



University of Jordan  
Faculty of Medicine



Medical Committee  
The University of Jordan

Introduction to

# Microbiology

Title :

**Mycology -2**

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Slides

Handout

Sheet

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## Overview:

- **Types of fungi**
- **Diseases that can be caused by filamentous fungi or yeast which can cause:**
- Tinea corporis-skin infection
- Tinea capitis-hair infection
- Tinea Unguium-Nail infection
- **Aspergillus-mold infection**

We divide the fungi according to the disease they cause into:

### 1) filamentous fungi (Molds):

-which can affect any part of the body and cause Mycoses

-it is composed of filaments(2types):

1)horizontal filaments

2)vertical filaments(2types):

A)vegetative mycelium- which is integrated in the medium

B)Aerial mycelium – which grow over the surface of the media and can be recognized by the microscope or by the eyes.

In relation to aerial mycelium they have vertical and branched filaments, at the tip of these filaments we have spores can be free or included in special structures, they are called **Microconidia** or **Microspore**(larger spore) and those are produced due to fragmentation of the growing filaments at the tip of the vertical filament .

-those spores are not related to all branches. (might be found in one, two branches or more)

-in general these spores are easily to be spread in nature ,also they can be inhaled, and they can be lodged in our mucosa of the respiratory tract Mostly ,skin.

-The majority of these spores are inhaled (related to RT)

- They might be related to skin and produce superficial skin infection as well as superficial mycoses

### 2) Yeast ,which is also divided into 2 subgroups:

**1<sup>st</sup> Group**- Which can replicate by budding and doesn't produce tube-like structure(**pseudotyphae\filaments**).

-**Also**, THEY are **not** associated with clinical infections (not pathogens)

## 2<sup>nd</sup> GROUP

- they might produce elongation and by attachment of these elongations can produce **Pseudohyphae**

-this type might be associated with infections

-this group is called **Candida**-most common type associated with infections such as candida albicans (start their infection by producing e Germ tube )

-can be recognized in **vitro** not vivo (Germ tubes and pseudohyphae)

One important group >> Cryptococcus neoformans

### *Diseases associated with filamentous fungi \Yeast:*

1) **Dermatophytosis - Dermato Mycoses-superficial mycoses-cutaneous mycoses (same thing )**

-infection related to the skin

-start with **epidermis**

-Caused by **filamentous dermatophytes** that affect one of these parts of the body:

- Epidermis(skin)
- Hair
- Nails

These types of dermatophytes are specialized and that's why they call them dermatophytes(**usually survive in dead tissue \*skin\hair\nails\***) but later they affect **growing** hair,skin,nails.

\*Spores of dermatophytes **are widely distributed in nature** and can reside on our skin and under certain conditions, can produce clinical infections related to the skin,nails,hair.

\*Generally, Small segments of the filaments \*NOT spores\* can lodge especially in case of injuries ,abrasions in the skin and there they can produce spores and then produce filaments and cause infection.

\*Dermatophytes are not related to any country but related to **everywhere in the world.**

\***Species of dermatophytes \*common Genera\*:**

1)Trichophyton

2)microsporium

3)epidermophyton

\*each one of these genus is composed of many species ,(5-10)spp.

\*The **Difference** between these species is **not** related to pathogenicity or the prevalence factor ,as they have the same spores ,same filaments

\*In Fact, it's only related to the **epidemiology** (related to the number of these species) of the disease, like the recognition of **more number** of trichophyton species in certain community\country.

\*All species of Dermatophytes **produce the same clinical features.**

\***Main clinical feature:** Start from the **skin**

-**Tinea Corporis** ( in relation to the appearance of infection in the skin)

-**Tinea** "originate from the Latin language "which is related to **worm- like disease** because in the past they have recognized that the presence of skin infection is associated with **annular** lesions (حلقي) due to specific skin worms later they have discovered that this is **due to filamentous fungi** .

\*Recognition (**how can we recognize this infection clinically?**)

1)change in the **color** of the skin

From white >>>to brown (light, dark)

2) **The Pruritus** (حكة) from of allergy, **erythema**, and this might be associated **with super infection** (by staph. Or diphteroides) if the patient use his finger to relieve himself from pruritus

\*Under normal conditions, this change in the color of the skin **can appear and disappear within one week** which means that **it's self limiting** (doesn't need any treatment).

