



# MICRO

OSPE PRACTICAL

## Urinary Tract Infection

# NOTE

- **This file was revised by Dr.Ali Alsomily**
- Examinations of UTI ( next slide) are not important, just to understand :)
- The complications and treatment are important + make sure you mention the complete name of the organism when you identify it

**Hopefully we made it easier :)  
Wish you all the best !!**

Done by:  
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# Examination of UTI

## INTRODUCTION

Urine collection

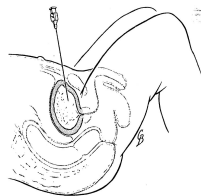
Urine analysis

Interpretation of microbiology laboratory result

Type of Specimens	Note
Midstream urine (MSU)	Commonly used
Clean catch	
Adhesive bag	Neonates
Suprapubic Aspiration	Most specific
Catheter sample	should not be tested because it may have been standing for several hours



Adhesive bag



Suprapubic Aspiration

### Transport media <sup>(1)</sup>

1-Sterile Urine container



2- Dipslides  
One side → CLED media  
Other side → MacConkey (MAC) or blood agar.



### Urine analysis

Biochemical	Dip stick (PH) leukocyte esterase ,nitrate test
microscopic examination	cell-counting chamber (RBC,WBC..etc)

Quantitative (Colony counts)

urine sample is streaked on surface of **Agar plate** and with a special **loop calibrated** to deliver a known volume.

**Over night incubation**

- Isolation of colonies,
- Biochemical tests,
- Drug susceptibility test

**Over night incubation**

**RESULT**

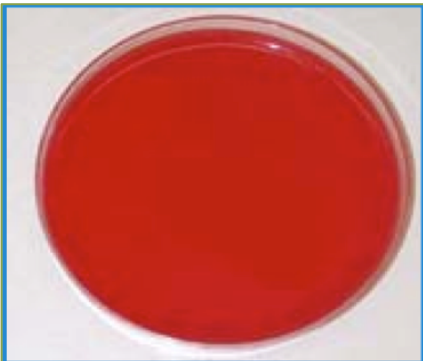
(1) medium for transporting clinical specimens to the laboratory for examination

# Causative organisms of UTI

Organism	Note
<b>GRAM Negative Bacilli</b>	
<b>Escherichia coli</b>	Most common in inpatients & outpatients
Klebsiella	Second most common in outpatients
Proteus	
Other Enterobacteriaceae (Enterobacter, Citrobacter....)	
Pseudomonas aeruginosa	
<b>GRAM Positive Cocci</b>	
Enterococcus	In chains
Staphylococcus saprophyticus	In clusters
Streptococcus agalactiae (group B)	Chains
Staphylococcus aureus (Associated with staphylococemia)	Clusters
<b>Other organisms</b>	
Candida albicans	Second most common in inpatients (specially catheterized patients)
Schistosoma haematobium	

# MICRO

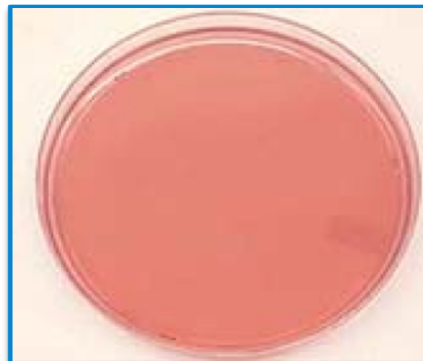
# culture media



**Enriched medium**

blood agar

- ✓ culturing fastidious microorganism
- ✓ observed the hemolytic reaction



**differential media**

MacConkey agar

Lactose fermenting

colonies are **pink**

E.g:

1. **Escherichia coli**
2. Klebsiella
3. Enterobacter

Non-lactose fermenting

**colorless** or appear same as the medium. E.g:

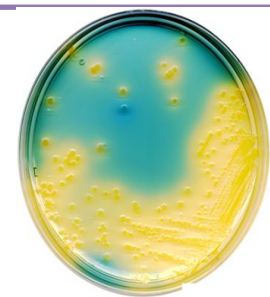
1. Pseudomonas aeruginosa
2. Proteus



**Selective medium**

CLED agar<sup>(1)</sup>

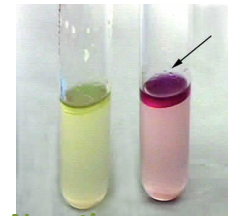
- ✓ detection
  - ✓ isolation
- Of **E.Coli** and **coliform** bacteria in urine



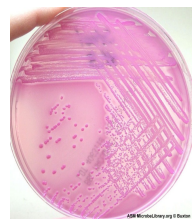
(1) CLED :Cystine Lactose-Electrolyte-Deficient Agar

