URINE ANALYSIS
URINARY TRACT INFECTIONS
UGT MODULE LAB 1
2023-2024

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Routine Urine Culture

Urine:

- Urine carries waste products and excess water out of the body.
- Normal urine is typically pale yellow and clear.
- Obvious abnormalities in the color, clarity, and cloudiness may suggest different diseases.

Normal Urine

Abnormal Urine

Routine Urine Culture

Aim of the test

- An etiological diagnosis of bacterial urinary tract infection with identification and susceptibility test of the isolated bacteria(s).

Types of specimen

- Urine (Midstream urine), suprapubic aspiration, catheterized urine.

Note: First morning specimens yield highest bacterial counts from overnight incubation in the bladder and are the best specimens.

Criteria of specimen rejection

- Un-refrigerated specimen older than **2 hours** may be subject to overgrowth and may not yield valid results; unlabeled specimen; mislabeled specimen; specimen in expired transport container; 24 hours urine specimens.

→ They are not suitable for culture.

Urine Analysis

(steps)

1. Specimen Collection
2. Transportation
3. Processing

→ Include:

- Nonculture Methods
  (which is visible by naked eye.)
  - Urine macroscopic analysis
  - Urine microscopic analysis
  - chemical analysis
  - Detection of pyuria by leukocyte esterase tests
  - Detection of bacteriuria by nitrite test
- Culture Methods

Specimen Collection

*The first urine is eliminated and collecting of the midstream of the urine.

Patient preparing

-Collection of midstream urine for investigation:

- Patient not needing assistance:

✘Give the patient a suitable container. *Wide opening container.

✘Instruct the patient to collect the midstream urine .

✘Tell the patient not to touch the inside or rim of the container. → To prevent contamination

✘Tell the patient to close the container properly.

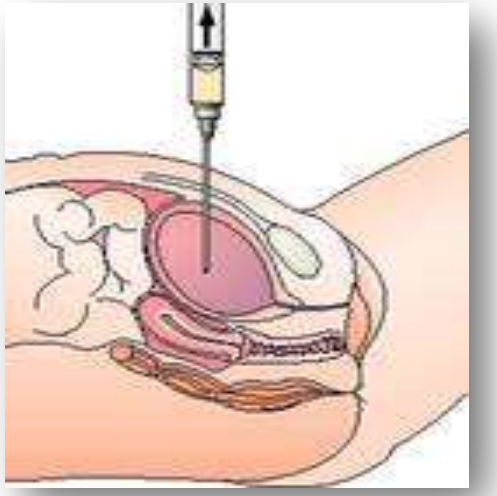
Specimen Collection

Who will collect the specimen

- ❑ Midstream urine is collected by the patient.
- ❑ If disabled, nursing staff will assist in collection.
- ❑ For catheterized specimen, nursing staff will collect the specimen.
- ❑ Suprapubic aspiration is performed by the physician.

Quantity of specimen

To fill line in transport tube (~20 mL).



Suprapubic aspiration

Transportation

Time relapse before processing the sample

The maximum time allowed for processing a urine sample is **2 hours** from the time of collection.

Storage

At room temperature unless delay is inevitable; it must be refrigerated or mixed with preservative like boric acid.

Processing- Nonculture Methods

Macroscopic Urinalysis

Macroscopic examination used to view elements that are visible by naked eye.

1- Hematuria: is the presence of abnormal numbers of red cells in urine due to:

a. Glomerular damage.
b. Tumors.
c. Urinary tract stones.
d. Upper and lower urinary tract infections.

Processing- Nonculture Methods

Macroscopic Urinalysis

Hematuria

Two Types of Hematuria

- Gross hematuria: means that the blood can be seen by the naked eye. The urine may look pinkish, brownish, or bright red.

Gross Hematuria

Processing- Nonculture Methods

Macroscopic Urinalysis

2- Hemoglobinuria:

- Presence of heamoglobin in urine due to rupturing of RBCs
- This may occur in malaria, typhoid, yellow fever, hemolytic jaundice and other diseases.

Processing- Nonculture Methods

Macroscopic Urinalysis

3- Pyuria :

Refers to the presence of abnormal numbers of leukocytes that may appear with infection in either the upper or lower urinary tract or with acute glomerulonephritis.

Urine with pyuria

Processing- Nonculture Methods

Microscopic Urinalysis

*Is done by having a urine of 10mm of the urine sample in a test tube and centrifugation of this sample; the solid particles will sediment in the bottom, and the clear fluid will be discarded, and a drop of the sediment is mounted on a slide and monitored and view under the microscope.

The primary purpose of microscopic examination of urine sediment is to detect abnormal formed elements (eg, cells, casts, crystals) in the sample.

Microscopic hematuria & pyuria

Microscopic hematuria & pyuria means that the urine is clear, but RBCs and WBCs can be seen only under a microscope.

Pyuria: refers to urine which contains pus cells granulocytes.

Normal values:

- Men: <2 WBCs per high power field
- Women: <5

Normal values for RBCs in urine:

4 RBCs per high power field (RBC/HPF).

Microscopic Hematuria

Processing- Nonculture Methods

Microscopic Urinalysis

Microscopic hematuria & pyuria

Reporting:

could be recorde as number (1)

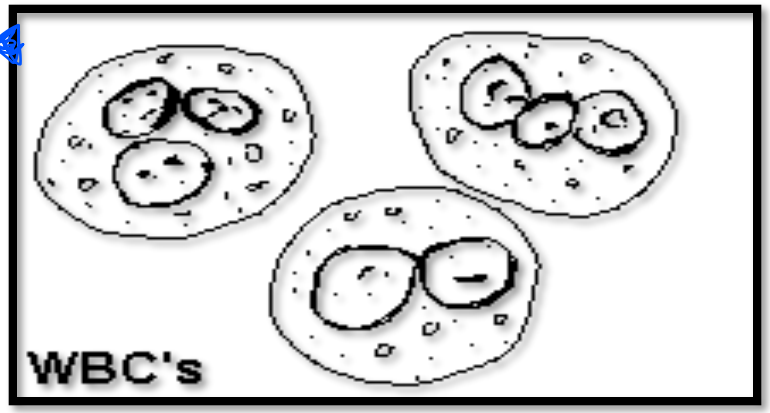
WBC count recorded as:

<10/ml
10-100/ml
100-500/ml
>500/ml

Other findings may be recorded as:

-/+ = Scanty (2)
+ = Few
++ = Moderate
+++ = Many

WBCs and RBCs in Urine



These white blood cells in urine have lobed nuclei and refractile cytoplasmic granules.

(*Biconcave shape disc.)

