



# Microbiology

Lecture No: 34 .....

Dr Name: Dr. Asem .....

Done by: Leen Younis .....

Sheet  Slide

# Mycology

This is the last lecture in the Introduction to Microbiology, which include medical mycology. We've already mentioned the major biological features and growth patterns of two major types of fungi:

1. Yeast.
2. Filamentous fungi.
  - » Pathogenicity of the two types (spherical yeast cells or Filamentous) can differ according to the type of infection.

## • YEAST

Generally, if yeast cells attach to our cells (the oral cavity mucosa, vaginal mucosa, intestinal mucosa or the skin), there will be no changes in the morphology of these cells. The only change will be in developing pseudohyphae.

Pseudohyphae is characterized by elongation in the cells known as germ tube which cause infection in the mucosa of the oral cavity or other parts of the body. Pseudohyphae (germ tube) can be seen (demonstrated) in vitro by using human's or animals' serum. It's used when we culture from the oral cavity a type of yeast and we want to know if this yeast is pathogenic. (Note that true hyphae are present in filamentous cells of fungi).

These pathogenic types can cause meningitis and also reach the bloodstream and then get carried to the internal organs (ex; meninges). They mainly affect immunocompromised patients and patients suffering from the lack of cell mediated immunity.

There are non-pathogenic types of yeasts which are not associated with developing any clinical infection. They are part of the normal flora and known as **Budding yeast – Saccharomyces cerevisiae**. This type belongs

to the Saccharomyces family. Usually used in bread (خميرة) and some types of food.

## - Candidiasis / candidiosis

It's a type of yeast that is considered as an opportunistic pathogen due to the fact that they're found in few numbers in the oral cavity, intestine, mucosa of the vagina (especially in young ladies, which can increase or decrease due to variety of conditions), etc.

The major conditions that contribute to the pathogenicity of this organism are:

1. Immunodeficiency in the body, it's the lack of immune response especially due to the lack of cell mediated immunity and not the humoral immunity (antibodies) {more details about that will be taken in the immunology course}.

### Sources of any infection are either :

1. Exogenous

It is acquired from outside the body by contaminated food or using contaminated instruments especially in hospitalized patients.

2. Endogenous

2. Using certain wide spectrum antimicrobial drugs for a long period which kill a large number of G+ve/G-ve bacteria that might enhance the growth of these opportunistic fungi and result in infection.

Candidiasis is more related to endogenous infection. Which means that our body already carries few numbers of this species and under the conditions of immunodeficiency or using antimicrobial drugs or even radiation (for cancer patients), it can kill the normal flora and result in infection.

## **Candidia albicans**

There are many species of candidiasis that can be associated with infection in the mucosa. However, 70% of the cases can be contributed to candida albicans (most common). Other species are less encountered like candida tropicalis, C. glabrata, C. Krusei, etc.

Candida albicans like other types of candida has the following clinical features :

1. Oral thrush especially in children. It develops by elongation of the cells with the presence of spores (blastospores, which are special to the candida albicans species) between each two cells. They can be easily recognized by taking a swab of the oral cavity to recognize the elongation of the cells. The infection happens when the tip of the elongated cells attaches to receptors on mucosa, producing markers for inflammation.

Thrush is a large number of elongated yeast cells covered as a nest of surface of the tongue or the gums and that can be easily recognized. **BE CAREFUL!** You must not remove this whitish color by any instrument as this can cause bleeding which can be dangerous causing wound dissemination. In this case, the patient must stop the use of the drug he's\she's using like antimicrobial drug or stop the radiation or anticancer medication or should use an antifungal ointment (مرهم) to cover the tongue and the oral cavity mucosa to relieve the patient, especially children.

2. Other types of infection that might disseminate from the oral cavity or the intestine and cause systemic infection (goes to the blood stream and affects other organs). It's very rare in candidiasis, unlike bacteria.

3. Vaginal Candidiasis, this is more commonly in young ladies after sexual contact, pregnancy or the use of certain drugs that change the pH of the vagina like some anti-pregnancy drugs/ hormonal drugs. It is very common, the majority of women during their productive life will suffer from vaginal discharge due to candidiasis, pain during urination, irritation and uncomfortableness during sexual contact.

Treatment of candidiasis is easy, especially oral or vaginal candidiasis, they can be treated with topical ointment, recovery within 48-72 hours. However the recovery won't be 100%. It'll be reduced 90- 95%, these few cases may not be associated with oral candidiasis or the interstitial or vaginal mucosa (~100% recovery can't be achieved because you have to control other conditions associated with the source of candidiasis in addition to the use of drugs). In addition, if the patient is immunodeficient, you have to restore the immune response first then give him the drug.

