Respiratory fungal infections

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Learning Objectives •

- Enlist the fungal agents causing respiratory tract infections with respect to its classification.
- Enlist systemic fungi, discuss their mode of transmission, diagnosis.
- Discuss the microbiologic features of opportunistic fungal pathogens.
- Describe the route of transmission, clinical manifestations and diagnosis of opportunistic infections.

Systemic pathogens

There are 4 important **classical pathogens** in the United States. All of them cause **acute pulmonary** (asymptomatic or self-resolving in 95% of cases), **chronic pulmonary**, or **disseminated infection**.

- Histoplasma
- Coccidioides
- Blastomyces
- Paracoccidioides

Diagnosis is made with sputum cytology ; **sputum culture** on blood agar; and **special fungal media** (inhibitory mold agar, Sabouraud).

Peripheral blood culture is useful for Histoplasma since it circulates in reticuloendothelial system (RES) cells. Dimorphic transition is thermally dependent and reversible (25°C ↔ 37°C.)

Opportunistic Fungi

⇒ **Mold:**

- Aspergillus
- Mucor

⇒ **Yeast:**

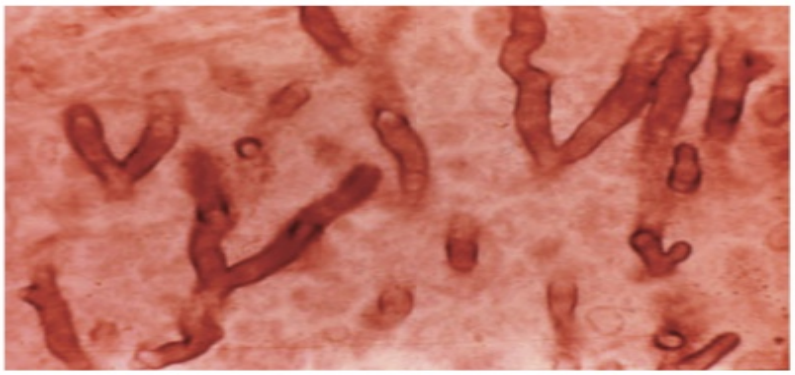
- Cryptococcus neoformans
- Candida species
- Pneumocystis jirovecii (carinni)

***Aspergillus* spp**.

Opportunistic pathogen, airborne spread.

More than 100 species of *Aspergillus.* Septate hyphae branching at 45° angle.

Most human disease caused by *A. fumigatus* followed by *A. flavus*, and *A. niger*.



Aspergillus fumigatus

Aspergillosis

Aspergillosis is a spectrum of disease of humans by members of the genus *Aspergillus*.

Depending upon the immune status of patients it can cause :

- Allergic bronchopulmonary aspergillosis
- Aspergilloma (fungus ball)
- Invasive pulmonary aspergillosis

⇒ Allergic bronchopulmonary aspergillosis

• In individuals with altered lung function such as asthma and cystic fibrosis patients, aspergilli can cause allergic bronchopulmonary aspergillosis, a hypersensitive response to fungal components.

⇒ Aspergilloma or aspergillus fungal ball

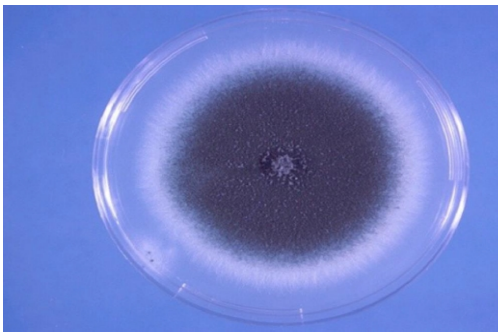
- Risk factor: Preexisting pulmonary disease (cavities): tuberculosis, COPD(chronic obstructive pulmonary disease) , abscess.
- Clinical features: cough and hemoptysis
- Surgical removal to reduce coughing, may induce pulmonary hemorrhage

⇒ Invasive aspergillosis.

- Those most at risk for this life-threatening disease are individuals with hematological malignancies such as leukemia, transplant patients; individuals with genetic immunodeficiency's); and individuals infected with human immunodeficiency virus
- C/P: Fever, cough, hemoptysis
- Nasal colonization, leading to **pneumonia or meningitis**
- Dissemination to other organs is common.
- Prognosis poor

Aspergillosis - Diagnosis

- Direct examination KOH,Lactophenol blue: Branching (at 45 degree angle) septate hyphae of *Aspergillus species*
- Culture *Aspergillus species* grow on Sabouraud dextrose agar



Cryptococcus neoformans

Encapsulated yeast (monomorphic)

Environmental Source: soil enriched with pigeon droppings

Acquired by i**nhalation**

Disease. Predisposing conditions include Hodgkins and AIDS

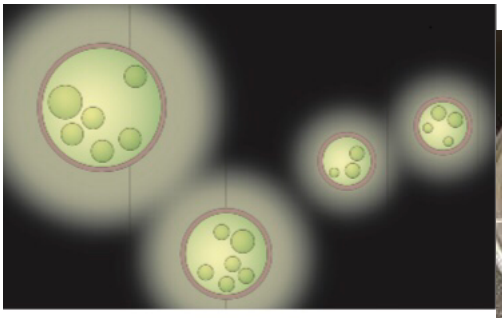
- Most infections are asymptomatic

C/P Fever, cough, chest pain and breathing problem.