# First: GRAM NEGATIVE

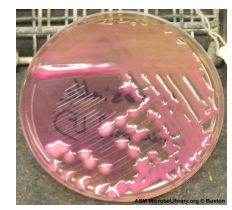
Lactose fermenting	1- <i>E. coli</i>	
	Indole Reactions	Positive
	Urease	Negative
	2- <i>Klebsiella pneumoniae</i>	
	Indole Reactions	Negative
3- <i>Enterobacteriaceae</i>		
Nitrate	Positive	



Negative Positive  
Indole Reactions



MacConkey agar

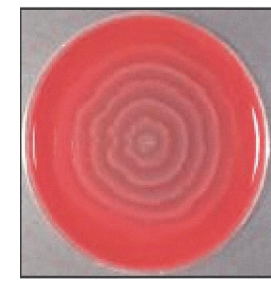


MacConkey agar  
*Klebsiella*

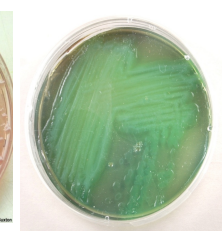
Non-Lactose fermenting	4- <i>Proteus</i>	
	Urease	Positive → act on urea → splits ammonia → alkalizes the urine → production of crystals
	Swarming (motility)	Positive ( seen in a blood agar)
	NOTE:	✓ Commonly infect: People with kidney stone ✓ CLED inhibits the proteus swarm
	5- <i>Pseudomonas aeruginosa</i>	
Oxidase	Positive → purple	
Note	Produce special greenish pigment	



Positive Negative  
Urease test



Swarming

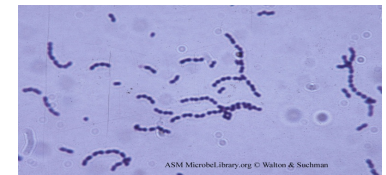


agar  
*Pseudomonas*

# Second: GRAM POSITIVE

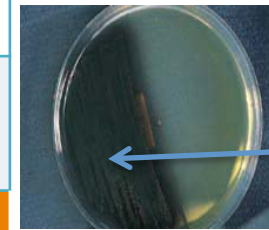
## 1-Streptococci ( GRAM positive cocci in chains )

Catalase test	<b>Negative</b>
Enterococcus species	Positive Bile Esculin hydrolysis test Normal flora in colon



**Enterococcus**

Gram positive cocci in chains

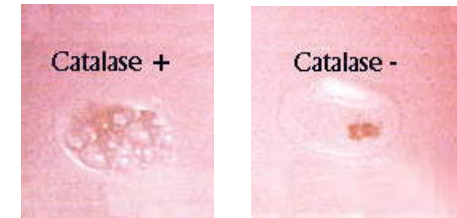


Positive Bile Esculin hydrolysis test

## 2- Staphylococcus species (GRAM positive cocci in clusters )

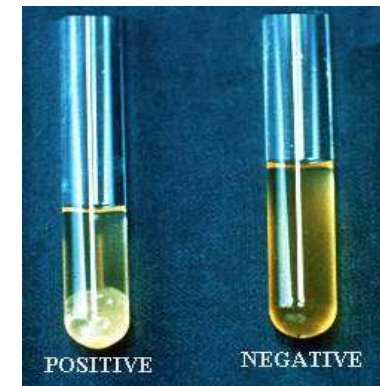
Catalase test	<b>Positive</b> $2H_2O_2 \rightarrow O_2 + 2H_2O$		
Types	Coagulase+ Coagulation of plasma	S.aureus (normal flora in the nose)	Golden colonies (yellowish)
	Coagulase- Plasma remains fluid	Novobiocin resistant	s.saprophyticus
		Novobiocin sensitive	S.epidermidis

### Catalase test



Staphylococcus Streptococci

### Coagulase test

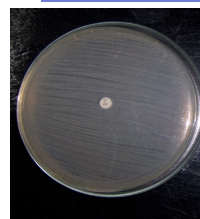


S.aureus

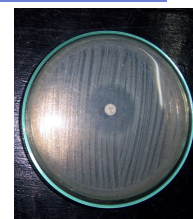


S.epidermidis

### Novobiocin test



s.saprophyticus



S.epidermidis

# Complication and treatment of UTI

Organism	E.Coli	proteus	Pseudomonas	Entrococcus	Group B	Staph.saprophyticus
Gram stain	Negative bacilli	Negative bacilli	Negative bacilli	Positive chain	Positive chain	Positive cluster
Culture	LF	NLF	NLF	SWC	SWC	SWC
Biochemical test to confirm	Indol positive	Urea positive	Oxidase positive	PBEHT	Catalase negative	Coagulase negative (novobiocin resistant)
Treatment			Ciprofloxacin	Vancomycin		
	Ampicillin, sulfonamide, Nitrofurantoin, ciprofloxacin					

