AL-Mustaqbal University Collage.
Department of Pathological Analysis Technique.
Subject: - Advanced laboratory techniques..
Lecture-No. 1.
Microbiology.

Introduction

❖ **Medical microbiology**: - is the study of microbes that infect human, the diseases they cause, and their diagnosis, prevention and treatment.

The agents of human infectious diseases belong to **five** major groups of organisms: **bacteria**, **fungi**, **protozoa**, **helminthes**, and **viruses**.

The bacteria belong to the **prokaryote** kingdom, the fungi (yeasts and molds) and protozoa are members of the kingdom of protists, and the helminthes(worms) are classified in the **animal** kingdom (Table 1–1).

The protists are distinguished from animals and plants by being either unicellular or relatively simple multicellular organisms. In contrast, **helminthes** are complex multicellular organisms. Taken together, the helminthes and the protozoa are commonly called parasites. Viruses are quite distinct from other organisms, they are not cells but can replicate only within cells.

❖ **IMPORTANT FEATURES OF MICROBES: -**

Many of the essential characteristics of these organisms are described in Table 1–2.

One salient feature is that bacteria, fungi, protozoa, and helminthes are cellular whereas viruses are not. This distinction is based primarily on three criteria:

(1) **Structure.** Cells have a nucleus or nucleoid (see below), which contains DNA; this is surrounded by cytoplasm, within which proteins are synthesized and energy is generated. Viruses have an inner core of genetic material
(either DNA or RNA) but no cytoplasm, and so they depend on host cells to provide the machinery for protein synthesis and energy generation.

TABLE 1–1 Biologic Relationships of Pathogenic Microorganisms

Kingdom	Pathogenic Microorganisms	Type of Cells
Animal	Helminths	Eukaryotic
Plant	None	Eukaryotic
Protist	Protozoa	Eukaryotic
	Fungi	Eukaryotic
Prokaryote	Bacteria	Prokaryotic
	Viruses	Noncellular

TABLE 1–2 Comparison of Medically Important Organisms

Characteristic	Viruses	Bacteria	Fungi	Protozoa and Helminths
Cells	No	Yes	Yes	Yes
Approximate diameter (μm)[1]	0.02–0.2	1–5	3–10 (yeasts)	15–25 (trophozoites)
Nucleic acid	Either DNA or RNA	Both DNA and RNA	Both DNA and RNA	Both DNA and RNA
Type of nucleus	None	Prokaryotic	Eukaryotic	Eukaryotic
Ribosomes	Absent	70S	80S	80S
Mitochondria	Absent	Absent	Present	Present
Nature of outer surface	Protein capsid and lipoprotein envelope	Rigid wall containing peptidoglycan	Rigid wall containing chitin	Flexible membrane
Motility	None	Some	None	Most
Method of replication	Not binary fission	Binary fission	Budding or mitosis[2]	Mitosis[3]

1-For comparison, a human red blood cell has a diameter of 7 μm.

2-Yeasts divide by budding, whereas molds divide by mitosis.

3-Helminthes cells divide by mitosis, but the organism reproduces itself by complex, sexual life cycles.

(2) **Method of replication.** Cells replicate either by binary fission or by mitosis, during which one parent cell divides to make two progeny cells while retaining its cellular structure. Prokaryotic cells (e.g., bacteria) replicate by binary fission, whereas eukaryotic cells replicate by mitosis.

In contrast, viruses disassemble, produce many copies of their nucleic acid and protein, and then reassemble into multiple progeny viruses. Furthermore, viruses must replicate within host cells because, as mentioned previously, they lack protein-synthesizing and energy-generating systems.

With the exception of rickettsiae and chlamydiae, which also require living host cells for growth, bacteria can replicate extracellular.

(3) **Nature of the nucleic acid.** Cells contain both DNA and RNA, whereas viruses contain either DNA or RNA but not both.

EUKARYOTES & PROKARYOTES

Cells have evolved into two fundamentally different types, **eukaryotic** and **prokaryotic,** which can be distinguished on the basis of their structure and the complexity of their organization. Fungi and protozoa are eukaryotic, whereas bacteria are prokaryotic.

(1) The eukaryotic cell has a true **nucleus** with multiple chromosomes surrounded by a nuclear membrane and uses a mitotic apparatus to ensure equal allocation of the chromosomes to progeny cells.

(2) The **nucleoid** of a prokaryotic cell consists of a single circular molecule of loosely organized DNA, lacking a nuclear membrane and mitotic apparatus.

(Table 1–3).

In addition to the different types of nuclei, the two classes of cells are distinguished by several other characteristics:

(1) Eukaryotic cells contain organelles**,** such as mitochondria and lysosomes, and larger (80S) ribosomes, whereas prokaryotes contain no organelles and smaller (70S) ribosomes.

(2) Most prokaryotes have a rigid external cell wall that contains peptidoglycan**,** a polymer of amino acids and sugars, as its unique structural component. Eukaryotes, on the other hand, do not contain peptidoglycan.

TABLE 1-3 Characteristics of Prokaryotic and Eukaryotic Cells

Characteristic	Prokaryotic Bacterial Cells	Eukaryotic Human Cells
DNA within a nuclear membrane	No	Yes
Mitotic division	No	Yes
DNA associated with histones	No	Yes
Chromosome number	One	More than one
Membrane-bound organelles, such as mitochondria and lysosomes	No	Yes
Size of ribosome	70S	80S
Cell wall containing peptidoglycan	Yes	No

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Lecture-No.5.
General Urine Examination-3.