RBCs in urine

Processing- Nonculture Methods

Microscopic Urinalysis

Bacteria

- Bacteria are common in urine specimens (from contamination).
- Therefore, micorganisms in carefully collected urines should be interpreted in view of clinical symptoms.

(*Like catheterised urine sample or suprapubic aspiration.)

*Black arrows indicating bacilli in a urine sample.

Microscopic Urinalysis

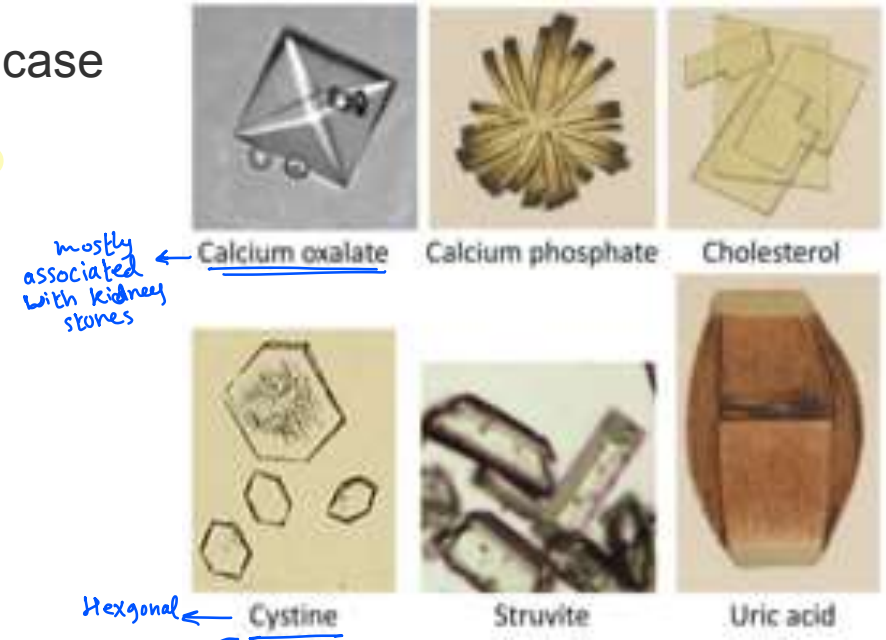
Urine Crystals

Importance of the urine crystals (crystalluria):

1. These crystals are important in the case of kidney stones.
2. Renal damage was caused by the crystals.
3. In liver diseases.
4. Inborn error of metabolism.

Reporting of the crystalluria:

1. Rare/HPF.
2. FeW/HPF.
3. Moderate/HPF.
4. Many/HPF.



mostly associated with kidney stones

Hexagonal

When found in many counts may indicate genetic defect in the cystine metabolism.

Microscopic Urinalysis

Casts

Are formed only in the **distal convoluted tubule (DCT)** or the **collecting duct**

The major component is the Tamm-Horsfall protein

Other proteins are albumin and immunoglobulins.

→ 2 types:

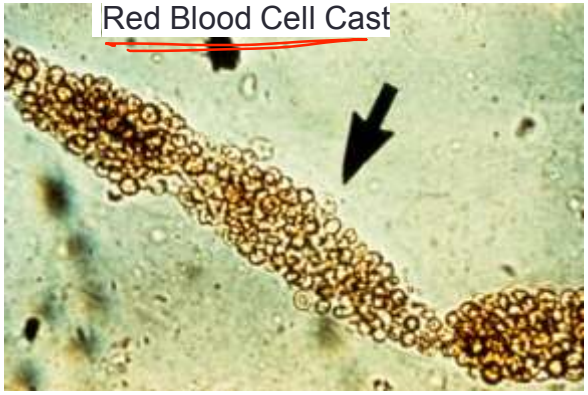
Cellular casts are made from protein and contain white blood cells, red blood cells, or epithelial cells. Non-cellular casts are made from protein and can contain fat. Hyaline, fatty, granular, and waxy casts are all non-cellular casts.

Cellular casts, fatty casts, granular casts, and waxy casts are not normally present in urine, so their presence could indicate the patient has kidney problems.

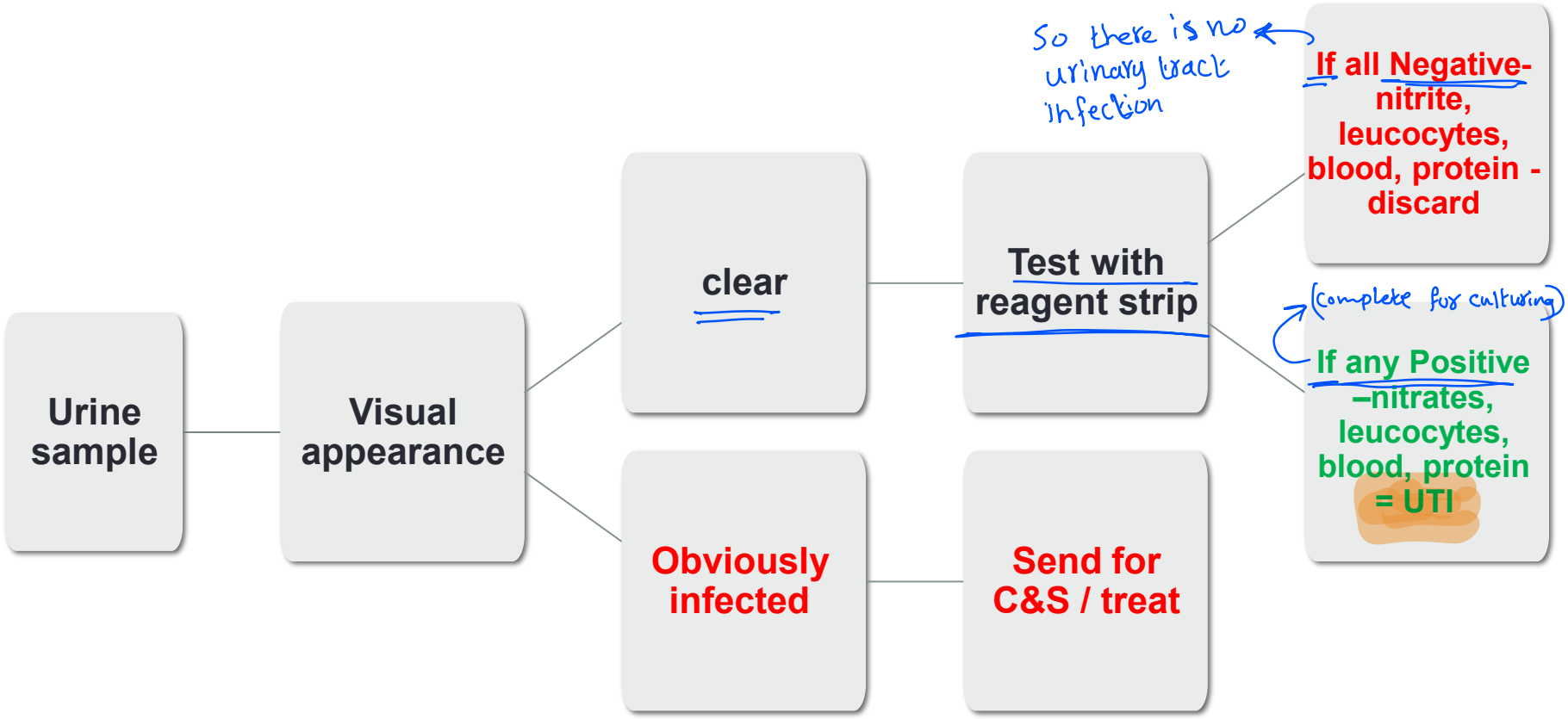
Hyaline casts are made from only protein and can typically be found in low numbers in urine, with 0 to 4 casts per high-powered field. Larger numbers of hyaline casts could indicate dehydration, physical exertion, fever, or kidney disease

