



microbiology

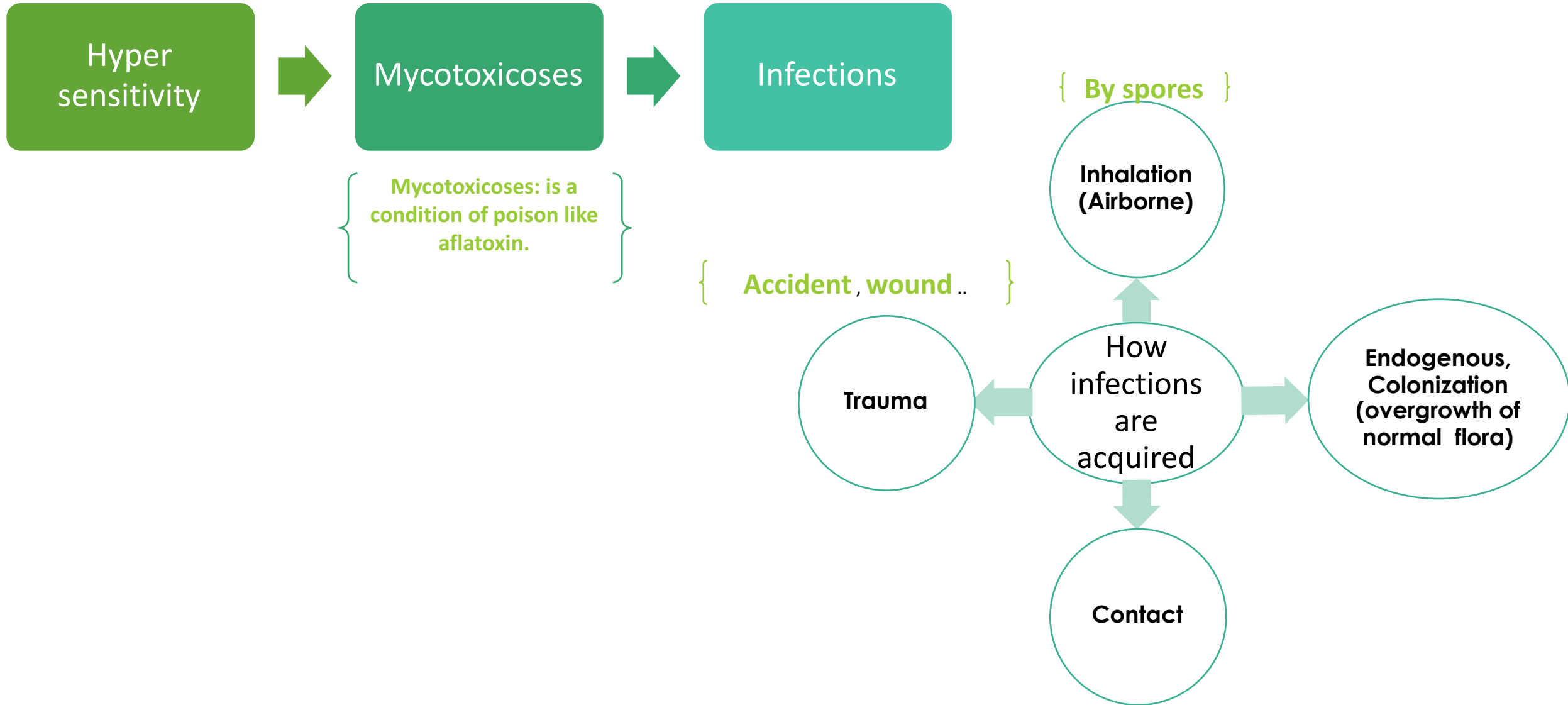
LECTURE: DIVERSITY OF FUNGI

IMPORTANT.
DOCTORS NOTES.
EXTRA INFORMATION.