General Urine Examination

***The Microscopic Examination: -**

A microscopic examination may or may not be performed as part of a routine urinalysis. It will typically be done when there are abnormal findings on the physical or chemical examination and the results from all will be taken into account for interpretation.

The microscopic exam is performed on urine sediment-urine that has been centrifuged to concentrate the substances in it at the bottom of a tube. The fluid at the top of the tube is then discarded and the drops of fluid remaining are examined under a microscope. Cells, crystals, and other substances are counted and reported either as the number observed "per low power field" (LPF) or "per high power field" (HPF). In addition, some entities, if present, are estimated as "few," "moderate," or "many," such as **epithelial cells**, **bacteria**, and **crystals**. Cells and other substances that may be seen include the following:

1-Red Blood Cells (RBCs)
2-White Blood Cells (WBCs)
3-Epithelial Cells
4-Bacteria, Yeast and Parasites
5-Trichomonas
6-Casts
7-Crystals

Introduction: -

Microscopic examination of urine sediment is of great clinical importance and should never be omitted.

The sediment should be examined for: Type, and Amount Examination of the sediment should always be made shortly after collection so that:

a. Degeneration and lysis of cellular elements will not occur
b. Bacteria will not proliferate

Procedure: -

A. Centrifugation

- Shake the urine sample to make the sample homogenous.
- Put (9-11) ml of urine sample into test tube.
- The recommended parameter for the urine centrifugation is 5 minutes at 2000 RPM.

B. Re-suspension

- The re-suspension procedure has to provide the better homogeneous distribution possible.

 An inadequate re-suspension can be the cause of an uneven distribution although, in the presence of mucus, to which elements may adhere, can cause a significant variation in the different field counts.

C. Examination

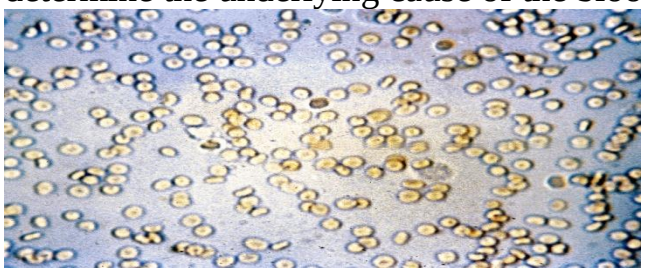
 Place a drop of unstained suspension in a glass slide

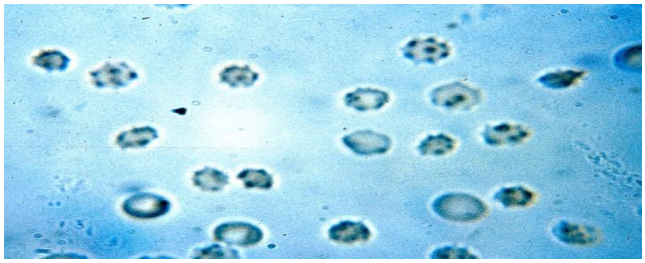
 Place the glass slide on the microscope stage. Examine several fields at 10X and 40X magnification

 Classify and count casts within LPF (Low Power Fields).

 Switch to 40X magnification and examine for other elements, i.e., WBCs, RBCs, Epithelial cells, yeast, bacteria, Sperm cells, mucous filaments and crystals.

1-Red Blood Cells (RBCs): - Normally, a few RBCs are present in urine sediment (0-5 RBCs per high power field, HPF). Blood in the urine is not a normal finding, but it is not uncommon and is not necessarily a cause for alarm. **Hematuria** is a sign or an indicator that prompts a healthcare practitioner to investigate further to try to determine the underlying cause of the blood.





Overview: Theoretically, no red cells should be found, but some find their way into the urine even in very healthy individuals.

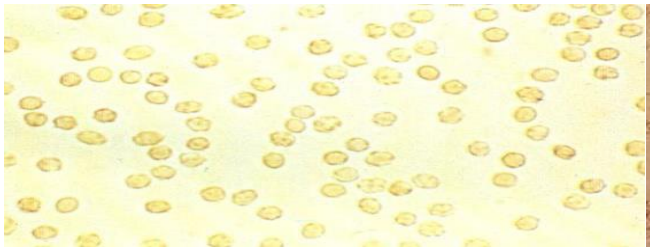
Increased red cells in urine above normal level is termed hematuria

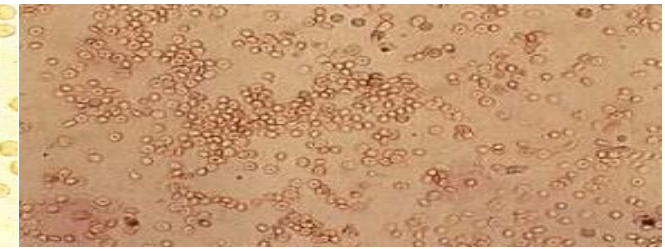
Procedure: RBCs is reported semi-quantitatively as number seen per high power field (HPF) and reported as follow; <5, 5-20, 20-100, or >100.

Normal: RBC up to 5/HPF are commonly accepted as normal.

Appearance:

The appearance of red blood cells (RBC) in urine depends largely on the concentration of the specimen and the length of time the red cells have been exposed. Fresh red cells tend to have a red or yellow color and appear as retractile disks Prolonged exposure results in a pale or colorless appearance as hemoglobin may be lost from the cells and the RBC's begin to have a granted appearance specially in concentrated urine (hypertonic urine).