Composed of protein and granules. → Result from the degradation of the cells.

(The most common)



UTI testing pathway



Processing- Nonculture Methods

Detection of bacteriuria by nitrite test

- Used for screening for **bacteria**.
- Normal urine contain nitrate but not nitrites.
- In the presence of bacteria, the normally present nitrate in the urine is reduced to nitrite.

*But some micro-organism cause UTI but doesn't has the ability to reduce nitrate.

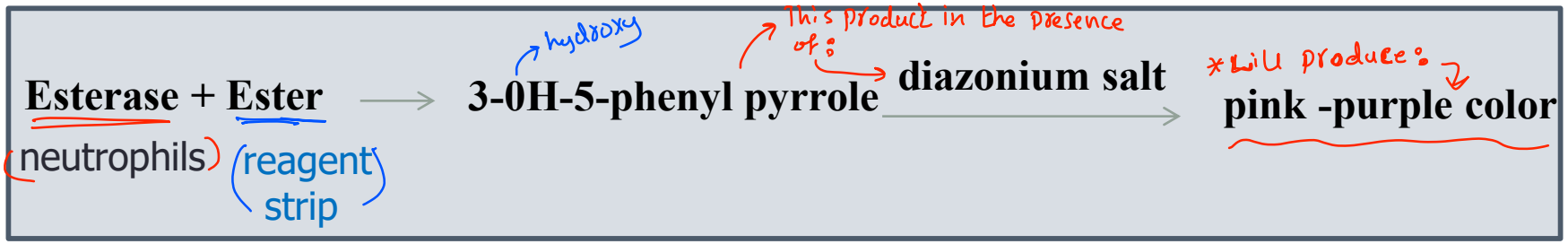
- Positive test indicates presence of more than 10 organisms/ml.
- Detected by **dipstick chemical analysis**

Processing- Nonculture Methods

Detection of pyuria by leukocyte esterase tests

*This enzyme is produced by leukocytes.

-Depends on esterase method:



+ve result: means more than 5 leucocytes/hpf. (high power field)

-Detected by **dipstick chemical analysis**

Dipstick chemical analysis

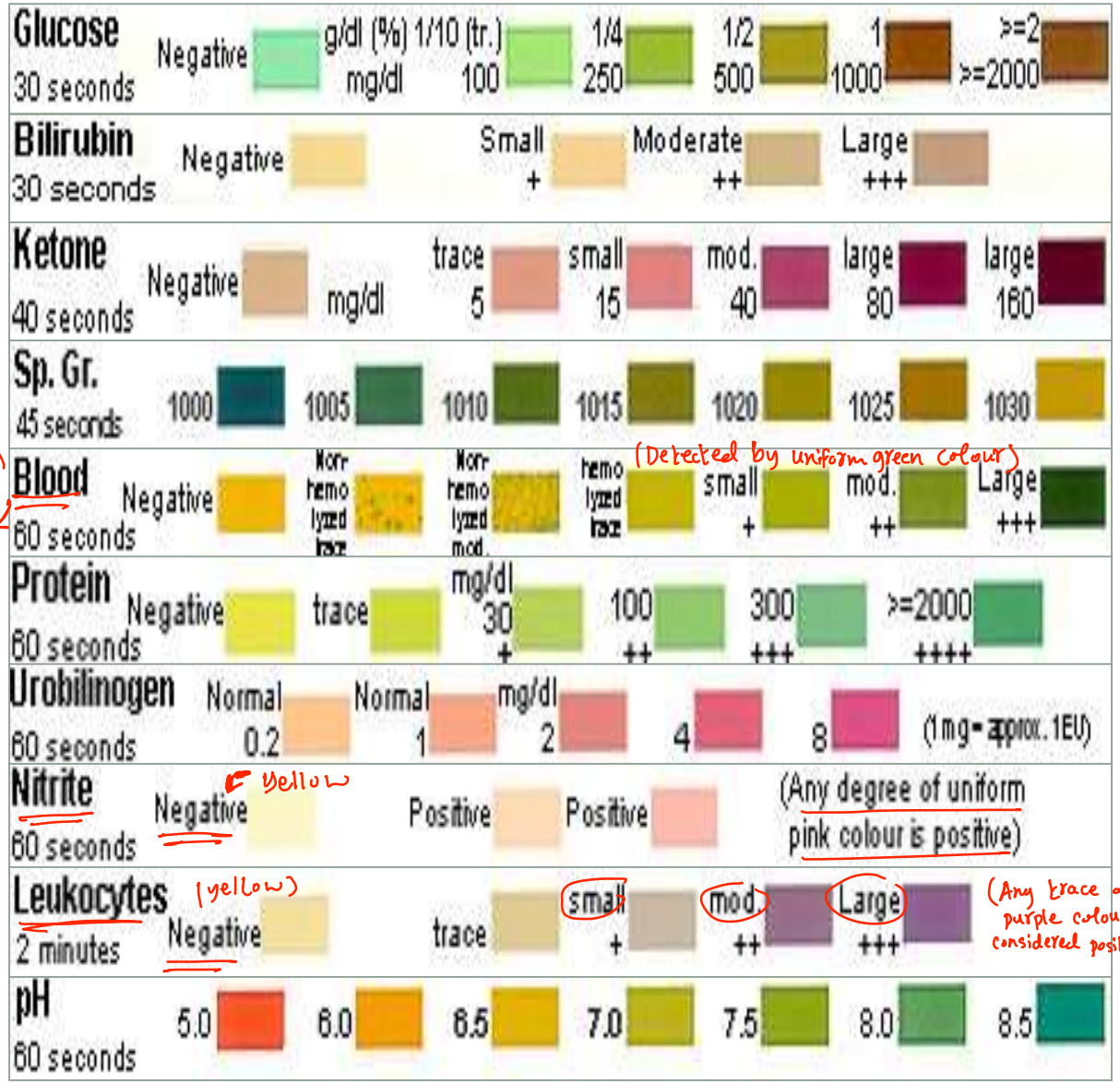
The squares on the dipstick represent the following components in the urine

- Glucose
- Bilirubin
- Ketones
- Specific Gravity
- Blood
- pH
- Protein
- Urobilinogen
- Nitrite
- Leukocyte Esterase

* Most of these are not found in normal urine.

