



Microbiology

team 436



Lecture : Respiratory Fungal Infection

■ important

■ Extra notes

■ Doctors notes

"لا حول ولا قوة إلا بالله العلي العظيم" وتقال هذه الجملة إذا دهم الإنسان أمر عظيم لا يستطيعه ، أو يصعب عليه القيام به .

Objectives:

- Respiratory System
 - Rout of infection?
 - Oral Cavity, any role?
 - Respiratory fungal infections are less common than viral and bacterial infections.
 - Have significant difficulties in diagnosis and treatment.
-

Respiratory fungal infection - Etiology

YEAST (Opportunistic)	Mould fungi (Opportunistic)	Dimorphic fungi (Primary infections) Common in travel
Candidiasis (Candida)	Aspergillosis (Aspergillus species)	Histoplasma capsulatum
Cryptococcosis (Cryptococcus neoformans, C. gattii)	Zygomycosis (y, e.g. Rhizopus, Mucor)	Blastomyces dermatitidis
	Other mould	Paracoccidioides brasiliensis
		Coccidioides immitis

Primary Systemic Mycoses

- Infections of the respiratory system that occur by **Inhalation**.
 - **Dissemination seen in immunocompromised hosts.**
 - Common in North America and to a lesser extent in South America. Not common in other parts of the World.
 - **Etiologies are dimorphic fungi:**
 - ✓ In nature **found in soil** of restricted habitats.
 - ✓ Primary pathogens, **dimorphic** fungi
 - ✓ They are **highly infectious**
 - **They include:**
 - ✓ Histoplasmosis,
 - ✓ Blastomycosis,
 - ✓ Coccidioidomycosis,
 - ✓ Paracoccidioidomycosis
-

Aspergillosis

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

- **These include :**

- (1) Mycotoxicosis (such alpha toxin which produced by Aspergillus)
- (2) Allergy
- (3) Colonization (without invasion and extension) in preformed cavities
- (4) Invasive disease of lungs
- (5) Systemic and disseminated disease.

- **Aetiological Agents:**

Aspergillus species, common species are:

A. fumigatus, (Glabeular)

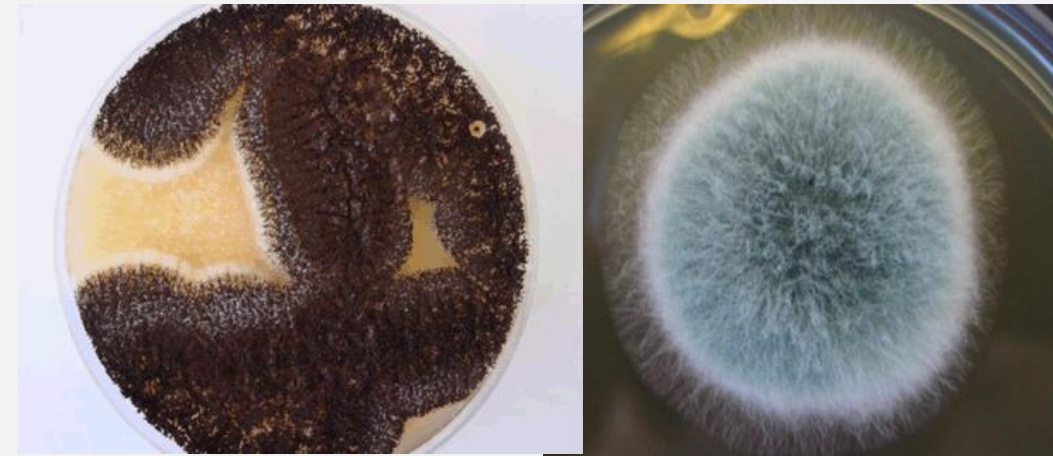
A. flavus, (Regional)

A. niger,

A. terreus

A. nidulans.

Common airborne Fungi



Aspergillus niger

Aspergillus fumigatus

CLASSIFICATION OF ASPERGILLOSIS:

Airways/nasal exposure to airborne Aspergillus

- **Invasive aspergillosis**
- **Chronic aspergillosis**
Aspergilloma of lung
Maxillary (sinus) aspergilloma
- **Allergic:**
Allergic bronchopulmonary (ABPA)
Allergic Aspergillus sinusitis
- Persistence without disease
- colonisation of the airways or nose/sinuses

Risk factors :

- **Bone marrow/ organ transplantation**
- **AIDS**
- **Diabetes**
- others
- **Cancer: Leukemia, lymphoma,.. Etc**

Aspergillosis:

Chronic Aspergillosis (Colonizing aspergillosis)

(**Aspergilloma** OR Aspergillus fungus ball) (Fungus Ball is a mass or clumping of hyphae + mucous + fibrin + cellular debris) usually inside cavity.

