliflower like growth 	<ul style="list-style-type: none"> ➤ Histopathologic findings of chestnut brown, muriform cells. 	<ul style="list-style-type: none"> ➤ antifungal therapy Itraconazole & terbinafine ➤ Posaconazole with flucytosine



SUBCUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
3. EUMYCOTIC MYCETOMA	<i>Phaeoacremonium</i> <i>Curvularia</i> , <i>Fusarium</i> <i>Madurella</i> , <i>Exophiala</i> , <i>Pyrenochaeta</i> , <i>Leptosphaeria</i> <i>Scedosporium spp.</i> <i>Septate</i> <i>Chlamydoconidia</i>	<ul style="list-style-type: none"> ➤ Foot & hand/back shoulders & chest wall also. ➤ Small, painless, subcutaneous nodule/plague - increase slowly & enlarge - disfigured 	<ul style="list-style-type: none"> ➤ Grains can be mounted ➤ Microscopic 	<ul style="list-style-type: none"> ➤ Amphotericin B, Kitoconazole, itraconazole ➤ Antifungal Theraphy



SUBCUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
4. SUBCUTANEOUS ZYGOMYCOSIS (Entomophthoromycosis)	<ul style="list-style-type: none"> ➤ a) <i>Conidiobolus coronatus</i> ➤ b) <i>Basidiobolus ranarum</i> ➤ Facial area in adults ➤ Proximal limbs in children respectively ➤ Mucoraceous Zygomycetes, sparse hyphae, fragmented, septae 	<ul style="list-style-type: none"> ➤ Chronic ➤ a) Rhinofacial area - swelling of the upperlips & face - painless ➤ b) Disk, shaped, rubbery movable masses – shoulders, pelvis, lips & thighs. 	<ul style="list-style-type: none"> ➤ Require biopsy for diagnosis ➤ Can culture 	<ul style="list-style-type: none"> ➤ Itraconazole ➤ Oral potassium iodide alternatively ➤ Facial reconstruction surgery in case of <i>C.coronatus</i>



SUBCUTANEOUS MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
<p>5. SUBCUTANEOUS PHAEOHYPHOMY COSIS (Superficial, subcutaneous or deeply invasive or disseminated)</p>	<p><i>Numerous & diverse</i> <i>Black molds in culture</i> <i>Yeast like in tissue.</i> <i>Branched septate – budding yeast like</i></p> <p><i>Exophiala jeanselmei,</i> <i>Alternaria,</i> <i>Curvularia,</i> <i>Phaeoacremonium,</i> <i>Bipolaris spp.</i></p>	<ul style="list-style-type: none"> ➤ Solitary inflammatory cyst. ➤ Feet & legs although other body sites ➤ Lesions grows slowly and expand ➤ Firm & painless 	<ul style="list-style-type: none"> ➤ Culture ➤ Identification of pattern of sporulation 	<ul style="list-style-type: none"> ➤ Itraconazole, with or without flucytosine ➤ Posaconazole ➤ Voriconazole ➤ Terbinafine





SYSTEMIC MYCOSES DUE TO DIMORPHIC FUNGI

- 1. Blastomycosis
- 2. Histoplasmosis
- 3. Coccidioidomycoses
- 4. Paracoccidioidomycosis

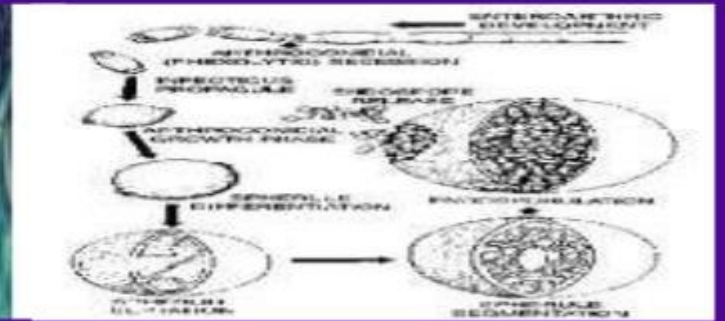
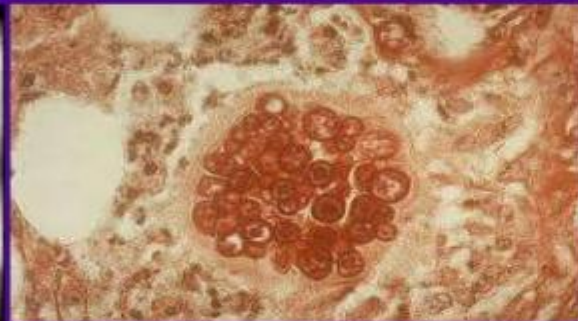
(Blastomyces dermatitidis, Coccidioides immitis & C. posadasii, Histoplasma capsulatum var. capsulatum & H. Capsulatum var duboisii, Paracoccidioides brasiliensis & Penicillium marneffeii).