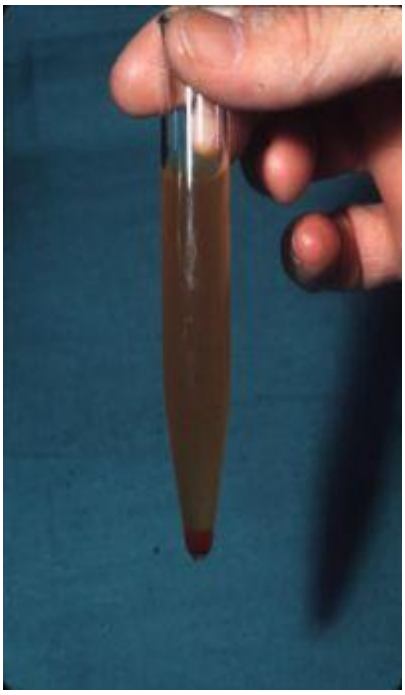
Note: erythrocytes may lyse in very dilute or highly alkaline urine; Lysed red cells appear as very faint "ghosts", or may be virtually invisible. (Red cell ghosts may simulate yeast)

Note: The presence of dysmorphic RBC's (distorted cell) in urine suggests a glomerular disease such as a **glomerulonephritis**. Dysmorphic RBC's have odd shapes as a consequence of being distorted via passage through the abnormal glomerular structure.
Note: the presence of increased number of RBCs with casts and proteinuria suggests bleeding from renal origin
Note: growth hematuria suggests bleeding origin in urethra or bladder neck.

Interpretation:
Hematuria: - is the presence increased amount of red blood cells (erythrocytes) in the urine.

Microscopic hematuria

Small amounts of blood, can be seen only on urinalysis or light microscopy), In microscopic hematuria, the urine appears normal.
Macroscopic hematuria (or "frank" or "gross") Hematuria Gross hematuria is suspected because of the presence of red or brown urine.
-Case-Note: Typically, microscopic hematuria indicates damage to the upper urinary tract (kidneys), while visible blood indicates damage to the lower tract (ureters, bladder, or urethra). But this is not always the case.



What are the Causes of hematuria?
Renal causes Post-streptococcal glomerulonephritis): It is the commonest cause of hematuria in children above 3 years. History of preceding streptococcal pharyngitis is usually obtained.
Note: The prognosis of post-streptococcai glomerulonephritia is excellent and complete recovery within few weeks occur but microscopic hematuria may remain for several months.
2-White Blood Cells (WBCs): - The number of WBCs in urine sediment is normally low (0-5 WBCs per high power field, HPF). WBCs can be a contaminant, such as those from vaginal secretions.
An increased number of WBCs seen in the urine under a microscope and/or positive test for leukocyte esterase may indicate an infection or inflammation somewhere in the urinary tract. If also seen with bacteria (see below), they indicate a likely urinary tract infection.

Urine Pus cells: -
Overview:
Leucocytes usually enter tubular lumen through and between tubular epithelial cells
An increase in urinary WBCs is called **pyuria** and indicates the presence of an infection or inflammation in the genitourinary system.
Microscopic examination and chemical testing are used to determine the presence of leukocytes in the urine.

Procedure: -
WBC is reported semi-quantitatively as number seen per high power field (HPF) and reported as follow; <5, 5-20, 20-100, or >100 (Over 100).
Normal: - WBC up to 5/HPF are commonly accepted as normal.

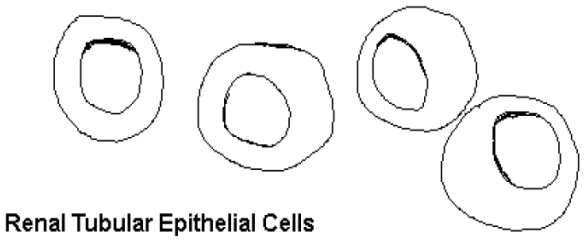
Appearance:
These white blood cells in urine have lobed nuclei and retractile cytoplasmic granules.
White Blood Cells (WBC) in unstained urine sediments typically appear as round, granular cells which are 1.5-2.0 times the diameter of RBCs.
Note: WBC in urine is most commonly neutrophils but nuclei tend to become round as neutrophils age in urine.
Note: Like erythrocytes, WBC may lyse in very dilute or highly alkaline urine; WBC cytoplasmic granules released into the urine often resemble cocci bacteria.
Note: to differentiate between neutrophils and RBCs cells a small drop of GAA is added which enhance the nuclear details and lyse the red blood cells.

Interpretation:
Greater numbers of WBCs (pyuria) generally indicate the presence of an inflammatory process somewhere along the course of the urinary tract.
Positive results are clinically significant and indicate: Acute pyelonephritis Cystitis prostatitis urethritis.
Other causes of inflammation must be considered, such as: Kidney stone Urinary tract neoplasm, including renal cancer and bladder cancer. Acute Glomerulonephritis (non-bacterial)
Note: In bladder infections, WBCs tend to be associated with bacteria, epithelial cells, and relatively few RBCs.
Note: WBC clumps suggest renal origin of WBCs and should be reported when present.
Note: Pus count greater than 30\HPF suggest acute infection and urine culture is recommended Sterile pyuria
Sterile pyuria: - is urine which contains white blood cells (>10 white cells/mm3) while appearing sterile by standard culturing techniques.
Causes A recently (within last 2 weeks) treated urinary tract infection (UTI) with 'fastidious' organism (an organism that grows only in specially fortified artificial

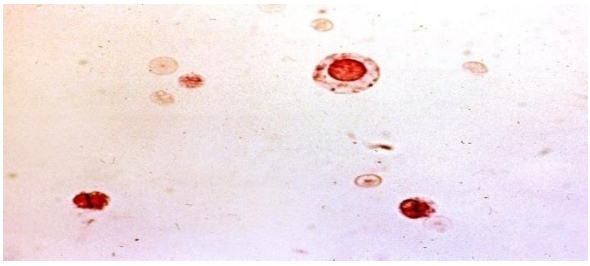
culture media under specific culture conditions), e.g. ***Neisseria gonorrhoeae*** and **Renal tuberculosis**.