- Signs include: Cough, **hemoptysis**, variable fever
- Radiology will show mass in the lung , **radiolucent (air) crescent**

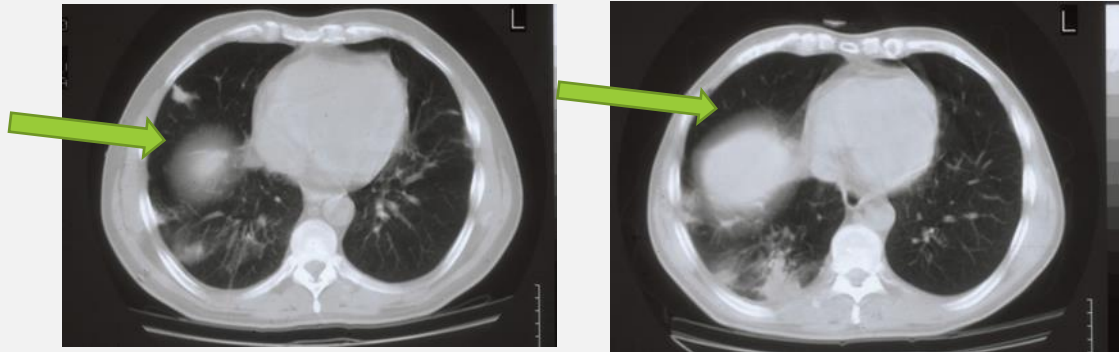
Invasive pulmonary Aspergillosis

Signs: Cough , hemoptysis, fever, **Leukocytosis**

Radiology will show lesions **with halo sign**

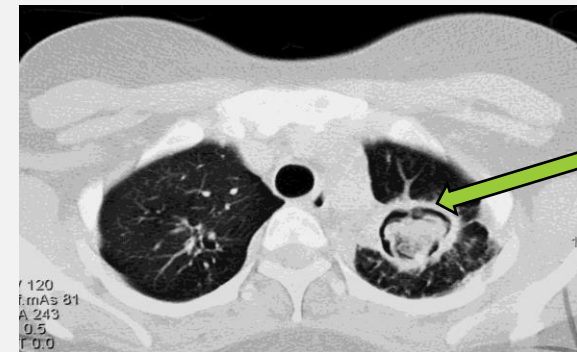
مهم

Invasive pulmonary aspergillosis



- Note the Halo sign

Simple (single) aspergilloma



Note the Air crescent

Allergic bronchopulmonary (ABPA)

- Symptoms of Asthma
- Bronchial obstruction
- Fever, malaise
- **Eosinophilia**
- Wheezing +/-

Also:

- **Skin test reactivity to *Aspergillus***
 - **Serum antibodies to *Aspergillus***
 - **Serum IgE > 1000 ng/ml**
 - Pulmonary infiltrates
-

Fungal sinusitis

Clinical :

- **Nasal polyps** – and other symptoms of sinusitis
- **In immunocompromised**, Could disseminate to → eye → craneum (Rhino cerebral)
- The **most common cause in KSA** is ***Aspergillus flavus***
- In addition to *Aspergillus*, there are other fungi that can cause fungal sinusitis
- *Aspergillus* sinusitis has the same spectrum of *Aspergillus* disease in the lung

Diagnosis

- **Clinical and Radiology**
- Histology
- Culture
- **Precipitating antibodies** useful in diagnosis
- **Measurement of IgE level,**
- **RAST test***

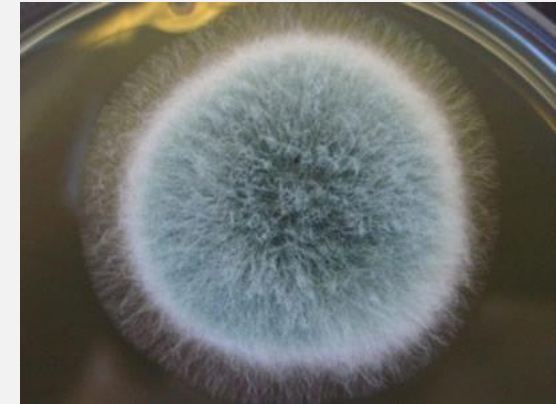
Treatment :

depends on the type and severity of the disease and the immunological status of the patient

* A **radioallergosorbent test** is a blood test using radioimmunoassay test to detect specific IgE antibodies, to determine the substances a subject is allergic to.

