



# LECTURE: Candidiasis

## Editing File

- **Important**
- **Doctor's notes**
- **Extra explanation**

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

# OBJECTIVES:

1. Acquire the basic knowledge about Candida as a pathogen
  2. know the main infections caused by Candida species
  3. Identify the clinical settings of such infections
  4. Know the laboratory diagnosis, and treatment of these infections.
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# Candida (the organism):

Features	<ul style="list-style-type: none"><li>• Candida is a <b>unicellular</b> yeast fungus</li><li>• It is imperfect* reproducing by <b>budding**</b></li></ul>
Morphology	<ul style="list-style-type: none"><li>• Microscopy: <b>Budding yeast cells, and Pseudohyphae.</b></li><li>• <b>Culture:</b> Creamy colony, <b>fast growing</b> on Sabouraud Dextrose agar (SDA), Blood agar (48 hr)***</li></ul>
species	<ul style="list-style-type: none"><li>• There are many species of Candida (&gt;150)</li><li>• The common species are: Candida albicans, C.parapsilosis, C.tropicalis, C.glabrata, C.krusei.</li></ul>
Human commensal (normal flora)	Oral cavity - Skin - Gastrointestinal tract - Genitourinary tracts

**Budding :** if there is any weakness at the wall of the yeast cell --> there will be pouching ( out growth at that side )--> it will continue until the daughter cells are completely formed , the daughter cell could :

- 1-detach from the mother cell
- 2- or become elongated and make Pseudohyphae



\*Means :the sexual stage is unknown

\*\*Asexual

\*\*\*fast growing comparing with molds

## Candidiasis (the disease):

- Definition:
  - Any infection caused by any species of the yeast fungus Candida.
  - The most common invasive fungal infections in immunocompromised patients
  - 4th most common cause of nosocomial (hospital acquired) blood stream infection

- It is considered opportunistic infection:

a) Alteration in:  
Immunity - Normal physiology - Normal flora

b) Damage in the barriers

- Clinical – Spectrum of disease

- Transmission of **Opportunistic** Fungi: Mostly endogenously because it's a normal flora

a) ENDOGENOUS:

- Colonization precedes infection
- Antibiotic suppression of normal flora, fungal overgrowth

b) EXOGENOUS:

# Candida – Clinical (superficial)

1) Mucous membrane infections	
a) Oral Thrush “oropharyngeal”	<ul style="list-style-type: none"> <li>• <b>White or grey Pseudomembranous patches on oral surfaces</b> especially tongue with underlying erythema.</li> <li>• Common in neonates, infants, elderly</li> <li>• <b>In immunocompromised host, e.g. AIDS.</b></li> </ul>
b) Vaginitis (Vulvovaginitis)	<ul style="list-style-type: none"> <li>• Common in pregnancy, diabetics, use of contraceptives.</li> <li>• Thick (<b>white</b>) discharge, itching irritation <b>and burning</b> . Lesion appear as <b>white patches on vaginal mucosa.</b></li> </ul>
b) Esophagitis	<b>White patches on mucous membranes</b>

## Forms of Oral candidiasis:



Oral thrush



pseudomembranous form



erythematous form



pseudomembranous-erythematous form.



Painful, depapillation of the tongue dorsum.



Painful hyperplastic Candida of the lateral tongue



Hyperplastic candidiasis, that was mistaken for leukoplakia

# Candida – Clinical (superficial)

2) Cutaneous infections	
Intertriginous <sup>1</sup> candidiasis:	<ul style="list-style-type: none"> <li>• Infections of skin folds eg. axilla, buttock, toe web, under breast.</li> <li>• Erythematous lesion, dry or moist or whitish accompanied by itching and burning.</li> </ul>
Nail infections: (pain - nail discoloration)	<ul style="list-style-type: none"> <li>• Onychomycosis (infection of nails) Discolored, hard, dislodge.</li> <li>• Paronychia (infection of skin around nail bed)</li> </ul>
Diaper rash	
Chronic mucocutaneous candidiasis	<p>children with T-cell abnormality. recurrent persistent superficial infection (non-invasive) mostly caused by failure of T-cell immunity against candida. Most common cause: Candida albicans (in children).</p>