\***Tinea corporis** has another name which is **Pityriasis versicolor** \***versicolor due to the change in color\***; in relation to presence of **lipophilic yeast** which is **part of our skin flora** but under certain conditions, it might **cause superficial skin infection especially in relation to:**

-change in the **hormone** of the body.

-as well as exposure to **ultra-violet light** \***sunlight\***

-presence of **fever**

-**stress** during examination

\*which appear as **spots** on face, hand

\*This is **not a serious disease**

\*its **self limiting** \*no need for medication\*

\*May be there is **allergic reaction** associated with this infection, we can use **ointment**

\*But it **can't disseminate** to reach blood stream and produce sepsis as we said that it's **not serious**.

\***Causative agent: Lipophilic Yeast** which has a scientific name which is "**Malassezia Furfur**"

\***Important Point:**

We mentioned that **Tinea corporis** is **not** associated with **serious disease** but this is only true with **Lipophilic Yeast** as a causative agent.

**But, Tinea corporis** can be associated with serious disease if the Causative agent is **Dermatophytes**, and here **it's not self limiting** so it require **antifungal drug** and needs attention \*does Not disappears without treatment\*

\*SO, **Tinea corporis** can be associated with either **Lipophilic yeast** or **dermatophytes** as a causative agent.

\*And the job of the physician\dermatologist here is to distinguish between Tinea corporis produced by Dermatophytes and those produced by Yeast.

\***Notes:**

1) Generally, All types of Dermatophytes **can't penetrate** the Dermis and reach the subcutaneous tissue to the blood stream.

2) Lipophilic Yeast-Malassezia furfur **cant be cultured** successfully therefore the detection of it is by yeast like structure in clinical specimen .

3) Whereas Tinea corporis produced by dermatophytes(Epidermophyton,Trichophyton,Microsporium) **can be detected** and identified in the lab.

\***Factors that contribute to the development of skin infection especially tinea corporis ,tinea versicolor ,are:**

1) **Warm**

2) **Lack of Hygiene**

3) **Humidity**

\*These factors can increase the incidence of tinea corporis.

\***Remember:** IN relation to tinea corporis its not associated with age related infection ,**as it affect any age**, But it is well known that tinea corporis **is less associated to children than adults**.

**2)Tineacapitis:**

\*In relation **to infection of the hair**\*especially the hair of the head\*

\*can be easily recognized according to the part of the hair that is infected

\*Hair (**2 parts**): **hair follicles, hair shaft** (Projected part)

\***Hair shaft can be infected by spores of these fungi:**

-spores can be presented inside the tube like structure of the hair and produce **ENDOTHRIX** (spores inside the hair shaft )

-Or **EXOTHRIX (exospores):**

-**which** is a sticky material

-can be recognized by clumping of the hair (sticky hair) and this indicate the presence of infection.

\*Tinea Capitis is a **serious disease** especially in **children**.

\*And the infected hair follicles produce **damage** >> superinfection with bacteria >> severe inflammatory reaction>>and the patient lose his hair for long life.

\*Tineacapitis should be treated **without delay**.

\*spores of this infection can be easily spreaded from one person to another

\*In schools they are afraid from **outbreak** in Tineacapitis

\***Important Cause of Tinea Capitis >> Lack of hygiene**

**why it is more associated with children rather than adults ? :**

**1-Lack of Hygiene** of the hair (no repeat washing of the hair especially in children)

**2-Due to production of sexual hormones** that inhibit the production of TineaCapitis.

### **3) Infection of the Nails-Tinea Unguium**

\*It's a **complex** type of infection

\*Generally, Nails are **not susceptible** to infection with microorganisms ,But if there is an abrasions in the tip of nails especially after close contact with **warm water**, chemical **detergent** ,**acetone**(in ladies)>>>this might **produce damage to the surface of the nails**.

\*Its associated with the **spores** of dermatophytes.

\*infection starts at the tips of the nail then spreads into the body of the nail\*

\*Generally related to the tip of the nail >>which **change in color (become yellow)**, also there is this **thickness** in the infected part and become **fragile** (هش) \*easily broken\* so it can be **easily recognized**.