### - **Encapsulated Cryptococcus (capsulated neoformans)**

A type of yeast that's exogenously acquired. It is commonly found in the intestine of birds (pigeons), excreted in the environment and can be inhaled. If the patient suffers from tuberculosis, lung cavity due to the presence of fibrosis or malignancies and acquire this encapsulated Cryptococcus, he'll develop a very serious disease known as Cryptococcus pneumonia. It's very severe and difficult to treat as it's associated with necrotizing pneumonia, causing cell damage in the lung as well as chronic meningitis. It is difficult to detect by lab tests or clinical examinations.

Chronic meningitis due to streptococcus pneumonia might give the impression of the presence of certain malignancies in the brain or CNS. So it requires a lot of tests to be certain of the diagnosis.

Few numbers of these encapsulated cryptococcus are required to cause infection so it's always dangerous and fatal before treatment with antifungal drugs.

## • FILAMENTOUS FUNGI

These are normally spread in nature in the form of spores or presence of small fragments. There are different types like penicillium, trychophyton, etc

### - Aspergillus

They're very common in nature, and can easily contaminate food and our homes , ...etc. They're important for the presence of vertical hyphe which project on the surface of the culture medium and in the patient. Their spores can be easily inhaled by the patient and spread out.

Once healthy people inhale these spores from aspergillus or other filamentous fungi, the lysosomal enzymes secreted from the mucosa of the respiratory tract and then by endocytosis the cell will engulf and get rid of the spores preventing them from establishing fungus ball on the surface of the mucosa of the respiratory tract whether in sinuses, pharynx or lungs.

If there's any damage in the mucosa or the patient is immunodifficient, if there's cavity (damage in form of granuloma in lungs) the spores here might begin to produce filaments which later form a nest of filaments in form of a ball commonly seen in patients who have cavity in their lungs due to tuberculosis or fibrosis or malignancy. It produces more severe damage in lungs and it is hard to cure even with antifungal drugs.

Antifungal drugs in comparison to antimicrobial ones are considered toxic (to some ) and cannot be given to a patient for a long time as it might damage their liver, kidneys etc.

There are many types of aspergillus, usually associated with human infection. The most common types in clinical features, named according to the color of their spores:

1. A. Niger (black spores), constitutes about 90% of the fungal infections.
2. A. Fumigatus (blue spores).
3. A. Flavus (yellow spores).

A.fumigatus and A.niger are mainly associated with 2 clinical features:

1. Polmonary disease (allergic reaction) following repeated exposure to this fungi. Causing bacterial infection in the sinuses, as well as asthma, ear infection (Otitis media ,otitis externa). It can be easily detected by an increase in IgE's. At least 10% of our population suffer from allergy because of this fungus. The allergy isn't severe but it produces restlessness with some side effects.

\*\* Otitis media is often caused by bacteria (H.flu, streptococcus pneumonia..). Otitis externa affects the external ear and it's recognized by the discharge's color, often according to the type of the fungus.

- 2.Otomycosis can be painful and causes meningitis, affects cancer patients. Affects the ear and is associated with black discharge .

### **Asparagene Flavous**

Its mainly related to food. Its important because it produces a type of mycotoxins called AFLATOXINS (most serious toxin related to food). If 1 microgram of aflatoxins accumulates in some food like peanut, milk

powder, grains, etc. it can kill by causing liver cirrhosis. Unlike toxins caused by streptococcus types which can manifest in vomiting and diarrhea, here we don't recognize any symptoms related to the GI. We later recognize damage in liver which can lead to death. In our country, they investigate certain types of food that can contain the toxin. Aflatoxins contaminate African rice and can't be easily killed off by cooking as it's heat stable.

Once there's some amount of moist (humidity) and temp of 10-40 C, all filamentous fungi will increase and produce filaments and spores.

To observe the toxin, put a few drops of water on some nuts and leave them in room temperature for 2-3 weeks, you'll recognize the presence of blackness or some other color. If you taste them, they'll be bitter this indicates the presence of the end product, aflatoxin.

---

To conclude this lecture, we're not required to know much details about the different types of fungi. We only need to focus on the following:

- General biological features of yeasts and fungi.
- Types of infections caused by yeast.

Candidiasis

Encapsulated Cryptococcus

Filamentous (*Aspergillus*)

- Types of culture medium
- Growth patterns.
- Types of filaments.
- Presence of spores .



In fungi and yeast we mainly rely on the morphological structure (arrangement of spores/presence of branching/spore colors). Regarding Candida, we might use biochemical tests since yeast is considered biochemically active like the fermentation test to see if it ferments lactose, glucose etc. However we can't use these for filamentous.

Remember that dermatophytes (a type of filamentous fungi) cause skin infection, can be detected by filaments only, not spores and they produce tinea corporis , tinea capitis , tinea unguium , which causes infections in hair, skin and nails.

THE END.

GOOD LUCK :)