Intertriginous candidiasis



Diaper rash



Onychomycosis



Paronychia



Chronic mucocutaneous candidiasis

<sup>1</sup> in between

# Candida – Clinical (systemic)

- Urinary tract infection
- Candidemia (presence of candida in the blood; **hematogenous** spread to other organs)
- Disseminated (**systemic, invasive**) infection :Endophthalmitis (eye) - Liver and spleen – Kidneys – Skin – Brain – Lungs - Bone

## Pulmonary Candidiasis

- Primary pneumonia is less common and could be a result of Aspiration
- Secondary pneumonia commonly seen with hematogenous candidiasis **especially in:**
  - Immunocompromised patients

### Diagnosis

Isolation of Candida from sputum, BAL bronchioalveolar lavage is not always significant because it is normal flora in the mouth so the sample may be contaminated. So we have to correlate with:

- ✓ Clinical features – Radiology - Other Lab investigations

But if we find candida in a normally sterile site (CSF, blood) then we consider it as significant.

## Candidemia :Candida is the fourth most common in causing nosocomial\* bloodstream infections (BSI)

### Transmission:

- Increased colonization (endogenous or exogenous factors)
- Damage in host barriers by **catheters**, trauma, surgery
- Immunosuppression (transplant patient, AIDs)
- **Central venous catheters (CVC)**

Rank	Pathogen	BSI prevalence (%)	% BSI			% Crude Mortality		
			Total	ICU	Non-ICU	Total	Non-ICU	
1.	CoNS	19.8	31.3	35.9	28.6	20.7	25.7	13.8
2.	S aureus	10.2	20.2	16.5	23.7	25.4	34.4	15.9
3.	Enterococcus spp	4.8	9.4	9.8	9.0	33.9	43.0	24.0
4.	Candida spp	4.6	9.0	10.1	7.9	39.2	47.1	29.0
5.	E coli	2.8	5.6	3.7	7.6	22.4	33.9	16.9
6.	Klebsiella spp	2.4	4.8	4.0	5.5	27.6	37.4	20.3
7.	Pseudomonas	2.1	4.3	4.7	3.9	36.7	47.9	27.6
8.	Enterobacter spp	1.9	3.9	4.7	3.1	26.7	32.5	16.0
9.	Serratia spp	0.9	1.7	2.1	1.3	27.4	33.9	17.1
10.	Acinetobacter	0.6	1.3	1.6	0.9	34.0	43.4	16.3

### Disseminated candidiasis

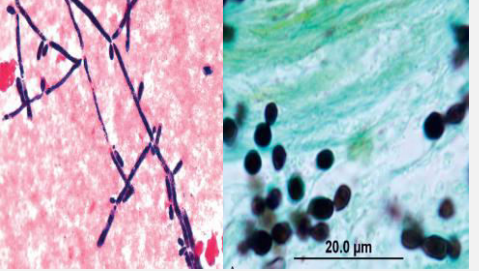
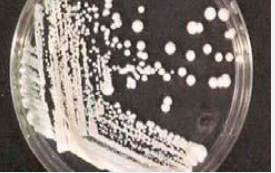
(involvement of any organ): Septic shock – Meningitis - Ocular involvement (retinitis)

### clinical manifestation

- Fever could be the only clinical manifestation

\*hospital acquired

# Candidiasis – Laboratory diagnosis

Specimen:	depend on site of infection <b>we decide what sample to take:</b> <ul style="list-style-type: none"> <li>Swabs, Urine, Blood, Respiratory specimens, CSF, Blood</li> </ul>	
1. Direct microscopy :	What stains do we use? <ul style="list-style-type: none"> <li>Gram stain, KOH, Giemsa, GMS, or PAS stained smears.</li> </ul> What do we see? <ul style="list-style-type: none"> <li>Budding yeast cells and pseudohyphae will be seen in stained smear or KOH</li> </ul>	
2. Culture:	<ul style="list-style-type: none"> <li>Media: SDA (Sabouraud Dextrose Agar ) &amp; Blood agar at 37oC,</li> <li>Creamy moist colonies in 24 - 48 hours.</li> </ul>	
3. Blood culture:	In case of Candidemia , it is not blood agar . We take blood sample from the patient and we put it in a bottle then in a machine	
4. Serology: Patient serum	Test for Antigen , e.g. Mannan antigen using ELISA	Test for Antibodies
5. PCR:		



