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Pathogenesis of fungi (Mycoses):

Most fungi are saprophytic or parasitic to plants and are adapted to their natural environment. Infection in humans is a chance event, occurring only when conditions are favorable. Except for few fungi such as the dimorphic fungi that cause systemic mycoses and dermatophytes, which are primary pathogens, the rest are only opportunistic pathogens. The human body is a hostile environment and offers great resistance to fungal invasion. Most fungi are saprophytic and their enzymatic pathways function more efficiently at the redox potential of non-living substrates than at the relatively more reduced state of living metabolizing tissue. Some fungi such as ***Candida*** and ***Malasezzia*** have adapted to the human environment and exist as commensals.

The complex interplay between fungal virulence factors and host defense factors will determine if a fungal infection will cause a disease. Generally, infection depends on inoculum size and the general immunity of the host.

Fungal Pathogenicity (virulence factors):

• Ability to adhere to host cells by way of cell wall glycoproteins

• Production capsules allowing them to resist phagocytosis

• Production of a cytokine called GM-CSF by *Candida albicans* that suppress the production of complement.

• Ability to acquire iron from red blood cells as in *Candida albicans*

•Ability to damage host by secreting enzymes such as keratinase, elastase, collagenase

• Ability to resist killing by phagocytes as in dimorphic fungi

• Ability to secrete mycotoxins

• Having a unique enzymatic capacity

• Exhibiting thermal dimorphism

• Ability to block the cell-mediated immune defenses of the host.

• Surface hydrophobicity

Host defense factors:

• Physical barriers, such as skin and mucous membranes

• The fatty acid content of the skin

• The pH of the skin, mucosal surfaces, and body fluids

• Epithelial cell turnover

• Normal flora

• Chemical barriers, such as secretions, serum factors

• Most fungi are mesophilic and cannot grow at 37oC.

• Natural Effector Cells (polymorphonuclear leucocytes) and the Professional Phagocytes (monocytes and
macrophages)

Factors predisposing to fungal infections:

• Prolonged antibiotic therapy

• Underlying disease (HIV infection, cancer, diabetes, etc.)

• Age

• Surgical procedures

• Immunosuppressive drugs

• Irradiation therapy

• Indwelling catheters

• Obesity
• Drug addiction
• Transplants
• Occupation

Fungal Diseases (Mycoses):

Mycoses can be conveniently studied as:

1. Superficial mycoses

I. Tinea versicolor

II. Tinea nigra

III. Black piedra

IV. White piedra

V. Otomycosis

VI. Occulomycosis

Superficial mycoses refer to the diseases of the skin and its appendages caused by fungi. They possess the affinity for parasitizing stratum corneum of keratin-rich tissues like skin, hair & nails and produce the dermal inflammatory response and intense itching in addition to a cosmetically poor appearance. The causative fungi colonize only cornified layer of epidermis or suprafollicular portions of hair & do not penetrate into deeper anatomical sites and do not exhibit a pathology (no granulomas, cysts or other lesions) therefore, they do not elicit a host cellular response but the patient usually only becomes particularly concerned for cosmetic reasons and not because of discomfort. Superficial mycoses affect 20% to 25% of the world's population, and the incidence is increasing.

- Pityriasis Versicolor: pigmented lesions on the torso
- Tinea nigra: gray to black macular lesions often on palms
- Black piedra: dark gritty deposits on hair
- White piedra: soft whitish granules along hair shaft
- Keratomycosis: Corneal ulcer
- Otomycosis: infection of the external auditory canal of the ear.

All are diagnosed by microscopy and are easily treated by topical preparations

Tinea Versicolor (pityriasis versicolor):

Tinea versicolor (pityriasis versicolor), a superficial skin infection of cosmetic importance only, is caused by ***Malassezia furfur*.** The lesions are usually noticed as hypopigmented areas, especially on tanned skin in the summer. There may be slight scaling or itching, but usually, the infection is asymptomatic. It occurs more frequently in hot, humid weather. The lesions contain both budding yeast cells and hyphae. Diagnosis is usually made by observing this mixture in KOH preparations of skin scrapings. Culture is not usually done. The treatment of choice is topical **miconazole**, but the lesions have a tendency to recur. Oral antifungal drugs, such as **fluconazole or itraconazole**, can be used to treat recurrences.