3-Epithelial Cells: - Epithelial cells are usually reported as "few," "moderate," or "many" present per low power field (LPF). Normally, in men and women, a few epithelial cells can be found in the urine sediment.

In urinary tract conditions such as infections, inflammation, and malignancies, an increased number of epithelial cells are present. Determining the kinds of cells present may sometimes help to identify certain conditions. For example, epithelial cells containing large amounts of broken-down hemoglobin (called hemosiderin) may indicate that there were red blood cells or hemoglobin in the urine recently, even if there are none now.



Renal Tubular Epithelial Cells

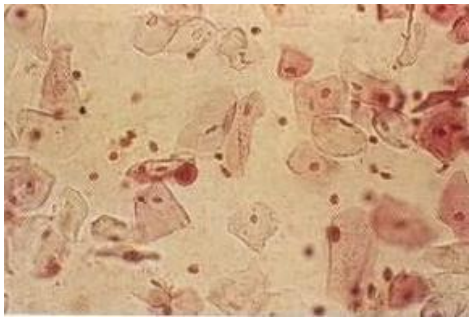


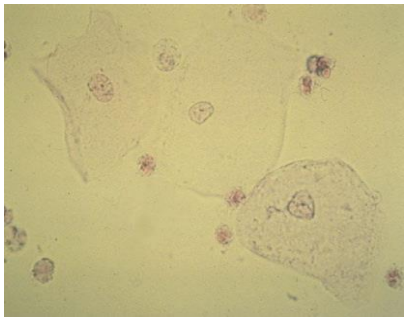
Urine Epithelial cells

Appearance

Urine epithelial cells are of three kinds: Renal tubule epithelial cells, Bladder epithelial cells, and Squamous epithelial cells.

They are large (the largest cells which can be present in normal urine samples), flat cells with irregular borders, a single small nucleus, and abundant cytoplasm.





Interpretation:

Epithelial cells in urine are generally of little specific diagnostic utility because:

Old cells lining the urinary tract at any level may continually slough into the urine.

Also in the case of voided samples, even cells from the genital tract can appear in the sample.

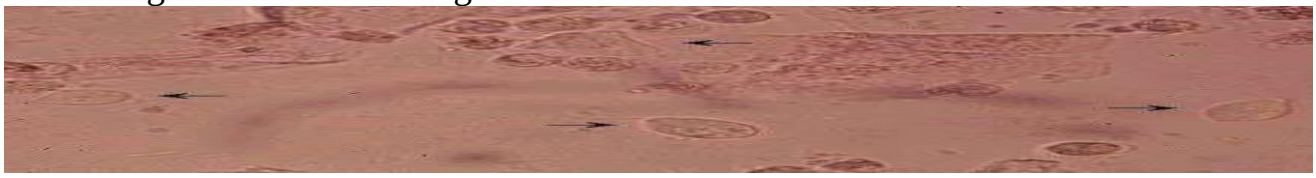
Increased number of epithelial cells associated with renal disease such as: Acute tubular necrosis Acute glomerulonephritis Pyelonephritis

Note: In cases of acute tubular necrosis, renal tubular epithelial cells containing large **non lipid vacuoles** may be seen, these are referred to as **bubble cells**. When lipids cross the glomerular membrane, the renal epithelial cells absorb the lipids and become highly refractive. These are called **oval fat bodies** and seen in cases of nephritic syndrome.

4-Bacteria, Yeast and Parasites: - In healthy people, the urinary tract is sterile and, if the urine sample is collected as a "clean-catch" sample, there will be no microbes seen in the urine sediment under the microscope. Special care must be taken during specimen collection, particularly in women, to prevent bacteria that normally live on the skin or in vaginal secretions from contaminating the urine sample.
If microbes are seen, they are usually reported as "few," "moderate," or "many" present per high power field (HPF).
Bacteria from the surrounding skin can enter the urinary tract at the urethra and move up to the bladder, causing a urinary tract infection (UTI)
Asymptomatic bacteriuria: - is a significant number of bacteria in the urine that occurs without any of the usual symptoms (burning during urination or increased frequency of urination).
Causes: -
Asymptomatic bacteriuria occurs in up to 6% of healthy individuals. It affects 18% of people with diabetes (mostly women), and 20% of elderly individuals (more often women than men). The reasons for the lack of symptoms are not well understood.

Note: Most patients with asymptomatic bacteriuria do not need treatment because the bacteria aren't causing any harm. Treatment with antibiotics is recommended during pregnancy, because it significantly reduces symptomatic urinary tract infections, low birth weight, and preterm delivery.
1- **Trichomonas vaginalis is a parasite that may be found in the urine of women, or rarely, men**.
5-Urine Ova: -
5-1) Trichomonas vaginalis: -
If male: urinary bladder, urethra, prostate
If female: vagina, and cervix
Mode of infection
- Directly through sexual intercourse as parasite can't live outside body for long period
- Indirectly through using patients articles as under wear clothes Pathology

Female symptoms
Infection is asymptomatic in 15-20% of cases
The main symptoms associated with Trichomonas infection in women include:
- dysuria [painful urination]
- Painful sexual intercourse
- Burning sensation of the vagina



Green/Yellow, frothy vaginal discharge with a strong foul-smelling odor.
- Trichomonas infection may cause Vaginitis, and Cervicitis.