# Candidiasis – Laboratory diagnosis (Laboratory identification of Yeast)

After identification we do susceptibility test in case of 1- sample from sterile body site or 2- recurrent infection

Because *C. albicans* is the most common species to cause infection

○ The following tests are used to identify *C. albicans*:

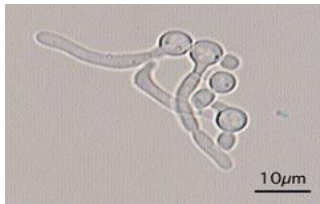
1. Germ tube test : Formation of germ tube when cultured in serum at 37°C in incubator for 2-4 hours
2. Chlamyospore production in corn meal Agar
3. Resistance to 500 µg/ml Cycloheximide

If these 3 are positive this yeast is *C. albicans*

لازم كل الثلاثة يطلعون بوزيتف

If negative, then it could be any other yeast:

- ✓ Use Carbohydrate assimilations and fermentation . ( not used because it takes 72 hours for results )
- ✓ Commercial kits available for this like: API 20C, API 32C
- ✓ Culture on Chromogenic Media (CHROMagar™ Candida) gives different color for each species



**Germ tube test** No constriction while pseudo hyphy has constriction so there is continuation between the mother and the daughter / it is the initial stage of formation of true hyphy




Chlamyospores of *C. albicans* in CMA  
Rounded and thickened wall could be terminal or intercalary =in between




Carbohydrates assimilation test , API 20C

# Candida species:

- Candida albicans

Sabouraud Dextrose Agar		
Morphology:	Creamy white yeast, may be dull, dry irregular and heaped up, glabrous and tough	

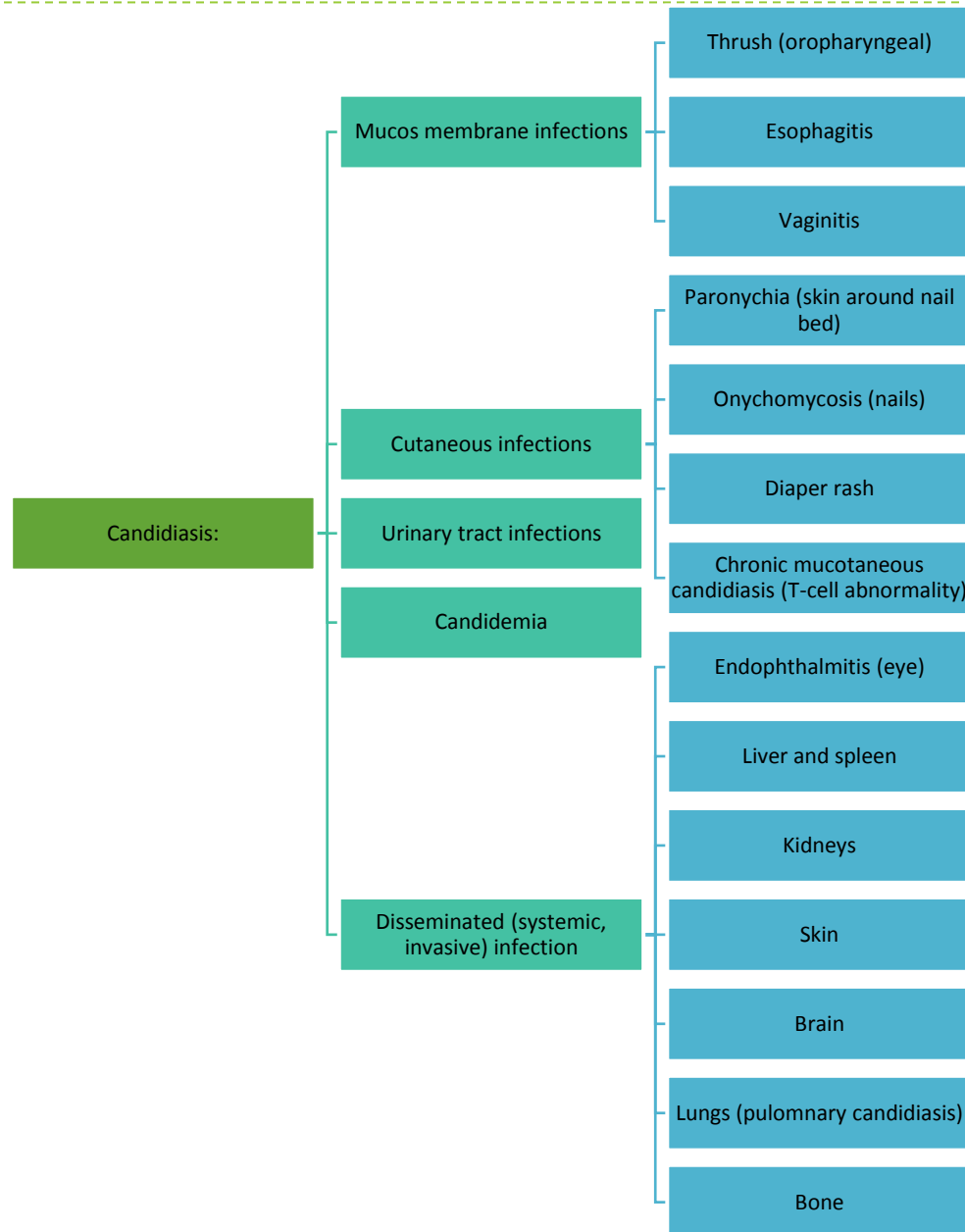
Chromagar		
Morphology:	producing green pigmented colonies on specially designed medium to speciate certain yeasts based on color they produce	