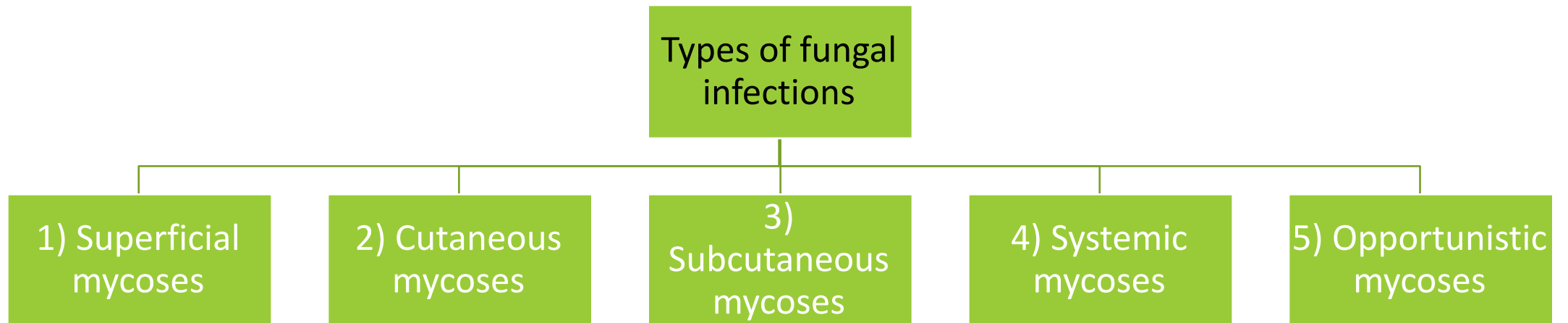
Objectives:

1. To provide students with an overview of the common medically important yeasts and mold fungi
2.
 - To provide students with an overview of the major fungal diseases that threatens human health.
3. To give a fundamental knowledge about the antifungal agents, their mechanisms of action, and spectrum

Mycotic disease



Types of fungal infections



Types of fungal infections - mycoses

	1- Superficial Mycoses	2- Cutaneous Mycoses (Dermatophytosis)	3- Subcutaneous Mycoses	4-Primary Systemic Mycoses	5- opportunistic fungal infection
Site of affect	outer layer of the skin or hair shaft (can go away without medications)	skin, hair or nails { Can transfer from person to another }	Fungal infections involving the dermis, subcutaneous tissues, muscle and may extend to bone.	*Contracted by inhalation, Start as respiratory disease *Geographically restricted (endemic), north and south America	in the next slide
Cause	No immune response (no pathogenesis changes)	a group of keratinophilic fungi, called dermatophytes (there is pathogenesis changes)	Usually they are initiated by trauma	Caused by primary pathogens	

Types fungal infections (Mycoses)

5- Opportunistic fungal infections { It can spread by the blood }

✓✓ **Diseases in immunocompromised host**

✓✓ **Risk factors:**

- HIV/AIDS
- Hematopoietic stem cell transplant (HSCT)
- Solid organs transplantation
- Malignancies
- Neutropenia
- Diabetes

THE FUNGI:

A) Opportunistic Fungi:

Only immunocompromised host get the disease

- Normal flora (ex. Candida spp)
- Ubiquitous in our environment (Aspergillus spp. And Zygomycetes spp)
- Other fungi

B) Primary Pathogens:

Any host can get the disease

- Dermatophytes
- Endemic geographically restricted:

(ex.) - Histoplasma spp. - Blastomyces spp.
-Coccidioides spp. -Paracoccidioides spp

DIAGNOSIS OF FUNGAL INFECTION:

- **Clinical features (clinical presentation):**
[History, risk factors, etc.]

- **Imaging (x-ray, CT scan, etc.)**
[Good value in diagnosis and therapy monitoring]

- **Lab Investigations:**
[Histopathology { To see any cellular changes }
Microbiology { To see any fungi grow }]

These are not extra information.

Targets for antifungal agents

➤ Cell membrane

- Polyene
- Azole

➤ Cell wall

- Echinocandins
 - Caspofungin
 - Micafungin
 - Anidulafungin

➤ DNA/RNA synthesis

- Pyrimidine analogues
 - Flucytosine

Antifungal Agents

= To kill fungi, we use antifungal agents.

The fungi are similar to us in some aspect so it's difficult to find the proper antibiotic because they maybe attack our cell instead of fungi's

Cell Membrane

Polyenes : { By IV fluid
More toxicity }

- Amphotericin B
 - lipid formulations
 - Nystatin
- Is the major antifungal agent and it was the first and the oldest
-

Mechanism of Action Amphotericin B (MOA):

- Binds to ergosterol within the fungal cell membrane resulting in formation of pores, which permit leakage of intracellular contents, and lead to **death**.
- Amphotericin B has an broad antifungal spectrum which includes most fungi that cause human disease

Cell Membrane

AZOLES: { Oral or parenteral
less toxicity }

Only for yeasts.

