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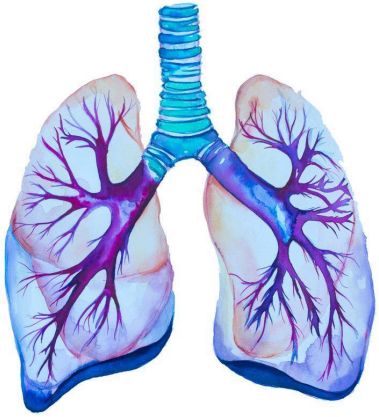


Respiratory fungal infection

Color index:

- Important
- Doctor Notes
- Extra, TN

Objectives :

- Acquire the basic knowledge about fungal infections of the respiratory system
- Know the main fungi that affects the respiratory system.
- Identify the clinical settings of such infections.
- Know the laboratory diagnosis, and treatment of these infections.

Introduction

- inhalation (airborne), and Aspiration (oral route), are mostly the rout of Respiratory infections.
- Respiratory fungal infections are less common than viral and bacterial infections. Viruses > bacteria > fungi.
- Invasive diseases have significant difficulties in diagnosis and treatment.

Opportunistic : Diseases in immunocompromised host. Ex, HIV/AIDS
Primary infections : caused by primary pathogen.

Etiology

Opportunistic		Primary infections
Yeast (pathogen ⟶ **disease**)	"Filamentous" Mould fungi (pathogen ⟶ **disease**)	Dimorphic fungi "both yeast and mould fungi"
• Candida ⟶ **Candidiasis** very rare • Cryptococcus neoformans and C. gattii ⟶ **Cryptococcosis** Usually seen in meningitis rather than resp C : Cryptococcus	• Aspergillus species ⟶ **Aspergillosis** • Zygomycetes, Rhizopus and Mucor ⟶ **Zygomycosis** • Other mould	• Histoplasma capsulatum • Blastomyces dermatitidis • Paracoccidioides brasiliensis • Coccidioides immitis

Primary Systemic Mycoses

	Primary Systemic Mycoses
Definition	Infections of the respiratory system.
Transmission	Inhalation
Where can we see it ?	**Dissemination** "it can spread to more than organ" seen in immunocompromised hosts. "Severe"
Where can we find it ?	Common in North America to a lesser extent in South America. Not common in other parts of the World.
Etiology **=** Dimorphic fungi	In nature found in soil of restricted habitats. Primary pathogens. They are highly infectious. "If you inhaled just few of it you will get infected unlike others" it include: • Histoplasmosis • Blastomycosis • Coccidioidomycosis • Paracoccidioidomycosis

Aspergillosis

Definition

Aspergillosis is a spectrum of diseases of humans and animals caused by members of the genus Aspergillus (mould fungi).

it include

Mycotoxicosis, Colonization (without invasion and extension) in preformed cavities. Invasive disease of lungs., Systemic and disseminated disease, Allergy.

Etiology	Risk factor	Diagnosis	Treatment
Aspergillus species, common species are : • A.fumigatu most virulent • A. flavus most common in Riyadh • A. niger • A. terreusand • A. nidulans. (image slide 8)	• Bone marrow/ organ transplantation Because we gave them immunosuppressants to decrease their immunity • Cancer: Leukemia, lymphoma. • AIDS • Drugs: Cytotoxic drugs, steroids. • Diabetes • Others	**Specimen**: • Respiratory specimens: [1]Sputum, [2]BAL, [3]Lung biopsy. • Other samples: Blood **Lab. Investigations:** (image slide 8) • Direct Microscopy: Giemsa Stain, [4]GMS Stain. Will show **fungal septate hyphae** • Culture on SDA. **Serology:** • Test for Antibody. • ELISA test for galactomannan Antigen."specific for Aspergillus" **PCR:** Detection of Aspergillus DNA in clinical samples.	**Antifungal:** Voriconazole "the drug of choice" **Alternative therapy:** Amphotericin B, Itraconazole, Caspofungin +surgery to remove aspergilloma

Aspergillus is first **common** fungal pathogen in respiratory infection.

1- NOT the best because it's full with normal flora
2- **B**ronchoscopy **A**lveolar **L**avage Second best method
3- The BEST method because it's sterile + you can check if the disease is invasive or not
4- **G**rocott **M**ethenamine **S**ilver

Classification of Aspergillosis

Pathogenesis: Airways/Nasal exposure to airborne Aspergillus.