\*there is some type of Yeast( Candida )that can start the infection of the nail and can be recognized easily by the presence of inflammation,erythema , **Pain and this normally can be treated with topical antifungal drug.**

\*But, the true infection of the nails by the dermatophytes **is hard to be treated and require at least one month to recover** from the infection (might reach 3 months of treatment and still infected) and it might not succeed so it is difficult to treat,and it might need surgical procedures to get rid from this infected nail .

\*It might also **spread from one nail to another.**

\***Tinea Unguium** might spread into the **interdigital space in the foot**, this space might be attacked by the same type of the dermatophyte and produce erythema.

\*it is more recognized in persons who do a lot of activities like sports.

\*Found in **adults more than children.**

\***Tinea pedis \athlete foot** Which is common in our country >> estimated in 30-40% of adult population \*

\***Treatment of tinea pedis** : by keeping the **foot dry**, exposure of the foot to light, **prevent the warm** of the foot the can be attributed to wearing shoes, and of course **by Antifungal drugs but most important thing is to keep your foot dry.**

\***Causative agent:** all types of dermatophytes (Trichophyton \Microsporium\Epidermophyton).

\***Important Note:**

**Epidermophyton can't** produce infection in the Nails \*forms infection in the skin and maybe the folding of the Nail but not the nail itself\*

\*It's **difficult to distinguish** between filamentous fungi especially in relation to dermatophytes, **unlike the yeast** which can grow easily on superficial layer of media (like dextrose agar) and **certain biochemical tests** can be done **like sugar fermentation** test to identify different species of Candida .

\*IN relation to filamentous fungi in particularly dermatophytes we rely on the Color of the spores ,as well as the arrangement of spores on the hyphae, and type of spores.

Please keep in mind:

\***we have two types of spores:**

**1)Microconidia**(small spores)

**2)Macrocondida**

**E.g: trichophyton** associated with **microconidia**

**-species of trichophyton are different only in the arrangement of these microconidia on the hyphae**

\*color of the aerial mycelium, and the color of the vegetative mycelium can be distinguished from each other.

\***Microconidia** \microspore>>small spores, and **NOT** fragmented.

\***Macroconidia** \macrospore>>single cell which is fragmented and each fragment later develops into **mature spore** which produce **filaments**, we usually **count** the number of fragments (fragmented into 2,3,4,8,10 fragments) in order **to recognize the type of species** in addition to the color of the spore.

\***IN the slides:**

**We have culture for penicillium>>** the green color on the left is referred to the color of the spores which have specific **arrangement** (normally related to the **genus**) and the **color** is related to the **species** and **growth pattern**; incubation period to recognize the presence of the aerial mycelium –the penicillium is recognized within 3 days, other are recognized within 2 weeks.

\*Other Example: is the **trichophyton** which is a **dermatophyte which is a filamentous fungi**

-the picture on the right.

\***Color:** Yellow to Orange

\*At the first week we **only recognize** the presence of **white filaments or hyphae**, no spores, and surface is white.

\*Slowly, the color develops from **the center to the peripheral** and starts with yellow color and slowly the yellow color changes within one week or two weeks and develops into orange color.

\***in order to identify such filamentous fungi we have to incubate at the room temperature and recognize the change of the color, presence of the spores, arrangement of the spores.**

**\*IN relation to the Yeast.**

-Normally, it's **not pathogenic**\*Budding yeasts\*

-can be associated with the **oral cavity**

-we have from the yeast type called: **Candida** which can cause **Candidiasis**

-Can cause infections of superficial mucosa of oral cavity, mucosa of intestine, vagina, as well as in skin



-we have many spp. Of the Candida such as: C. glabrata, C. tropicalis, C. krusei and **Candida Albicans** which is the most common one associated with 50%-80% of the **Candidiasis**.

-considered as **opportunistic pathogens**, because they are presented in **few numbers** in our oral cavity as it is part of the **normal flora**, often it will be suppressed by the presence of other bacteria such as **veridans streptococci** .

-Any use of wide **spectrum of antimicrobial drugs**, or use of **X-ray, radiation, toxic drug can increase** these candida and become **pathogenic** which produce infections related to the mucosa- oral cavity, in GU tract especially the vagina, intestine- **less** related to the skin and **rarely** might cause urinary tract infection if there is urinary catheters .