Diagnosis of Aspergillosis

- **Specimen:**
 - ✓ Respiratory specimens: **Sputum, BronchoAlveolar Lavage (BAL), Lung biopsy,**
 - ✓ Other samples:
 - ✓ Blood, etc.
- **Lab. Investigations:**
 - ✓ **Direct Microscopy:**
 - Giemsa Stain, Greccott methenamine silver stain (GMS)
 - **Will show fungal septate hyphae**
 - ✓ **Culture on SDA** (Sabouraud Dextrose Agar is selective media)
 - ✓ **Serology:**
 - Test for Antibody
 - **ELISA test for galactomannan Antigen**
 - ✓ **PCR:** Detection of Aspergillus DNA in clinical samples



Cultures of Aspergillus



Smear: Septate fungal hyphae.
Aspergillosis

Choice of antifungal for aspergillosis: Usually we need surgery also

- ✓ **Voriconazole**
- ✓ **Alternative therapy:**
 - Amphotericin B, Itraconazole, Caspofungin

Zygomycosis:

- Pulmonary zygomycosis
- Rhinocerebral zygomycosis
- **Risk factors**
 - ✓ Transplant patients
 - ✓ Malignancy
 - ✓ AIDS
 - ✓ Diabetic ketoacidosis
 - ✓ Many others

Pulmonary Zygomycosis:

- **Acute infection**
- Consolidation , nodules, cavitation, pleural effusion, hemoptysis
- Infection may extend to chest wall, diaphragm, pericardium.
 - Pulmonary infarctions and **hemorrhage**
 - Rapid evolving clinical course
- **Early recognition and intervention are critical**
- Etiology:
 - Zygomycetes , **Non-septate hyphae**
e.g. Rhizopus,

Note :

Aspergillosis –septate hyphae

p.Zygomycosis – non-septate hyphae

Diagnosis:

➤ Specimen:

- Respiratory specimens: Sputum, BAL, Lung biopsy,
- Other samples

➤ Lab. Investigations:

▪ Direct Microscopy:

Giemsa, Greccott methenamine silver stain (GMS)

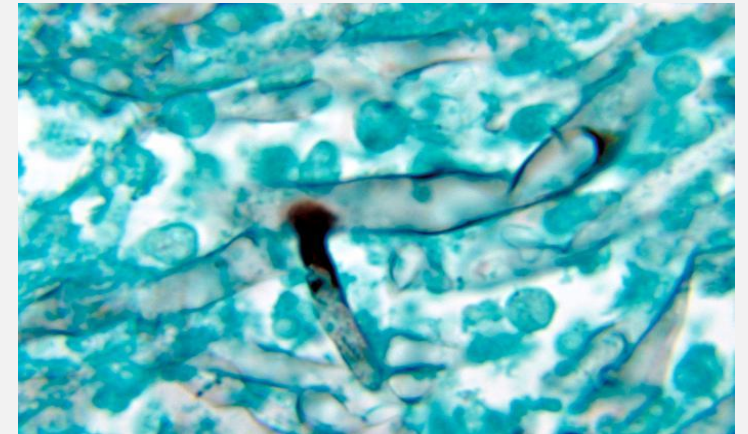
- Will show broad non- septate fungal hyphae

- Culture on SDA (no cycloheximide) because it may inhibit the growing of this fungi

➤ Serology: Not available

➤ Treatment:

- Amphotericin B
- Surgery



Pneumocystosis (PCP):

- **Pneumocystis pneumonia (PCP)**
- **Opportunistic fungal pneumonia**
- It is interstitial pneumonia of the **alveolar area** that effect immunocompromised hosts.
- Affect compromised host
- Especially common in **AIDS patients**.
- **Etiology: *Pneumocystis jiroveci***
- **Previously thought to be a protozoan parasite**, but later it has been proven to be a fungus
- **Does not grow in laboratory media** e.g. SDA (**only we can use silver \ IF stain which is more sensitive**)
- Naturally found in rodents (rats), other animals (goats, horses), Humans may contract it during childhood

Pneumocystosis:

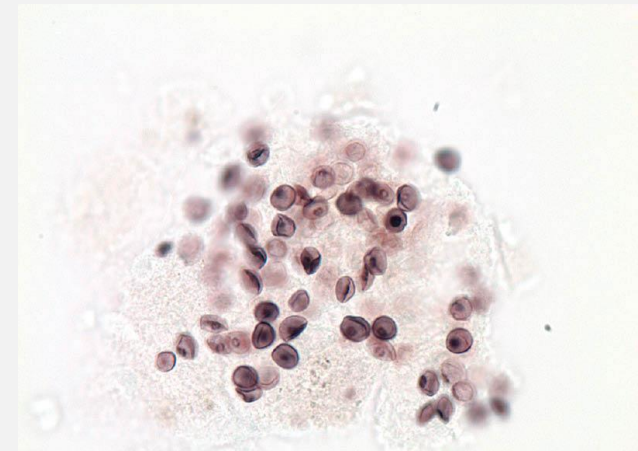
Laboratory Diagnosis:

- Patient specimen: **Bronchoscopic specimens (B.A.L.)**, Sputum (not very good), 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.