	Types	Causes	Signs and symptom	Diagnosis
Invasive pulmonary Aspergillosis In immunocompromised patient			• Cough • hemoptysis • fever • Leukocytosis	**Radiology**: will show lesions with halo sign. (Image slide 8)
Chronic Aspergillosis "Colonizing Aspergillosis"	• Aspergilloma of lung • Maxillary (sinus) aspergilloma	Aspergilloma, which is also known as (Aspergillus fungus ball).	• Dry Cough • hemoptysis • variable fever	**Radiology**: will show mass in the lung. radiolucent crescent"air surround the mass" (Image slide 8)
Allergic -In healthy patient usually -common in KSA	• Allergic bronchopulmonary Aspergillosis (ABPA) • Allergic Aspergillus sinusitis		• Symptoms of Asthma • Bronchial obstruction • Eosinophilia • Wheezing +/-	• Skin test reactivity to Aspergillus • Serum antibodies to Aspergillus This test is used to differentiate between asthma and allergic aspergillosis • Serum IgE> 1000 ng/ml
Persistence without disease			colonisation of the airways or nose/ sinuses.	

Fungal sinusitis

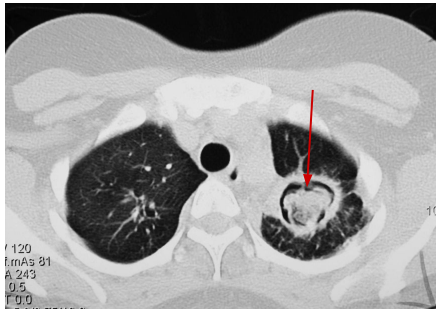
Common in KSA especially allergic synasitis

Aspergillus sinusitis has the same spectrum of aspergillus disease in the lung.

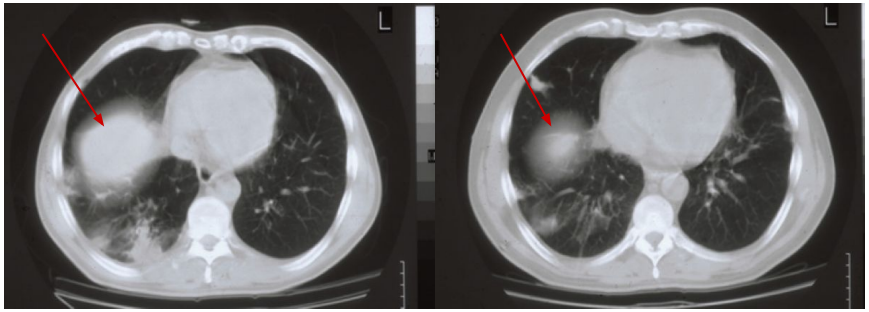
Symptoms	Etiology	Complication	Diagnosis	Treatment
Nasal polyps and other symptoms of sinusitis.	Aspergillus flavus and other fungi. Aspergillus flavus is the most common cause in KSA	In immunocompromised, Could disseminate to eye lead to craneum (Rhinocerebral)"Brain ".	• Clinical and Radiology • Histology • Culture • Precipitating antibodies useful in diagnosis • Measurement of IgE level, RAST test	**Depends on :** • the type and severity of the disease. • the immunological status of the patient.

Visuals

Diagnosis of Aspergillosis
Chronic and Invasive

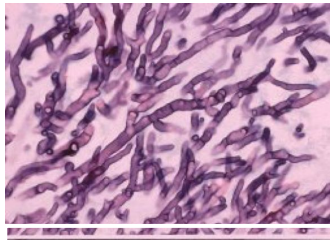


Chronic Aspergillosis, Note the Air crescent

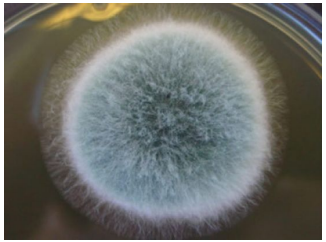


Invasive pulmonary aspergillosis, Note the Halo sign

Lab. Investigations of Aspergillosis



Smear: Septate fungal hyphae Aspergillosis

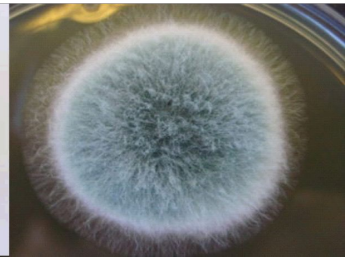


Cultures of Aspergillus

Common airborne Fungi
Types of Aspergillus

(differ by color after culturing)

(black-brownish) Aspergillus niger



Aspergillus fumigatus (greenish-yellow)

Zygomycosis

Pulmonary zygomycosis

- Acute infection
- Marked by : Consolidation , nodules , cavitation , pleural effusion , hemoptysis
- Infection may extend to chest wall , diaphragm , pericardium causing :

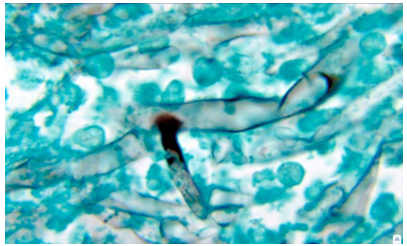
- Pulmonary infarction and hemorrhage
- Rapid evolving clinical course