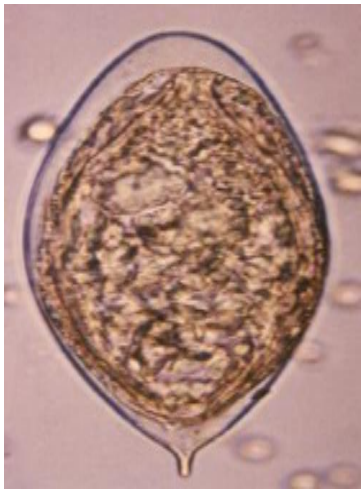
Note: Symptoms usually appear in women within 5 to 28 days of exposure.
Male symptoms

Infection is asymptomatic in 50-90% of cases
Symptoms associated with Trichomonas infection in women include:
- dysuria
- Mild urethral discharge
- Slight burning after urination or ejaculation
- Trichomonas infection may cause Urethritis

5-2) Schistosome haematobium: -

Diagnosis: -
Clinical diagnosis Clinical signs & symptoms of urinary schistosomiasis include:
- Haematuria is a common finding.
- Proteinuria is frequently present.
- Eosinophils can often be found in the urine.
- There is usually also a blood eosinophilia.

Urine Examination: -
Examination of urine for detection of egg this help in acute cases when egg can be detected easily in urine.



6-Casts are cylindrical particles: - sometimes found in urine that are formed from coagulated protein released by kidney cells.
They are formed in the long, thin, hollow tubes of the kidneys known as tubules and usually take the shape of the tubule (hence the name). Under the microscope, they often look like the shape of a "hot dog" and in healthy people they appear nearly clear. This type of cast is called a "hyaline" cast. Normally, healthy people may have a few (0–5) hyaline casts per low power field (LPF). After strenuous exercise, more hyaline casts may be detected.
Other types of casts are associated with different kidney diseases, and the type of casts found in the urine may give clues as to which disorder is affecting the kidney. Cellular casts, such as red blood cell and white blood cell casts, indicate a kidney disorder. Some other examples of types of casts include granular casts, fatty casts, and waxy casts.

6-1) Urine Castes: -

Overview:
Urinary casts are cylindrical aggregations of particulate matter that form in the distal nephron, dislodge, and eventually pass into the urine.
Tamm-Horsfall protein (THP), or Tamm-Horsfall mucoprotein, is the most abundant protein in normal urine. normal daily excreted quantity ranges from 25 to 50 mg.

Function
Uromodulin may act as a constitutive inhibitor of calcium crystallization in renal fluids, and may provide defense against urinary tract infections.
Lindner's mechanism of cast formation.
The cast matrix is formed of uromucoprotein fibrils and is built by a mechanism described by Lindner. The mechanism has four steps:

Initiation: - the first Tamm-Horsfall protein fibrils are fixed to the distal tubular walls, forming a porous sponge like lattice. Since the initial cast has large pores, urine and small debris pass through. This stage could correspond to the early hyaline cast.

Growth as time goes, more and more elementary fibrils, and maybe other proteins, are added to the initial structure, making the pore smaller. The declining pores size reduces the urine flow through the structure.

Maturation After complete obstruction of urine flow, the cast matrix is modified by the tubular activity. The maturation period depends on the nephron activity, especially at the blockade region. Proteins, originating from the surrounding tubular cells, are added to the structure. With renal tubular injury, epithelial cells slough into the lumen of the renal tubules and precipitated on the mucoprotein matrix. With time, the epithelial cells degenerate and can no longer be recognized as cells within the hyaline matrix, thus forming coarsely granular, then finely granular, casts. Waxy casts are the final step in the formation of casts and usually indicate chronic tubular disease.

Evacuation

Because of the surrounding cells activity and the hydrostatic pressure, a time comes where the cast loses its adherence to the tubular wall. The casts are then evacuated by the urinary flow.

Normal: They are absent or very few in urine samples

Note: *Casts are quantified for reporting as the number seen per low power field (10x objective) and classified as to type (e.g., hyaline casts).*

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Subject: - Advanced laboratory techniques.
Lecture-No.6.
General Urine Examination-3 part-2.