## Candidiasis- Treatment

Oropharyngeal:	Topical Nystatin suspension, Clotrimazole troches ,Miconazole, Fluconazole suspension. <i>Systemic treatment in Immunocompromised patients</i>
Vaginitis:	Miconazole, Clotrimazole, Fluconazole
Systemic treatment:	Fluconazole, Voriconazole, <b>Caspofungin ( drug of choice )</b> , Amphotericin B
Candidemia:	<ul style="list-style-type: none"><li>• <b>Treat for 14 days after last negative culture</b> and resolution of signs and symptoms</li><li>• <b>Remove catheters, if possible</b></li></ul>

- Antifungal susceptibility testing is not done routinely in the microbiology lab, It is done in the following cases:
    - ✓ For fungi isolated from sterile samples
    - ✓ If the patient is not responding to treatment
    - ✓ In case of recurrent infections
  - **Points to consider:**
    - ✓ C. glabrata can be less susceptible or resistant to fluconazole
    - ✓ C. krusei is resistant to fluconazole
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# SUMMARY:



Laboratory diagnosis: Specimen depends on site of infection.

1. Direct microscopy: (gram stain, KOH, Giemsa, GMS, or PAS stained)
2. Culture: (SDA + blood agar)
3. Blood culture
4. Serology: Antigens > ELISA, and Antibodies
5. PCR

Identification: (all positive > candida albicans)

1. Germ tube test
2. Chlamydospore production in corn meal Agar
3. Resistance to Cycloheximide

All negative > any other yeast: use CHO assimilations and fermentation, culture on chromogenic media

# QUIZ:

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1. What is the most common type of candida?
  - a. Albicans
  - b. Parapsilosis
  - c. Tropicalis
  - d. Krusei
2. What is the most common route of transmission?
  - a. IV line
  - b. catheter
  - c. surgery
  - d. Use of broad spectrum antibiotics
3. Overweight patient comes in complaining of pain and burning sensation in his axillary region. What is the most likely diagnosis?
  - a. chronic mucocutaneous candidiasis
  - b. Interiginous Candidiasis
  - c. Nail bed infection
  - d. diaper rash
4. 27 year old male comes into the clinic. He has white and red patches on his tongue and oral surfaces. You suspect its oropharyngeal candidiasis. What does the patient most likely have as a risk factor?
  - a. viral infection
  - b. AIDs
  - c. he's healthy
  - d. on antibiotics
5. Which method is not used to confirm a diagnosis of pulmonary candidiasis?
  - a. isolation from sputum
  - b. clinical features
  - c. Radiology
  - d. other lab testing
6. How to confirm that the species is candida albicans?
  - a. SDA media stain culture
  - b. germ tube
  - c. chlamydospore
  - d. all the above

# THANK YOU FOR CHECKING OUR WORK, BEST OF LUCK!



Doctors slides



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