Early recognition and intervention are critical

If it's in the form of sinusitis it will extends into the brain in 10 days

Rhinocerebral zygomycosis

Pulmonary Zygomycosis

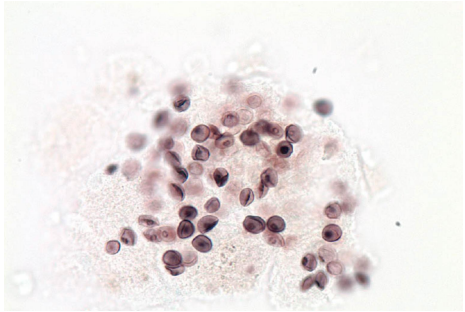
Etiology	Risk factors	Diagnosis	Treatment
Zygomycetes : **Non-septate hyphae** e.g. Rhizopus	• Transplant patients • Malignancy • AIDS • **Diabetic ketoacidosis** And many others	**Specimen**: • Respiratory specimens: Sputum, BAL, Lung biopsy + other samples **Laboratory Investigations**: • Direct Microscopy: Giemsa stain, GMS stain ➢ Will show broad non- septate fungal hyphae • Culture on SDA (**no cycloheximide**) **Serology**: Not available	• Amphotericin B • Surgery 

GMS stain for zygomycetes

Pneumocystosis (PCP)

Pneumocystis pneumonia (PCP) is **Opportunistic fungal pneumonia**

It is interstitial pneumonia of the alveolar area. Affect **compromised host** (Especially common in **AIDS** patients) .

Etiology	Diagnosis	Treatment
Pneumocystis jiroveci -Naturally found in rodents (rats), other animals(goats, horses), Humans may contract it during childhood   	• Does **not grow** in laboratory media e.g. SDA • Laboratory Diagnosis: - specimen : Bronchoscopic specimens (BAL) BronchoAlveolar Lavage, Sputum, Lung , biopsy tissue. • Histological sections or smears stained by - GMS stain. - Immunofluorescence (**better sensitivity**) If **positive** –> will see cysts of hat-shape, cup shape, crescent	• Trimethoprim"the drug of choice" – sulfamethoxazole • Dapsone  Cysts

Summary

	Primary Systemic Mycoses	Aspergillosis	Zygomycosis Pulmonary zygomycosis	Pneumocystosis Pneumocystis pneumonia (PCP) is Opportunistic fungal pneumonia.
Epidemiology/ signs and symptoms	Highly infectious , common in America but not here	**Cough - hemoptysis - fever** Invasive : leukocytosis Allergic : asthma symptoms Chronic : aspergilloma Fungal sinusitis : nasal polyps	**Acute infection** marked by Consolidation, nodules, cavitation, pleural effusion, hemoptysis.Risk factor: Diabetes.	It is interstitial pneumonia of the alveolar area. Risk factor: AIDS patients.
Etiology	Dimorphic fungi	A.fumigatus, A.flavus	Zygomycetes	Pneumocystis jiroveci
Diagnosis		**1-Specimen**: Sputum, BAL, Lung biopsy. **2-Lab. Investigations:** **(**GMS)⟶ **septate fungal hyphae** **3-Serology:** ELISA test for galactomannan Antigen. Allergic and sinusitis : IgE serum **4-PCR** detect the DNA of aspergillus. **5- Radiology** Invasive: halo sign Chronic : mass with crescent	**1-Specimen**: Sputum, BAL, Lung biopsy **2-Laboratory Investigations:** (GMS)⟶ **broad non-septate fungal hyphae** **3-Serology:** Not available	**1- Specimen** : BAL **2-Laboratory Investigations:** Histological sections or smears stained by (GMS) stain and Immunofluorescence (**better sensitivity**) If positive —> **cysts** Does **not** grow in laboratory media.
Treatment		**Antifungal:** Voriconazole	Amphotericin B, Surgery	Trimethoprim

Quiz :

1) Which one is considered highly infectious ?		
A.Coccidioidomycosis	B. Aspergillus niger	C. Rhizopus
2) All have abnormal level of IgE except		
A.Aspergillus sinusitis	B. allergic aspergillosis	C. Pulmonary Zygomycosis
3) One of the following considered as an acute infection		
A.pulmonary zygomycosis	B. Pneumocystosis	C. Fungal sinusitis
4) Which one of the following can't be cultured		
A.Aspergillus flavus	B. Pneumocystis jiroveci	C. Rhizopus
5) A patient's lab diagnosis show septate hyphae , which is :		
A.Zygomycetes	B. Pneumocystis jiroveci	C. Aspregillus fumigatus

Q1. A 55-year-old man who recently recovered uneventfully from a heart valve transplant presents to the emergency room with pleuritic chest pain, hemoptysis, fever, and chills. While he is being examined, he has a myocardial infarction and the medical team is unable to revive him. An autopsy revealed septate hyphae in many tissues, what is the likely diagnosis ?

Aspergillosis

Q2. A 57-year-old diabetic patient came to the hospital with a fever , headache and coughing blood , the laboratory diagnoses showed non-septate hyphae , what is the best treatment for in this condition ?

Amphotericin B

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Thanks

Editing file

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