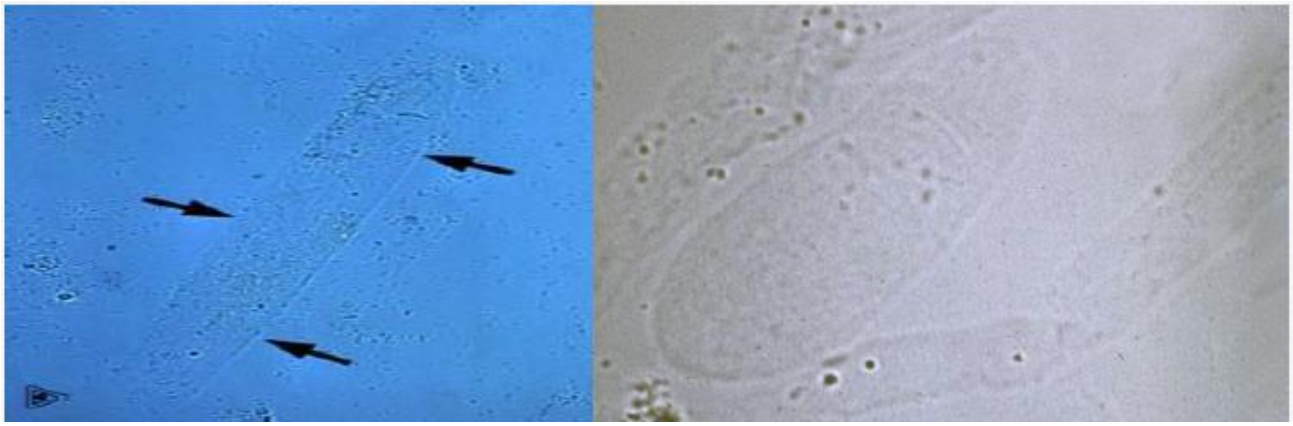
General Urine Examination

6-casts: -

Appearance:

The most common type of cast, hyaline casts are solidified Tamm-Horsfall mucoprotein secreted from the tubular epithelial cells of individual nephrons.

1-Hyaline casts: - are cylindrical and clear, with a low refractive index, so that they can easily be missed under bright field microscopy or on an aged sample where dissolution has occurred.



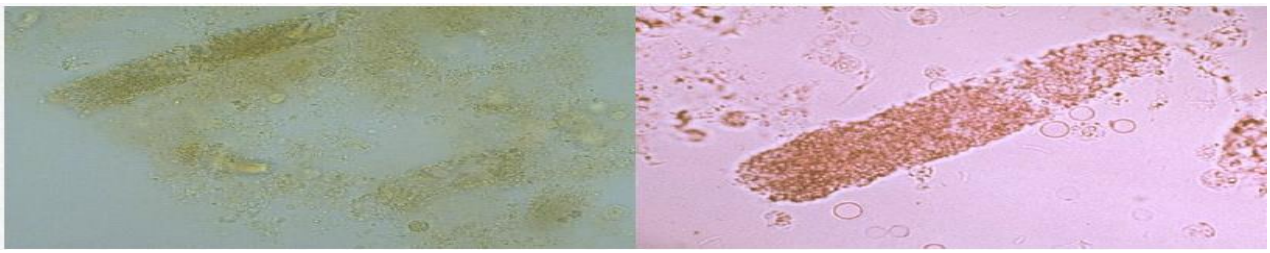
2-Granular casts: -

Appearance:

It can result either from the breakdown of cellular casts (remain in the nephron for some time before they are flushed into the urine), or the inclusion of aggregates of plasma proteins (eg, albumin) or immunoglobulin light chains.

Depending on the size of inclusions, they can be classified as fine or coarse, though the distinction has no diagnostic significance.

Appearance is generally more cigar-shaped and of a higher refractive index than hyaline casts.



7-Crystals

Urine contains many dissolved substances (solutes) – waste chemicals that the body needs to eliminate. These solutes can form crystals, solid forms of a particular substance, in the urine if:

The urine pH is increasingly acidic or alklain. The concentration of dissolved substances is increased; and the urine temperature promotes their formation.

Crystals are identified by their shape, color, and by the urine ph. They may be small, sand-like particles with no specific shape (amorphous) or have specific shapes, such as needle-like. Crystals are considered "normal" if they are from solutes that are typically found in the urine; these usually form as urine cools after collection and were not present in the body. Some examples of crystals that can be found in the urine of healthy individuals include:

-Amorphous urates
-Crystalline uric acid
-Calcium oxalates
-Amorphous phosphates

If the crystals are from substances that are not normally in the urine, they are considered "abnormal." Abnormal crystals may indicate an abnormal metabolic process. Some of these include:

Calcium carbonate
Cystine
Tyrosine
Leucine

Normal or abnormal crystals can form within the kidneys as urine is being made and may group together to form kidney "stones" or calculi. These stones can become lodged in the kidney itself or in the ureters, tubes that pass the urine from kidney to the bladder, causing extreme pain. For more details, read Kidney Stone Analysis and Kidney Stone Risk Panel.

Urine Crystals

Overview:

A variety of crystals may appear in the urine. They can be identified by their specific appearance and solubility characteristics. Crystals in the urine may present no symptoms, or they may be associated with the formation of urinary tract calculi and give rise to clinical manifestations associated with partial or complete obstruction of urine flow.

Q-) Why urine crystals are formed?

When the amount of solutes in urine increase (due to dehydration, dietary intake, or medications) urine super-saturation occurs and crystals will be formed either while the urine in the body or after the urine is voided

Factors influence the types and numbers of urinary crystals

In vivo factors include:

1-the concentration and solubility of crystallogenic substances contained in the specimen, 2-the urine pH, the excretion of diagnostic and therapeutic agents.

In vitro factors include:

temperature (solubility decreases with temperature), evaporation (increases solute concentration), and Urine pH (changes with standing and bacterial overgrowth).

Procedure:

Collect a random urine specimen.

Note: *Crystal identification should be done on freshly voided specimens.*

Examine the urinary sediment microscopically under high power.

The pH of the urine is an important aid to identification of crystals and must be noted.

Interfering Factors

Refrigerated urine will precipitate out many crystals because the solubility properties of the compound are altered.