Restricted geographically to specific area.

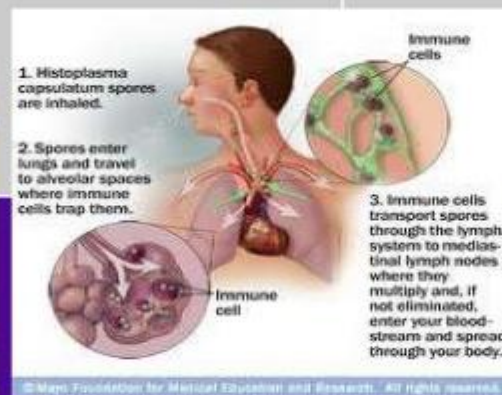
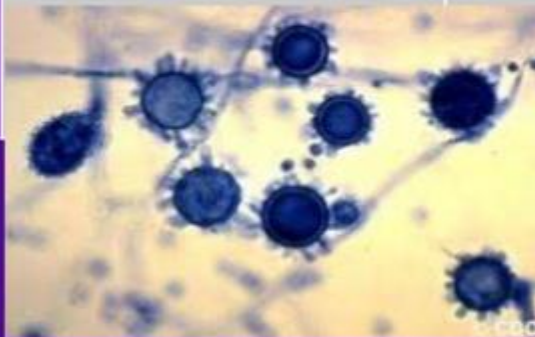
SYSTEMIC MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
1. BLASTOMYCES DERMATITIDIS	<p>BLASTOMYCOSIS</p> <p>Molds in culture - Branched septate</p> <p>Yeast like in tissue. – single budding yeast like</p> <p><i>Older culture may produce chlamydo spores</i></p>	<ul style="list-style-type: none"> ➤ Present as pulmonary disease (or) extra pulmonary disseminated disease ➤ Asymptomatic /present as a mild flu like illness. 	<ul style="list-style-type: none"> ➤ Sputum, pus , exudates, Urine & biopsy from lesions. ➤ Microscopic examination ➤ Culture ➤ Serologic test 	<ul style="list-style-type: none"> ➤ Itraconazole ➤ Ketoconazole ➤ Serious cases amphotericin B.



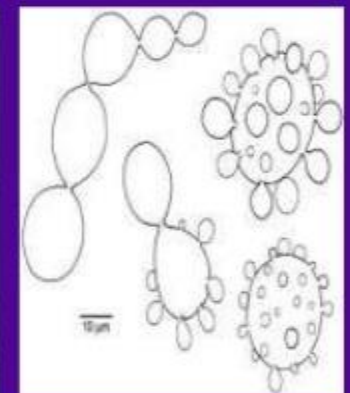
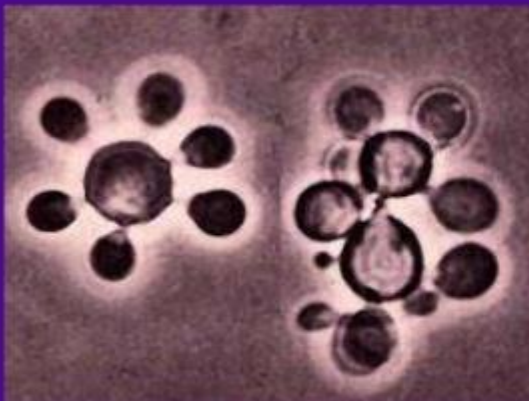
SYSTEMIC MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
2.COCCIDIOIDOMY COSIS	<i>Coccidioides immitis</i> & <i>C.posadasii</i> Molds hyphae – arthroconidia – endosporulating spherule in tissue.	<ul style="list-style-type: none"> ➤ Asymptomatic pulmonary disease ➤ Vally fever/SanJoaquin in vally fever/desert rheumatism 	<ul style="list-style-type: none"> ➤ Suptum, exudates from cutaneous lesion, spinal fluid, blood, Urine & Tissue biopsy. ➤ Microscopic examination ➤ Culture ➤ Serilogic test 	<ul style="list-style-type: none"> ➤ Itraconazole ➤ Serious cases amphotericin B. ➤ Azoles, fluconazole



SYSTEMIC MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
3.HISTOPLASMOSIS	<p>Histocapsulatum var Capsulatum, H. capsulatum var duboisii</p> <p>Molds in culture - hyaline septate - conidiophore</p> <p>Yeast like in tissue. – intracelluar budding yeast like</p>	<ul style="list-style-type: none"> ➤ Conidia develops into yeast cells – engulfed by alveolr macrophages ➤ Initial inflammatory reaction because granulomatous ➤ Mediastinal fibrosis 	<ul style="list-style-type: none"> ➤ Suptum, scrapings from superficial lesions, bone marrow, aspirates & buffy coat blood cells, blood films & biopsy from lessions. ➤ Microscopic examination ➤ Culture ➤ Serilogic test 	<ul style="list-style-type: none"> ➤ Itraconazole ➤ In disseminated disease, treatment with amphotericin B.