Tinea nigra is an infection of the keratinized layers of the skin. It appears as a brownish spot caused by the melanin-like pigment in the hyphae. The causative organism, ***Exophiala werneckii*,** is found in the soil and transmitted during injury. In the United States, the disease is seen in the southern states. Diagnosis is made by microscopic examination and culture of skin scrapings. The infection is treated with a topical keratolytic agent (e.g., **salicylic acid**).

- **White piedra**, fungi in the *Trichosporon* genus, occurs in semitropical and temperate countries. *Trichosporon* genus is subdivided into

six distinct human pathogenic species of which *Trichosporon asahii, T. ovoids, T. Rankin, T. mucoides, T. asteroids, &T. cutaneum* and are linked to white piedra. *Acremonium SP* might also cause this infection.

- ž Clinical findings: Soft, white to yellowish nodules loosely attached to the hair
- ž Microscopic .: Intertwined septate hyphae, blastoconidia, and arthroconidia
- ž Culture: Soft, creamy colonies
- ž Treatment.: **Shaving, azoles**
- ž
- ž **Black piedra** is a condition that is characterized by the presence of firmly adherent black, hard, gritty nodules, which are composed of a mass of fungus cells on the hair shaft, and cause disintegration and breaking of the hair. These stone-hard black nodules are usually localized to the scalp, but may also be seen on hairs of the beard, mustache and pubic hair, with the fungal activity limited to the cuticle.
- ž Fungal infection of the scalp hair
- ž Etiology: ***Piedraia hortae***
- ž Frequent in tropical areas
- ž Clinical findings: Discrete, hard, dark brown to black nodules on the hair
- ž Microscopic. Septate pigmented hyphae, and asci; unicellular and fusiform ascospores with polar filament(s)
- ž Culture: Brown to black colonies
- ž Treatment.: **Topical salicylic acid, azole cremes**
- ž

Otomycosis: Fungus and yeasts infection of the external auditory canal of ž

the ear. Numerous common fungi have been implicated.

- Some investigators believe this is not a true disease because tissue invasion and destruction has not been demonstrated
- It is a fungal infection of **the external ear.**
- · It is a very common infection.
- · It is usually caused by *Aspergillus niger* and *A.fumigatus*.
- · The symptoms are:
- 1. Itching,
- 2. Pain,
- 3. Deafness.
- Secondary bacterial infection by Pseudomonas and Proteus may occur
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- **Oculomycosis**: The clinical disease is an ocular infection named as mycotic keratitis. It usually follows corneal trauma. Fungal spores colonies the injured tissue and elicit an inflammatory reaction, leading to the formation of ulcer and

  endophthalmitis**.**
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- **KERATOMYCOSIS**

  (Mycotic keratitis).
- Posttraumatic / postsurgical corneal infection.
- Etiology: Saprophytic fungi (***Aspergillus, Fusarium, Alternaria, Candida), Histoplasma capsulatum***
- Clinical findings: Corneal ulcer

ž Microscopic: Hyphae in corneal scrapings ž

Therapy:

ž 1-A solution (5 %) of Natamycin applied topically.

- 2-Topically applied Amphotericin B, oral Sporanox (1:50 dilution of Sporanox in ophthalmic solution) and ketoconazole in suspension have been used in difficult cases
- 3-If thermophilic *Aspergillus* spp. are involved the organism may invade the brain. Few drugs are successful in such cases.
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- **How to Avoid Human superficial mycoses**??
- Cleanliness.
- Keep your home and office dry and well-ventilated.
- , Use antifungal treatments when infection occurs.
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