- Ex. **Fluconazole**, Ketoconazole , Itraconazole,
• **Voriconazole**, Posaconazole , Miconazole, clotrimazole

Mechanism of Action:

🎬 Inhibits synthesis of ergosterol, the major sterol of fungal cell membrane.

(Once the synthesis of ergosterol is inhibited, the fungus will live of the ergosterol stored, when its finished the fungus will eventually die)

Cell Wall

Echinocandin

Ex. **Caspofungin** , Micafungin and Anidulafungin.

Mechanism of Action:

- **Inhibits B-1,3 –D glucan synthase**, the enzyme complex that forms glucan polymers in the fungal cell wall.
- Glucan polymers are responsible for providing rigidity to the cell wall.

Good Active against :

Candida spp

Aspergillus spp

DNA/RNA synthesis

Flucytosine (*work only against yeast*)

Mechanism of Action:

- ✓ Fungal RNA miscoding.
- ✓ Interfering with DNA synthesis.

Spectrum of Activity (Restricted spectrum of activity)

Active against:

Candida species

Cryptococcus neoformans.

Monotherapy (limited resistance):

Flucytosine cannot work alone (the fungus will develop resistance).

Target	Group	Mechanism of action	Antifungal Agents	Spectrum of activity	Comments
Cell membrane	Polyenes	Binds to ergosterol within cell membrane, formation of pores which lead to cell death	Amphotericin B, Nystatin	Broad antifungal spectrum which includes most fungi	Serious toxic side effects (nephrotoxicity)
	Azoles	Inhibit the synthesis of ergosterol	Ketoconazole Itraconazole Fluconazole Voriconazole Posaconazole Miconazole clotrimazole	Fluconazole has a limited or no activity against mould fungi Voriconazol is the drug of choice for Aspergillosis Posaconazole has broader spectrum of activity than other azoles	Not effective against zygomycosis (except posaconazole) Adverse Effects Drug Interactions
Cell wall	Echinocandins	Inhibits glucan synthesis, (glucan polymers in the fungal cell wall)	Caspofungin Micafungin Anidulafungin	Good activity against <i>Candida spp</i> , <i>Aspergillus spp</i> Limited or no activity against other fungi	Less toxicity and side effects compared to amphotericin B and azoles
DNA/RNA synthesis	Pyrimidine analogues	Fungal RNA miscoding Interfering with DNA synthesis	Flucytosine	Restricted spectrum of activity <i>Candida species</i> <i>Cryptococcus neoformans</i>	Monotherapy now limited (Resistance)

Questions

1-How are mycotic diseases acquired?

Ans:.....

2- affect the outer layer of the skin:

A-systemic mycoses B-cutaneous mycoses C-superficial mycoses

3-fungal infection usually initiated by trauma:

A-subcutaneous mycoses B-opportunistic mycoses C-cutaneous mycoses

4-fungal infection that starts as a respiratory disease:

A-primary systemic mycoses B-opportunistic mycoses C-superficial mycoses

5-in what labs are fungal diseases diagnosed:

Ans:.....

6- an anti fungal agent that target the cell membrane:

A-Echinocandins B-polyene C-flucytosine

7- has a broad antifungal spectrum which includes most fungi that cause human diseases:

Ans:.....

8- an antifungal that interferes with DNA synthesis:

A-Flucytosine B-Azoels C-polyenes

9- an antifungal the inhibits the synthesis of ergosterol:

A-pyrimidine analouges B-polyenes C-Azoles

10- name the types of fungal infections

Ans:.....

1- colonization, inhalation, contact, trauma
2- B-superficial mycoses
3-A-subcutaneous mycoses
4- A primary systemic mycoses
5- histopathology and microbiology
6- B-polyene
7- Amphoteracin B
8-flucytosine
9- C-azoles
10- superficial mycoses ,cutaneous mycoses ,subcutaneous mycoses ,systemic mycoses ,opportunistic mycoses

Contact us :

436microbiologyteam@gmail.com

Twitter :

@microbio436

THE TEAM :

- Waleed Aljamal
- Ibrahim Fetyani
- Meshal Eiaidi
- Khalid Alhusainan
- Hussam Alkhathlan
- Faisal Alqumaizi

THE TEAM :

- Shrooq Alsomali
- Hanin Bashaikh
- Jawaher Alkhayyal
- Reem Alshathri
- Rawan Alqahtani
- Ohoud Abdullah
- Ghadah Almazrou
- Lama Al-musallm