Dipstick chemical analysis

- Glucose
- Bilirubin
- Ketone
- Specific Gravity
- Blood
- Protein
- Urobilinogen
- Nitrite
- Leukocyte
- pH



Intact erythrocytes

ruptured erythrocytes

(Detected by uniform green colour)

yellow

(yellow)

(Any trace of pink purple colour is considered positive)

Dipstick chemical analysis

leukocyte esterase tests

Leukocytes: Indicates infection or inflammation

Normal=negative (yellow)

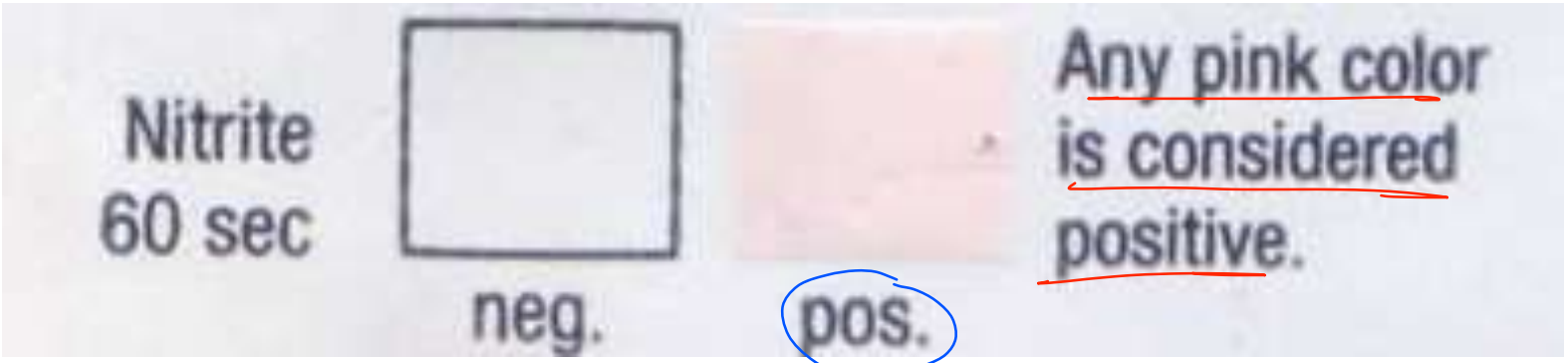
- Pyuria: Leukocytes in urine
- Cystitis: Bladder infection
- Pyelonephritis: Kidney infection

*Any degree of purple colour indicates: +ve leukocytes

*And this may associated with

Dipstick chemical analysis

Nitrite test



Urinary tract infection

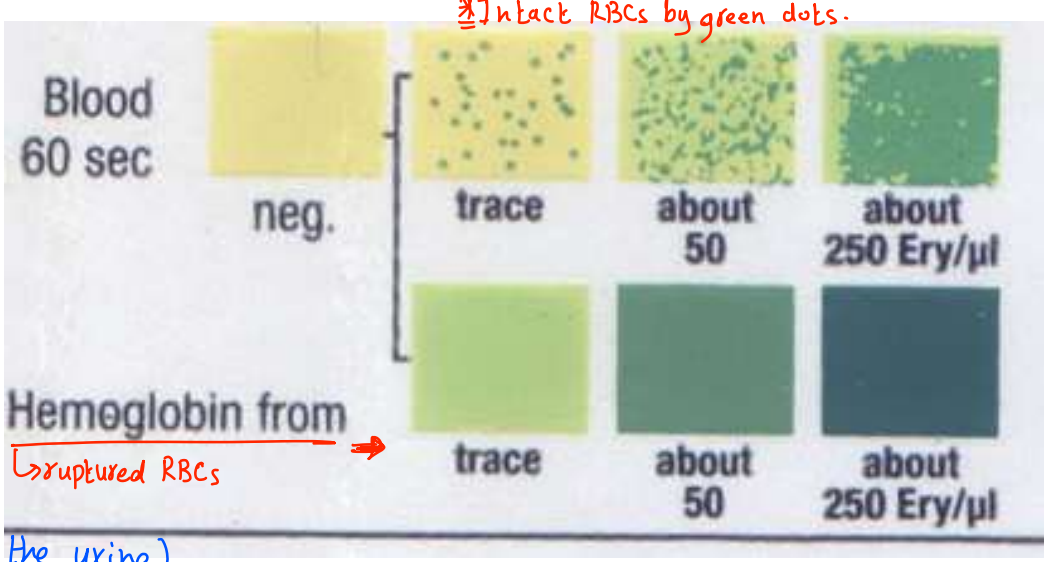
Normal=negative

*If it's negative and there is a visible turbidity → urinary tract infection should not be excluded, cause some microorganism dosn't reduce nitrate to nitrite

Dipstick chemical analysis

Dipstick Urinalysis Interpretation- Blood

Blood: Almost always indicates pathology because RBC are too large to pass through glomerulus



Normal=negative (No blood in the urine)

- Hematuria: Blood in urine
- Possible causes: Kidney stone, infection, tumor
- Caution: Very common finding in women because of menstruation.