SYSTEMIC MYCOSES	CAUSITIVE ORGANISMS	CLINICAL SYNDROME	DIAGNOSIS	TREATMENT
4.PARACOCCIDIOID OMYCOSIS	<p>Paracoccidioides brasiliensis</p> <p>Molds in culture - Branched septate</p> <p>Yeast like in tissue. – multiply budding yeast like</p> <p><i>Older culture may produce chlamydo spores and conidia</i></p>	<p>➤ Present as pulmonary disease (or) extra pulmonary disseminated disease.</p>	<p>➤ Suptum, exudates & biopsy from lesions.</p> <p>➤ Microscopic examination</p> <p>➤ Culture</p> <p>➤ Serilogic test</p>	<p>➤ Itraconazole</p> <p>➤ Ketoconazole & Trimethoprim-sulfamethoxazole</p> <p>➤ Serious cases amphotericin B.</p>





Opportunistic fungi

1. Saprophytic - from the environment
e.g., *Cryptococcus sp.*, *Aspergillus*,
Zycomycetes.
2. Endogenous – a commensal organism e.g.,
Candida sp.



Predisposing Factors: Providing a Route/ Source

- Antibiotics
- Burns and other skin problems
- Catheter- related problems
- Devices (prosthetic)
- Effects on mucosal integrity
- Fungus isolated previously



Candida albicans and other *Candida* species

- Harmless inhabitants of the skin and mucous membranes of all humans.
- Normal immune system keeps candida on body surfaces.
- Although candidiasis is endogenous in most cases, cross infections are described, especially in intensive care unit patients.
- Account for 80% of nosocomial fungal infections.
- Account for 30% of deaths from nosocomial infections.

Invasive Candidiasis

- If phagocytic system is compromised, infection spreads to many organs and causes focal infection in these organs (kidney ,eye ,heart , liver , meninges)
- Mortality of candidemia is 30-40%
- Prophylactic antifungal drugs during cytotoxic course of therapy



Aspergillosis:

- Very common airborne soil fungus.
- 600 species, 8 involved in human disease; *A. fumigatus* most commonly.
- Serious opportunistic threat to **AIDS, leukemia, and transplant patients.**
- Infection usually occurs in **lungs** – spores germinate in lungs and form **fungal balls**; can colonize **sinuses, ear canals, eyelids, and conjunctiva.**
- **Invasive aspergillosis** can produce **necrotic pneumonia, and infection of brain, heart, and other organs.**
- The main portal of entry for Aspergillosis is the respiratory tract, however, injuries to the skin may also introduce the organism into susceptible hosts.
- Amphotericin B and nystatin.



Cryptococcosis

- *Cryptococcus neoformans* causes cryptococcosis.
- A widespread **encapsulated yeast** that inhabits soil around pigeon roosts.
- Common infection of **AIDS, cancer or diabetes patients**.
- Infection of **lungs** leads to cough, fever, and lung nodules.
- **Dissemination to meninges** and brain can cause severe neurological disturbance and death.
- Cryptococcosis is most typically an opportunistic fungal infection that most frequently causes pneumonia and/or meningitis.

Diagnosis

Microscopic

India Ink for capsule stain (50-80% + CSF)

Gram

Calcoflur white

Silver stain

Culture

Bird seed agar

Routine blood culture

Serology

Latex agglutination, EIA, 90% sensitive & specific.

Radiology

CXR – infiltrates, nodules, lymphadenopathy, cavitation, effusion.

CT/MRI – 50% normal, hydrocephalus.

Therapy

- Amphotericin B +/- flucytosine
- Fluconazole
- Amphotercin x 2 wk then fluconazole 400-800 mg/d x 8-10 wk

Pulmonary Cryptococcus





OPPORTUNISTIC FUNGAL INFECTIONS ARE:

- Difficult to diagnose.
- Difficult to treat.
- Difficult to prevent.
- **More and more frequent.**
- A great challenge for a future work in all fields.