Diagnosis

Identification based on presence of capsule, urease, growth at 37°C and sugar assimilation.

• India ink preparation: Reveals capsulated yeast • Culture: Moist creamy white colonies on (SDA)



Cryptococcus Neoformans

SDA

Candida

Yeast endogenous to our mucous membrane normal flora

• C. albicans yeasts form germ tubes at 37 C in serum

• Forms **pseudohyphae** and **true hyphae** when it invades tissues (nonpathogenic Candida do not)

- Candidiasis refers to infection caused by many species of genus candida.
- Candida albicans is the most common

Virulence factors

- Change from yeast to Pseudo hyphal form
- Produce enzymes like proteinases and phospholipases which facilitate invasion

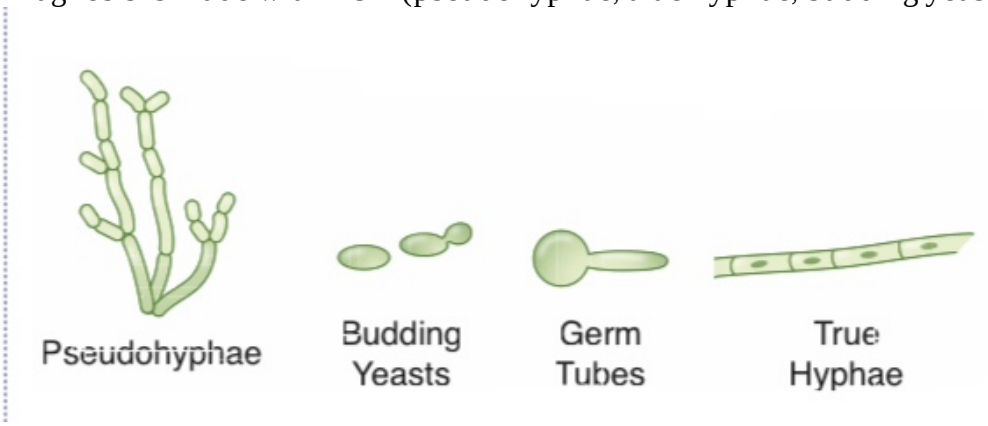
Pulmonary Candidiasis

- Mostly seen in immunocompromised patients or patients taking prolonged antibiotic therapy.
- Primary pneumonia is less common and could be a result of aspiration
- Secondary pneumonia commonly seen with hematogenous candidiasis in Immunocompromised patients

Clinical features: Fever, chest pain, cough

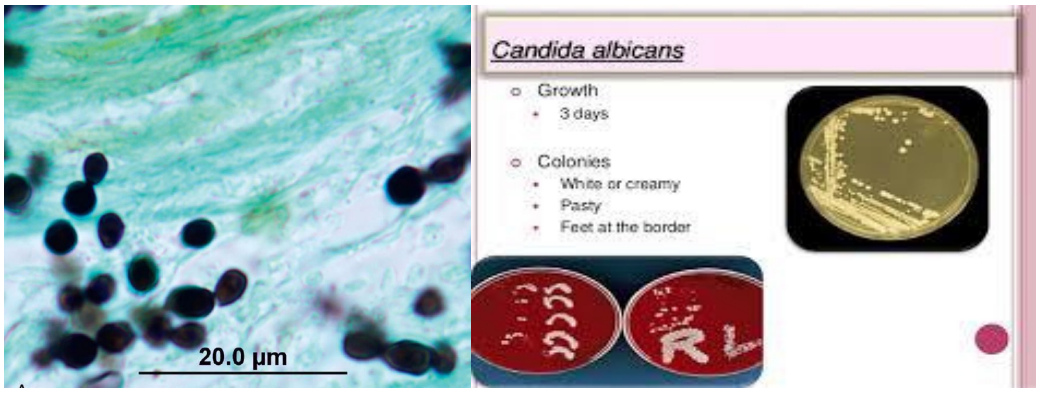
Laboratory Diagnosis

. Diagnosis is made with **KOH** (pseudohyphae, true hyphae, budding yeasts)



Culture:

- On SDA & Blood agar at 37°C,
  creamy moist colonies in 24 - 48 hours
- Biochemical tests/formation of germ tubes).



Reference

KAPLAN Medical, USMLE Step 1 Lecture Notes 2021, Immunology and Microbiology, p: 351, 357, 358, 359

Question

• A 55- Year-old man presents with chronic cough and hemoptysis. Patient has past history of TB. Chest radiograph and CT scan shows opaque mass in a cavity. What could be the diagnosis?

- Acute invasive aspergillosis
- Aspergilloma or fungal ball
- Cryptococcal infection
- Allergic bronchopulmonary aspergillosis