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الخدمات الطبية الملكية

مستشفى : _____

فحص البول
URINALYSIS

اسم المريض الكامل : _____

الرقم الطبي : _____ الفئة : _____

الرقم الوطني : ☐☐☐☐☐☐☐☐☐☐

الرتبة : _____ ذكر ☐ انثى ☐

العمر : _____ أعزب ☐ متزوج ☐

تاريخ الطلب :	القسم / العيادة :	اسم و توقيع الطبيب المشرف :	الطبيب الاختصاصي :

Diagnosis & Relevant Information :

Test	Result
Albumin (protein)	NIL
Sugar	NIL
Other Tests :	

* -ve result for:

Test	Result
Microscopic sediment :	
R. B. C	0 - 1
W. B. C	0 - 1
casts	
Crystals	no
Other Findings	

Normal results

Comments :

التسلسل :	التاريخ :	اسم و توقيع المشرف :	اسم و توقيع طبيب المختبر :

ر ط ف ٢١٤

الخدمات الطبية الملكية

مستشفى :

فحص البول
URINALYSIS

اسم المريض الكامل :

الرقم العلمي : الفئة :

الرقم الوطني :

الرتبة :

ذكر ☐ انثى ☐

العمر : أعزب ☐ متزوج ☐

التاريخ :	القسم / العيادة :	اسم و توقيع الطبيب المشرف :	الطبيب الاستشاري :

Diagnosis & Relevant Information :

Test	Result	Test	Result
Albumin	N/A	Microscopic sediment :	
Sugar	N/A	R. B. C	4 - 6
Other Tests :		W. B. C	8 - 10
		casts	
		Crystals	
		Other Findings	

-ve chemical analysis

- Increased number of ; is considered few here

Comments :

التسلسل :	التاريخ :	اسم و توقيع الطبيب المشرف	اسم و توقيع الطبيب المشرف

ن ط ٣/٤

الخدمات الطبية الملكية

مستشفى : .....

اسم المريض الكامل : .....

الرقم الطبي : ..... الفئة : .....

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الرتبة : ..... ذكر ☐ انثى ☐

العمر : ..... أعزب ☐ متزوج ☐

فحص البول
URINALYSIS

تاريخ الطلب :	القسم / العيادة :	اسم و توقيع الطبيب المشرف :	الطبيب الاختصاصي :

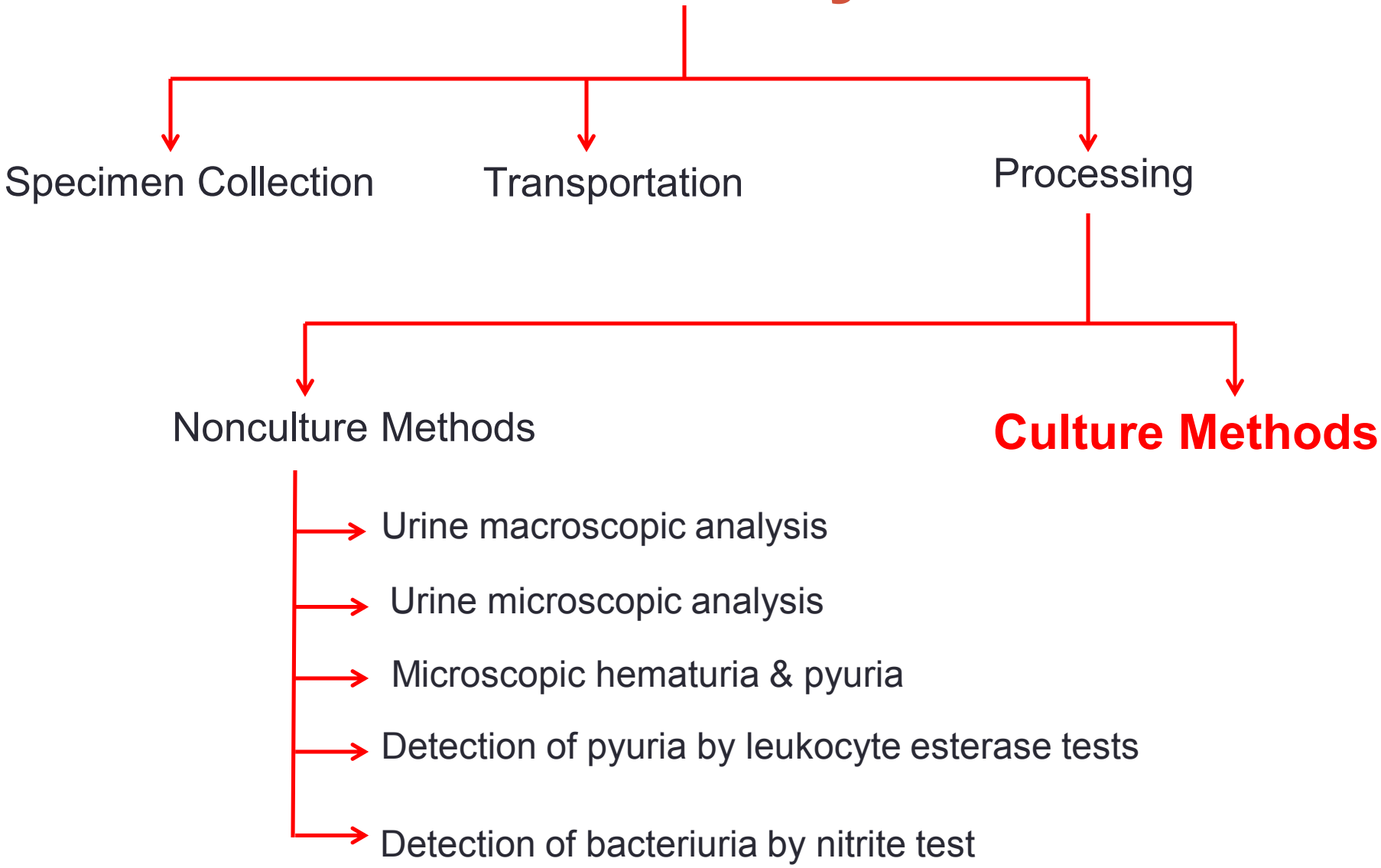
Diagnosis & Relevant Information :

Test	Result	Test	Result
Albumin (protein)	+ (1)	Microscopic sediment :	
Sugar	+ + (2)	R. B. C	8-10
Other Tests : (Not normal)		W. B. C (High number)	81-20
		casts	
		Crystals	Ca ox oxalate
		Other Findings	

Comments :