## Key:

**LF:** lactose fermentative

**NLF:** non lactose fermentative

**SWC:** small white colony

**PBEHT:** Positive bile esculin hydrolysis test

## Complications of UTI :

1. Endocarditis
2. Bacteremia
3. renal stone
4. pyelonephritis



# Third: Other organisms

## 1-Candida albicans (fungi)

Grow on

1. Sabouraud's Dextrose Media
2. Blood agar

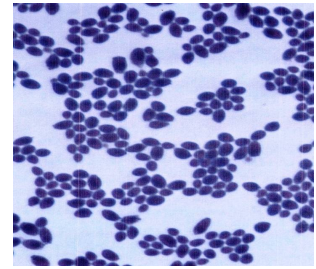
identification tests

1. Chlamydo-spore
2. Germ tube test

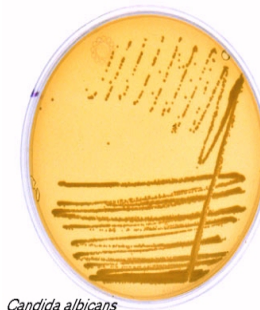
## 2-Schistosoma haematobium (Parasites )



2-Schistosoma haematobium



1-Candida albicans



*Candida albicans*

Sabouraud's  
Dextrose Media



Candida  
albicans on blood  
agar;



Chlamydo-spore



Germ tube test

This slide is Not important :)

# Case 1

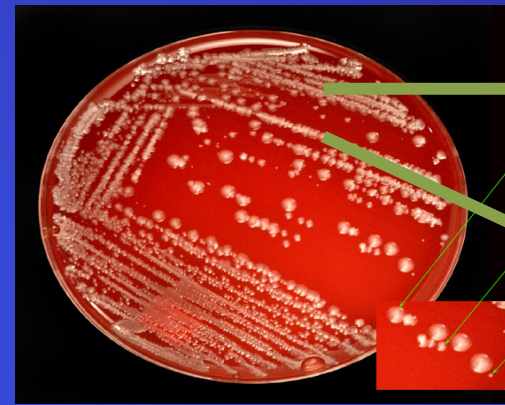
The blood agar plate and CLED plate provided were inoculated with a sample of urine from a patient with a suspected urinary tract infection. Examine the plates and photographs provided.

Q1

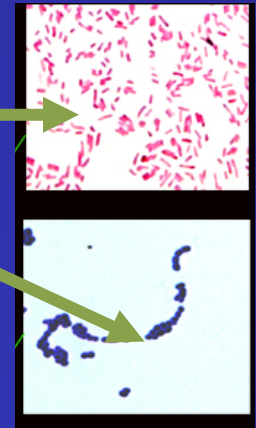
Identify the colonies on the blood agar plates and photographs. The photographs show the results of the Gram stain of each colony type.



CLED plate



Blood agar



Gram stain

A1

- Large colonies are Gram **Negative**
- small colonies are Gram **positive** .

This case to show that UTI can be caused by 2 microorganism

## Case 2

These Blood agar and CLED agar plates were inoculated with MSU from a 45 years old man suspected of having bladder stone and complaining of burning micturation.

Urine examination showed :

Moderate number of WBC and a PH of 8

**Q1. What is the likely this pathogen?**

**Q2. How would you confirm the identity of this pathogen?**

**Q3. What is the role of this organism in forming stones?**



CLED



Blood agar

A1. Proteus

A2. swarming + urease test → positive

A3. Urease → act on urea → splits ammonia → alkalinizes the urine  
( change the PH of urine ) → production of crystals

# MICRO Summary

		Organism	Differential Characteristics
Gram -	Lactose fermenting	E.coli	Indole Reactions is positive (purple ring on top of the tube)
		Klebsiella pneumoniae	Indole Reactions is negative
		Enterobacteriaceae	positive nitrate test
	Non-Lactose fermenting	Proteus	1. Urease positive 2. High motility →Swarming
		5-Pseudomonas aeruginosa	1. Greenish pigment on agar plate 2. Oxidase positive
Gram +	Streptococci		Catalase negative
		<u>Enterococcus species</u>	✓ Most common gram + infections ✓ Positive Bile Esculin hydrolysis test
	Staphylococcus		Catalase positive
		S.aureus	Coagulase positive (coagulation of the plasma)
		S.epidermidis	Coagulase negative (plasma still fluid)

**GOOD LUCK !!**