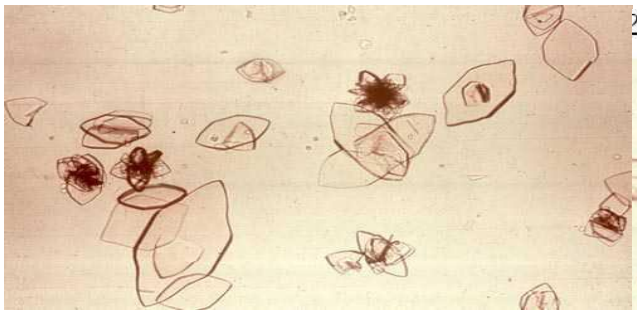
Urine left standing at room temperature will also cause precipitation of crystals or the dissolving of the crystals.

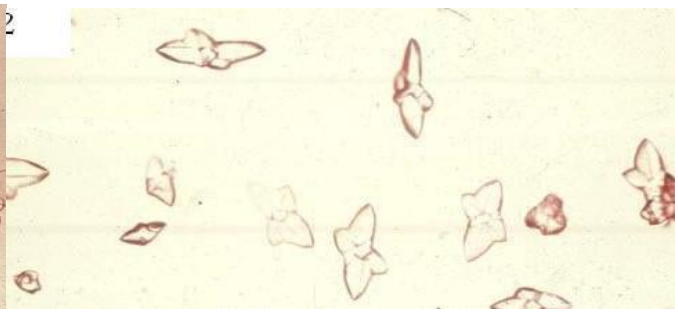
Appearance:

Uric Acid crystals

Pure uric acid crystals are colorless but the sediment in urine is impure so these crystals usually appear pigmented. Uric acid crystals may appear as yellow to brown rhombic or hexagonal plates, needles or rosettes.

It may be found in gout, kidney stones, chronic nephritis.



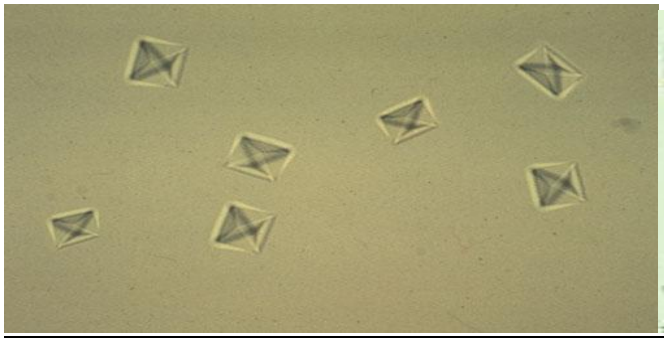


-Calcium Oxalate crystals (Dehydrate)

Calcium oxalate dehydrate crystals typically are seen as colorless squares whose corners are connected by intersecting lines (resembling an envelope).

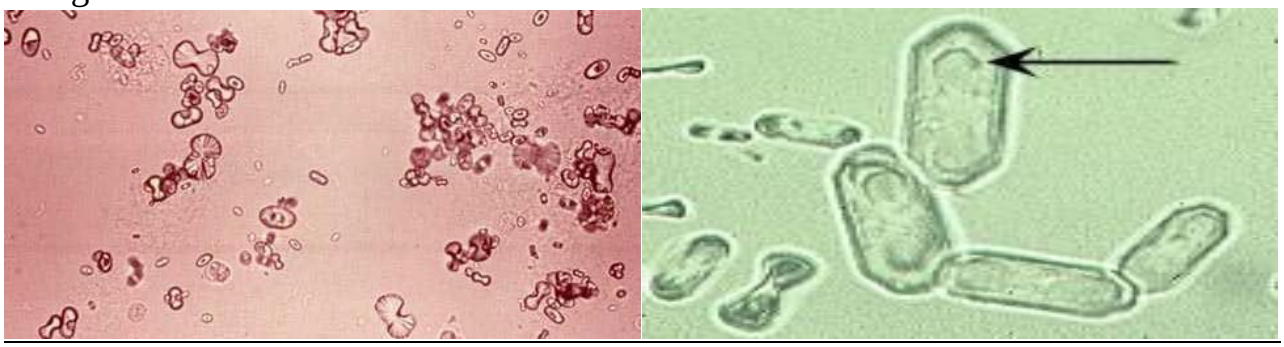
The crystals vary in size from quite large to very small.

Note: In some cases, large numbers of tiny oxalates may appear as amorphous unless examined at high magnification.

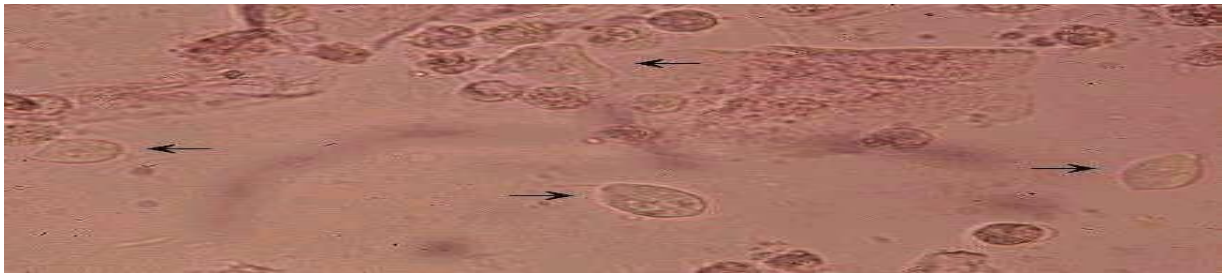


-Calcium Oxalate crystals (monohydrate)

Calcium oxalate monohydrate crystals vary in size and may have a spindle, oval. Found normally in urine after ingestion of vitamin C, tomato, spinach, garlic and orange.