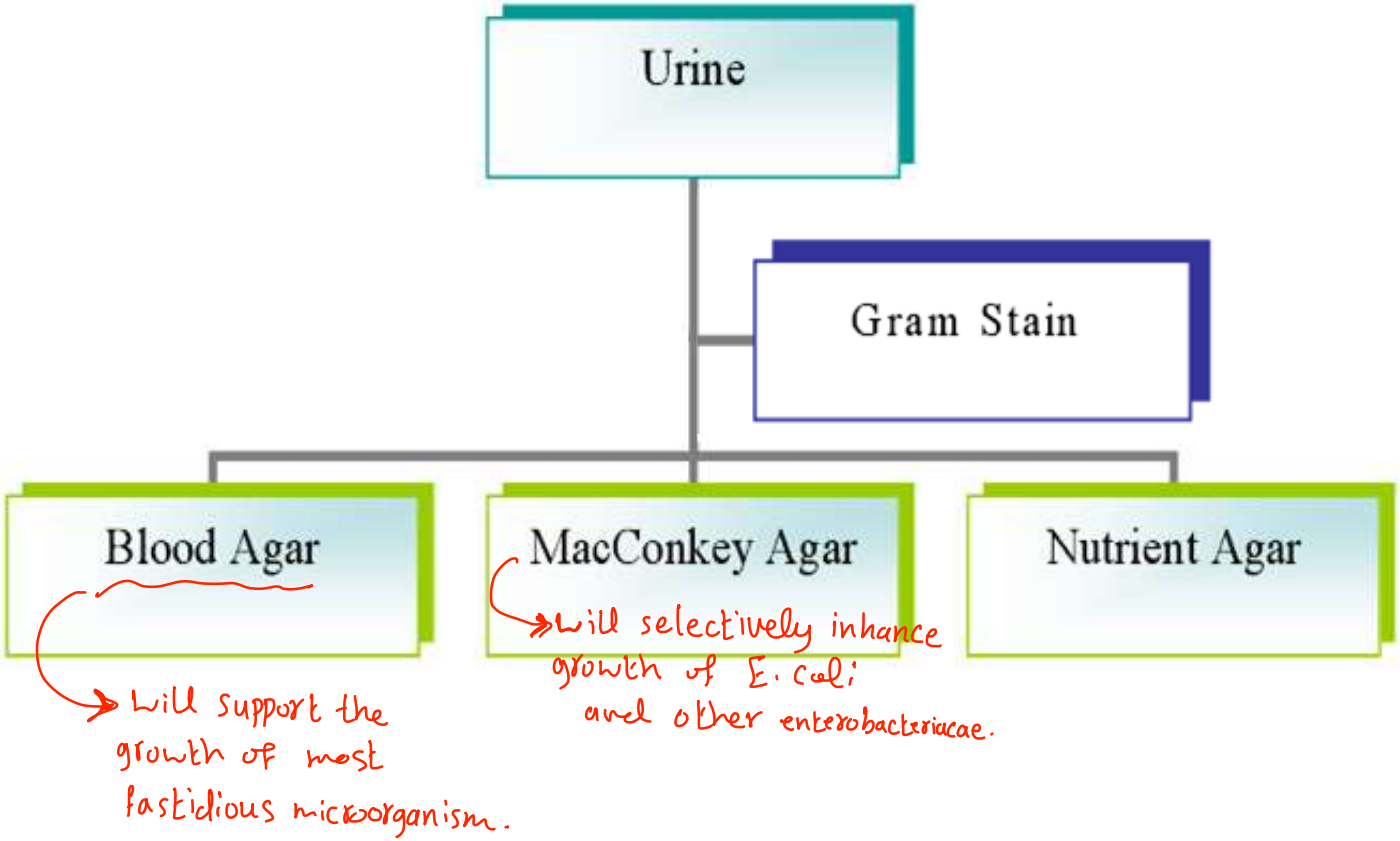
التسلسل :	التاريخ :	اسم و توقيع المشرف :	اسم و توقيع طبيب المختبر :

Urine Analysis

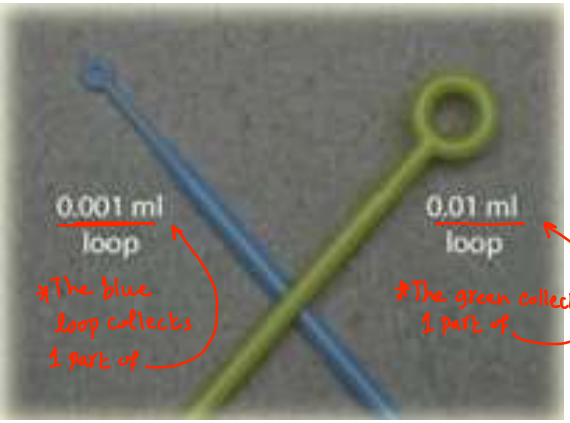


Urine Analysis

Culture Methods



Culture of urine sample

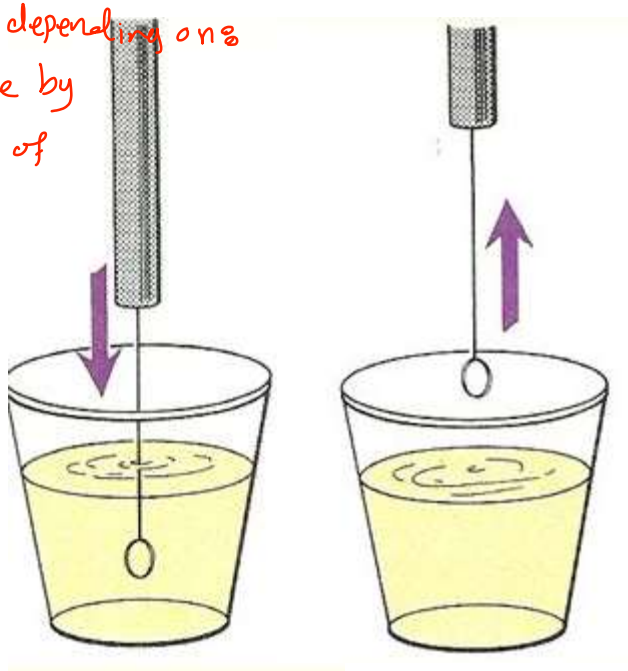


*The blue loop collects 1 part of

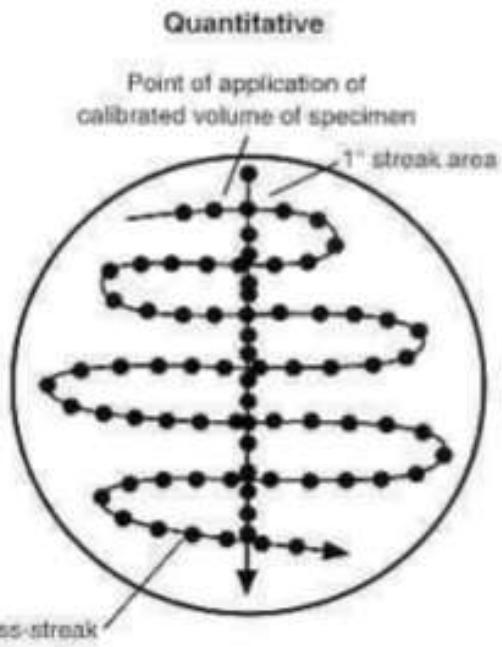
*The green collects 1 part of

→The method of urine culture is depending on:

1*Finding the colony forming urine by collecting a specific volume of a urine sample.