Treatment:

Trimethoprim – sulfamethoxazole (the two drugs are combined and known as co-trimoxazole)

Dapsone



Important slide

Pulmonary Candidiasis

Candida causing Pneumonia **but Not Common.**

Has Primary and Secondary

Secondary Dissimination of blood

Diagnose: **don't depend on Sputum**

Treatment: **Fluconazole**

Voticonazole if resistant to fluconazole

summary:

Respiratory Fungal Infections

Etiology

Opportunistic		Primary infections
Yeast	Mould Fungi	Dimorphic fungi
Candidiasis (candida, and other yeast)	Aspergillosis (Aspergillus species)	Histoplasma capsulatum
	Zygomycosis (Zygomycetes eg. Rhizopus, mucor)	Blastomyces dermatitidis
Cryptococcosis (Cryptococcus neoformans, C. gatti)		Other mould
		Coccidioides immitis

Classification

(1) Primary Systemic Mycoses
 (Inhalation)
 Primary pathogens
 Highly infectious
Etiology: Dimorphic fungi:
 Histoplasmosis
 Blastomycosis
 Coccidioidomycosis
 Paracoccidioidomycosis

(2) Aspergillosis
 (next slide)

(3) Zygomycosis

- Rhinocerebral zygomycosis
- Pulmonary zygomycosis (Acute)

Etiology:
 Zygomycetes (rhizopus)

Diagnosis:
 Specimen (sputum, BAL, biopsy)
 Lab (direct microscopy: GMS and Giemsa stain = broad non-septate fungal hyphae)
 (culture = SDA)
 (serology= not available)

Treatment:
 Amphotericin B
 Surgery

(4) Pneumocystosis (PCP)

Opportunistic fungal pneumonia

Etiology:
 Pneumocystis jiroveci

Diagnosis:
 Specimen (sputum, BAL, biopsy)
 Histology (GMS stain)
 Immunofluorescence

Treatment:
 Trimethoprim –
 Sulfamethoxazole
 Dapsone

summary:

Invasive aspergillosis

Signs:
cough, hemoptysis, fever,
leukocytosis.

Radiology:
Lesions with halo signs

Chronic aspergillosis (colonizing aspergillosis)

- Aspergilloma of lung
- Maxillary (sinus) aspergilloma

Signs: cough, hemoptysis,
variable fever

Radiology: mass in the lung,
radiolucent crescent

**Persistence without disease
colonization of the airways or
nose/sinuses**

(2) Aspergillosis

Etiology: (Aspergillus species)

A. fumigatus
A. flavus
A. niger
A. terreus
A. nidulans

Diagnosis:

Specimen (Sputum, BAL, biopsy,
blood, etc)

Lab (direct microscopy: GMS and
Giemsa stain = septate hyphae)
fungal

(culture = SDA)

(Serology = test for antibody,
ELISA)

(PCR = detection of aspergillus
DNA in clinical sample)

Treatment:

Voriconazole
Alternative: Amphotericin B,
Itraconazole, Caspofungin

Allergic

- Allergic aspergillus sinusitis
- Allergic bronchopulmonary
Aspergillosis (ABPA):
Symptoms of asthma, bronchial
obstruction, fever, malaise,
eosinophilia, wheezing +/-

Fungal Sinusitis

Signs: nasal polyps and other
symptoms of sinusitis

Most common cause:

Aspergillus flavus

Diagnosis:

clinical and radiology, histology,
culture, RAST, IgE levels

Treatment:

Varies according to severity and
type of the disease and the
immunological status of the patient

GOOD LUCK!

MICROBIOLOGY TEAM:

- Waleed Aljamal (leader)
- Ibraheem Aldeeri
- Ibrahim Fetyani
- Abdulaziz almohammed
- Abdulmalik alghannam
- Omar alabtain
- Turki maddi
- Mohammad alkahil
- Meshal Eiaidi
- Khalid Alhusainan
- Khalid Alshehri
- Nasir Aldosarie
- Shrooq Alsomali and Ghadah Almazrou (leaders)
- Reem Alshathri
- Ruba Barnawi
- Jawaher Abanumy
- Ouhod Abdullah
- Rawan alqahtani

The Editing File

We are waiting for your feedback



@microbio436

436microbiologyteam@gmail.com