\*Most types of Candidiasis can be caused following the use of antimicrobial drugs as well as it can be caused in cases of immunocompromised patients (immunodeficiency), and this candidiasis can be associated with any part of the body especially in the oral cavity, sometimes in relation to his skin, genital tract, gastrointestinal tract.

\*Candidiasis in community is usually associated with **ENDOGENOUS CANDIDIASI** , From our normal body flora.

\***EXOGENOUS** means that it come from outside the body only in **hospitalized patients** and from the use of certain types of invasive techniques \*catheters , respiratory tubes \*.

\*This Candidiasis can be associated with **THRUSH** \*in children more than adults\*- associated with **whitish color** over tongue which is associated with the gum, with the lips, floor of mouth .

\*This oral Thrush **must not be removed** by any instrument, if you try to remove this thrush the **patient might bleed**.

\*Instead we have to know the cause of this Thrush that might follow the use of antimicrobial drug or it indicates the presence of immunodeficiency in relation to the patient.

\*A person who has oral candidiasis must consult the physician , to know why he has developed this type of infection, and as we said he might be **an immunocompromised patient**, and it also can be associated with **malignancy** so it is **a very serious disease**.

\***In candidiasis**, the patients especially the children can't eat, and in some types of adult candidiasis it is fatal as it might reach **the larynx or the lung** .

\*So ,many of the immunocompromised patients especially AIDs patients can die due to Candidiasis.

\*in newborn babies, candida can reach the blood stream and produce **candidemia (above 50%)**, and reach meninges and produce meningitis. **\*difficult to treat\***

**\*Now, how can we recognize candidiasis directly from clinical specimens or from oral cavity?**

**-We do 2 tests:**

- 1) Sweat preparation- to look for the oval cells and budding yeast and if there is elongation
- 2)if you stain with gram stain it is considered gram(+ve) but it is not really a gram positive or negative we **only use the gram stain to demonstrate the presence of the morphological structures only.**

**\*In relation to:**

**\* pseudohyphae>>** means we have 2 or 3 filaments attached ,elongated cells,attached to each other , between two cells we have **Blastospores** (small oval cells) later can produce elongation and filaments and at the end of the filament or at the junction between two cells can produce oval cells which are called- **chlamydo spores.**

**i.e two cells can be identified in the lab >> Blastospores and Chlamydo spores**

**Now, we have Encapsulated Yeast –cryptococcus which is associated with serious infections mainly associated at the beginning with Asymptomatic infection in relation to lung infection, the infection is associated with Granuloma , But this is not a true granuloma , it is from the encapsulated yeast>> this organism can cause pneumonia and if this organism reach the blood stream it can cause chronic case of meningitis which might indicate the presence of brain abscess so it affect the CNS and not easily to be recognized due to the fact that C.NEOFORMANS are presented in few numbers(infected yeasts are limited)**

**\*so, we have to culture in special culture media, and we have to wait for one-two weeks.**

**\*physician might ask for direct smear if he suspect a case in order to recognize these encapsulated organisms and might give a negative test.**

Capsule is demonstrated by the use of india ink . Not easily due to the fact that they present in few #

**\*in relation to C.Neoforman:**

- They are **not widely** distributed in nature like candida or dermatophytes

-can be presented in feces of birds (esp pigeons)

-so immunocompromised patients, patients who have any type of malignancy (esp in lung) **should not contact** with birds in order not to develop the infection caused by this organism by inhalation from feces .

Last type of fungal infection ☺ ☺ ☺

**\*In relation to Aspergillus(mold infection)**

-**Widely distributed** in nature.

-**Species are:** A.fumigatus , A.flavus ,A.niger.

- A.niger> black\ A.fumigant>blue to green\A.flavus>yellow

- Associated with aspergillosis >> **Asymptomatic lung infection**

-Cause Allergy , Asthma

- **Complications**> presence of Cavity>presence with severe form of infection

-can be associated with **eye infection**> very serious because it can damage the eye of the patient within a short period of time, Needs a surgical intervention.

- otomycosis> ear discharge>presence with aspergillus

- associated with external otitis media

- only A.Flavus which produce a toxin called **Aflatoxin**- high toxic , only 10 < can cause **liver cirrhosis** and death of patient

-**Aflatoxin** usually associated with nuts ,powder milk ,rice therefore milk need to be detected for aspergenosis if it is presented then this milk must not be consumed.

Note here the presence of blastospores and chlamydospores.