*This loops have the ability to collect a specific volume.



2*And after collecting, it's streaked on the plate.

*Zig zag movement in order to spread the sample all over the plate.

3*After incubation at 37°C for 24 hrs; the colony must be counted, and the colony forming urine must be calculated by multiplying the number of the colony counted on the plate by the volume ...??

→ for the blue loop: (The colony counted) x 1000

→ For the green loop: (The " ") x100

↳In order to calculate the colony forming unit/mL of sample

General Criteria to Diagnose UTI

Suprapubic Aspiration:

Any growth. → will considered +ve → cause it's taken under aseptic technique.

Catheterization:

≥10,000 colony forming units/ml. → +ve

Midstream Clean Catch:

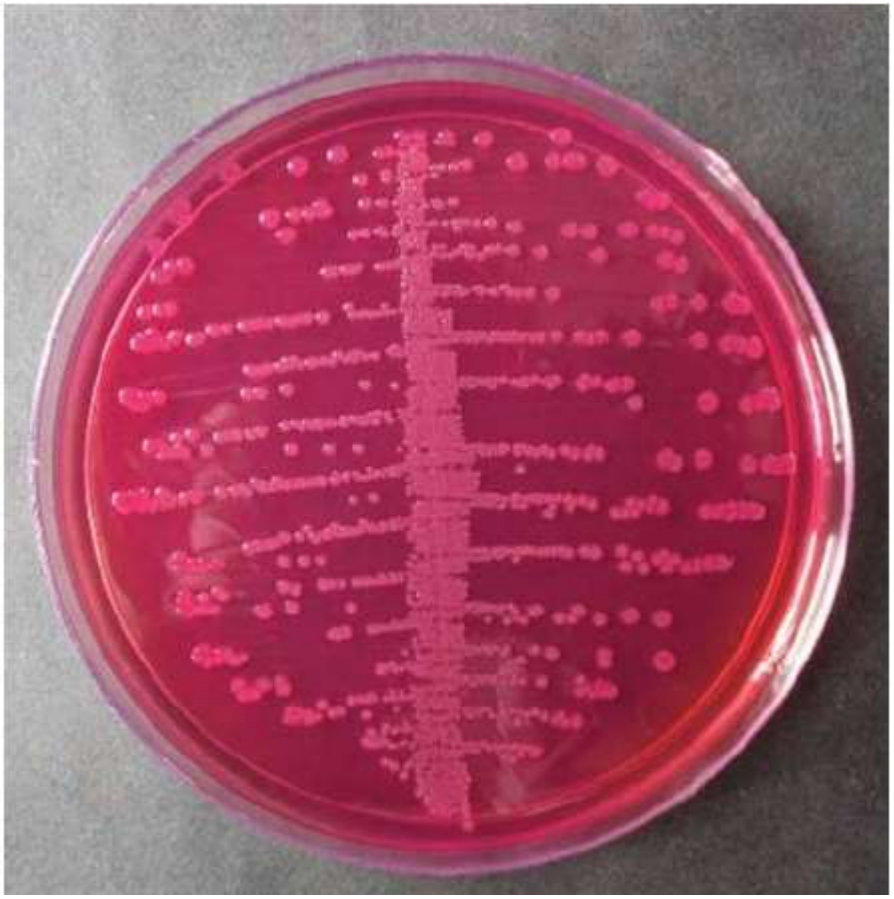
≥100,000 colony forming units/ml.

Urine Analysis

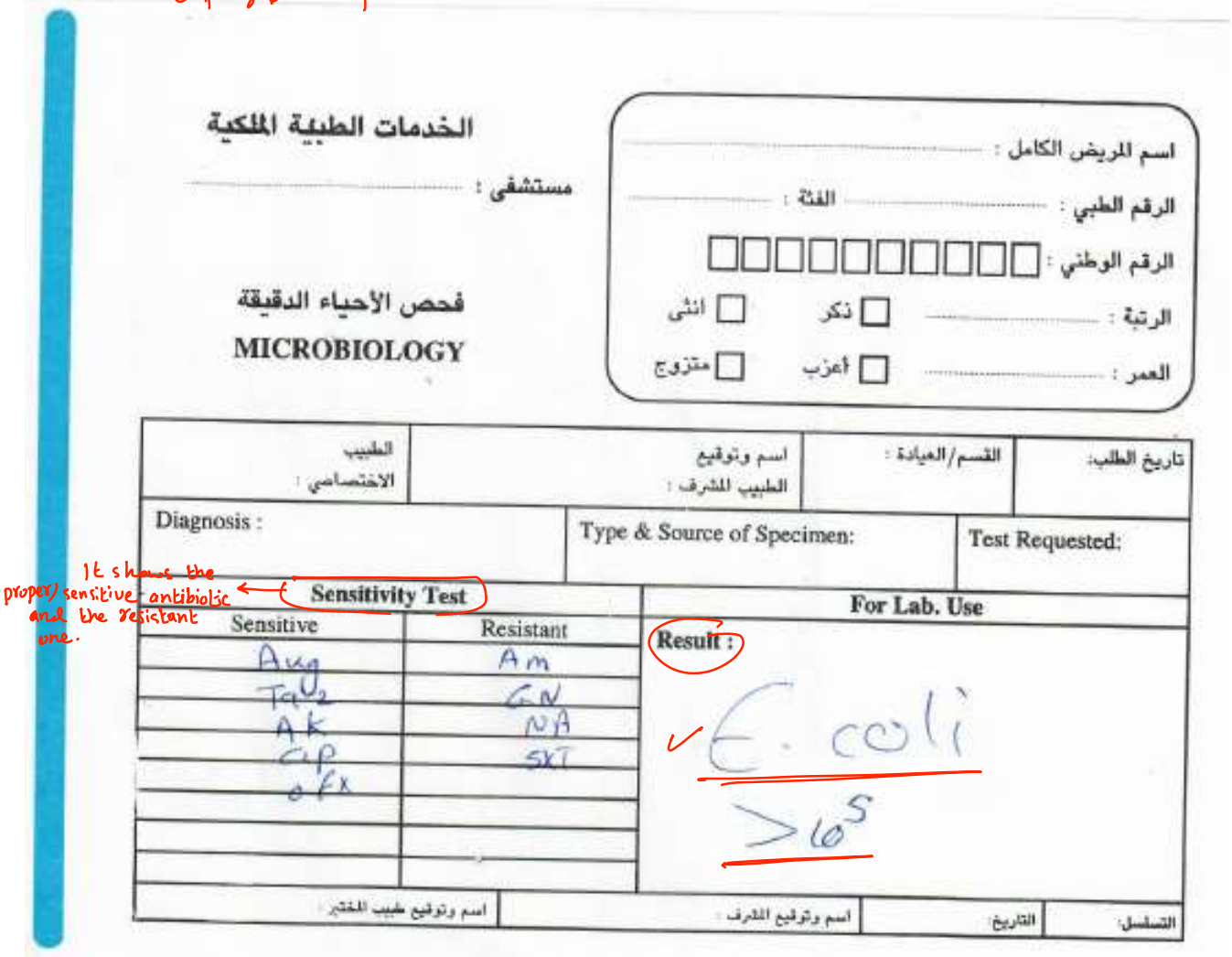
Culture Methods

- Significant Growth of E. coli in MacConkey Agar

*uncountable



*This is the report of the plate above



الخدمات الطبية الملكية

مستشفى : .....

فحص الأحياء الدقيقة

MICROBIOLOGY

اسم المريض الكامل : .....

الرقم الطبي : ..... الفئة : .....

الرقم الوطني : ☐☐☐☐☐☐☐☐☐☐

الرتبة : ..... ذكر ☐ انثى ☐

العمر : ..... أعزب ☐ متزوج ☐

تاريخ الطلب:	القسم/العيادة :	اسم وتوقيع الطبيب المشرف :	الطبيب الاختصاصي :

Diagnosis :	Type & Source of Specimen:	Test Requested:

It shows the proper sensitive antibiotic and the resistant one.

Sensitivity Test		For Lab. Use
Sensitive	Resistant	Result :
Aug	Am	E. coli
Taz_2	CN	$>10^5$
AK	NA	
CP	SXT	
oFx		

التسلسل:	التاريخ:	اسم وتوقيع المشرف :	اسم وتوقيع طبيب المختبر :

Pathogens and commensals

Common pathogens	Commensal flora
Neisseria gonorrhoeae any colony on chocolate or TM agar (special request).	*Diphtheroid bacilli*
E.coli and other Enterobacteriaceae	*Lactobacillus spp*
Enterococcus spp	*Coagulase negative Staphylococci*
* ***Staphylococcus aureus*** → is considered +ve UTI (cause it's not normally found) **Pure culture regardless to the no. of CFUs.**	*Alpha Haemolytic Streptococci*
Staph saprophyticus	*Bacillus spp*
Corynebacterium jeikeium	*Non pathogenic Neisseria spp.*
Acinetobacter spp	*Anaerobic cocci*
Pseudomonas spp	*Commensal Mycobacterium*
* *Gardnerella vaginalis* Unusual	*Commensal Mycoplasma spp.*
Beta -haemolytic streptococci	
**** Salmonella spp* (early stage of infection)**	*** yeast**
Parasites	
Schistosoma haematobium	
Trichomonas vaginalis	

* Diagnostic Microbiology, BAILEY & SCOTT, 9th EDITION

15- Bacterial culture from Midstream urine sample

** 100000 = 10^5

نفس سؤال الارشيف عند وريد

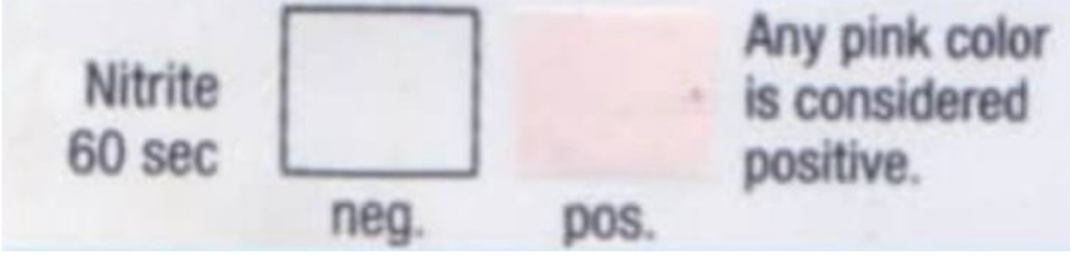
a. > 100000 ✓
b. > 1000
c. > 100

. This test is positive when the leukocyte count more than ?

Select one:

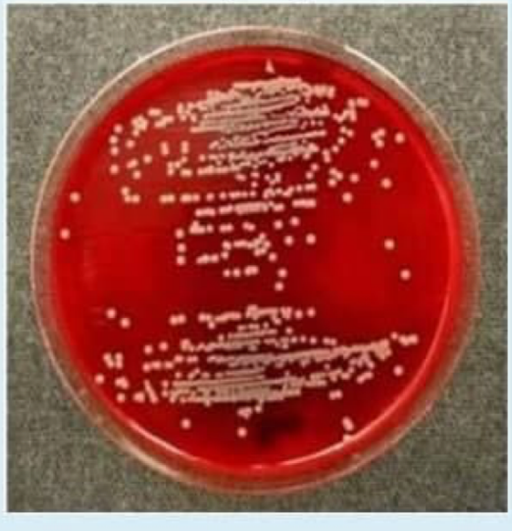
- a. 10 leucocytes/hpf.
- b. 9 leucocytes/hpf.
- c. 15 leucocytes/hpf.
- d. 5 leucocytes/hpf.
- e. 25 leucocytes/hpf.

17- This test used to detect ?



a Bacteria in urine. ✓
b. Fungus in urine.
c. Sugar in urine

Which of the following colony counts from a midstream urine sample is indicative for UTI?



Select one:

(10^5 /10^5)

- a. ≥ 105 CFU/ml.
- b. ≥ 103 CFU/ml.
- c. ≥ 102 CFU/ml.
- d. ≥ 108 CFU/ml.
- e. ≥ 106 CFU/ml.

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الخدمات الطبية الملكية

مستشفى : .....

اسم المريض الكامل : .....

الرقم الطبي : ..... الفئة : .....

الرقم الوطني : ☐☐☐☐☐☐☐☐☐☐

الرتبة : ..... ذكر ☐ انثى ☐

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فحص البول
URINALYSIS

تاريخ الطلب :	القسم / العيادة :	اسم و توقيع الطبيب المشرف :	الطبيب الاختصاصي :

Diagnosis & Relevant Information :

Test	Result	Test	Result
Albumin	+ (1)	Microscopic	
Sugar	+ + (2)	sediment :	
Other Tests :		R. B. C	8-10
		W. B. C	8-20
		casts	
		Crystals	Ca++ oxalate
		Other Findings	

Comments :

التسلسل :	التاريخ :	اسم و توقيع المشرف :	اسم و توقيع طبيب المختبر :