-Trichomonas vaginalis.
-Habitat.
-If male: urinary bladder, urethra, prostate.
-If female: vagina, and cervix.
-Mode of infection.
□ Directly through sexual intercourse as parasite can't live outside body for long period.
□ Indirectly through using patients articles as under wear clothes.
Pathology.
Female symptoms.
Infection is asymptomatic in 15-20% of cases.
Symptoms associated with Trichomonas infection in women include:
□ dysuria [painful urination].
□ Painful sexual intercourse.
□ Burning sensation of the vagina.
Green/Yellow, frothy vaginal discharge with a strong foul-smelling odor.
□ **Trichomonas infection may cause Vaginitis, and Cervicitis**.
Male symptoms
Infection is asymptomatic in 50-90% of cases
Symptoms associated with Trichomonas infection in male include:
□ dysuria.
□ Mild urethral discharge.
□ Slight burning after urination or ejaculation.
□ Trichomonas infection may cause Urethritis.



Schistosome haematobium

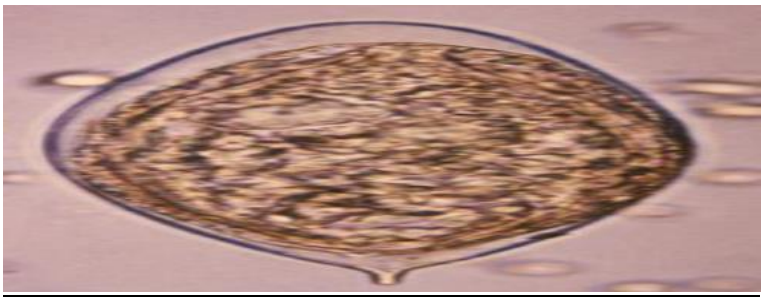
Diagnosis

Clinical diagnosis Clinical signs & symptoms of urinary schistosomiasis include:

- Haematuria is a common finding.
- Proteinuria is frequently present.
- Eosinophils can often be found in the urine.
- There is usually also a blood eosinophilia.

Urine examination

Examination of urine for detection of egg this help in acute cases when egg can be detected easily in urine.



Urine other findings

Bacteriuria

Overview:

bacteriuria means the presence of bacteria in urine.

Gram-negative bacilli Escherichia coli are the most common bacterium isolated from urine samples (>80% of UTIs are caused by E. coli).

Smaller percent are caused by Gram-positive cocci (5% to 20%)

Appearance:

Bacteria can be identified in unstained urine sediments when present in sufficient numbers. Rod-shaped bacteria and chains of cocci can be found.

Note: When urine is allowed to remain at room temperature, the number of bacteria doubles every 30 to 45 minutes.

Interpretation:

Bacteria in the urine usually indicate a urinary tract infection (either cystitis or pyelonephritis),

Note: Bacteriuria of clinical significance is usually accompanied by pyuria in ~90% of cases.

Urinary tract infection

A urinary tract infection (UTI) is a bacterial infection that affects any part of the urinary tract.

Any part of this system can become infected. As a rule, the farther up in the urinary tract the infection is located, the more serious it is.

Infection in the upper urinary tract generally affects the kidneys (***pyelonephritis***).

Infection in the lower urinary tract can affect the urethra (***urethritis***) or the bladder (***cystitis***).

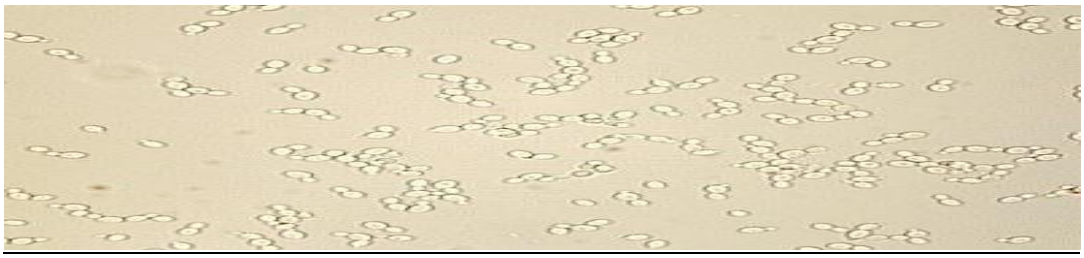
causes

Urinary tract infections typically occur when bacteria enter the urinary tract through the urethra (an ascending infection) and begin to multiply in the bladder.

The majority of UTIs are believed to start in the bladder as a result of extreme contamination (commonly by Escherichia coli); but in many cases the initiating event is unclear.

In many cases, bacteria first travel to the urethra. When bacteria multiply, an infection can occur. An infection limited to the urethra is called urethritis. If bacteria move to the bladder and multiply, a bladder infection, called cystitis, results. If the infection is not treated promptly, bacteria may then travel further up the ureters to multiply and infect the kidneys. A kidney infection is called pyelonephritis.

Note: *upper urinary tract infections like pyelonephritis may be hematogenous in origin.*



AL-Mustaqbal University Collage.
Department of Pathological Analysis Technique.
Subject: - Advanced laboratory techniques.
Lecture-No-6.
General stool Examination.

Stool Analysis

Digestive System

The digestive system is an entire organ that work together in a process known as digestion. It consists of two parts: The Alimentary tract (Gastro Intestinal Tract) (GIT) and the accessory glands. Fig (1)

Functions: process food that is placed in the mouth and that passes through the digestive tract where it is broken down, processed, absorbed and utilized as energy that fuels the body's daily functions. The excess of dietary mass and any toxins or waste products that are produced through metabolic processes are excreted through the anus. Organs that are indirectly involved are known as the accessory digestive organs.

Figure

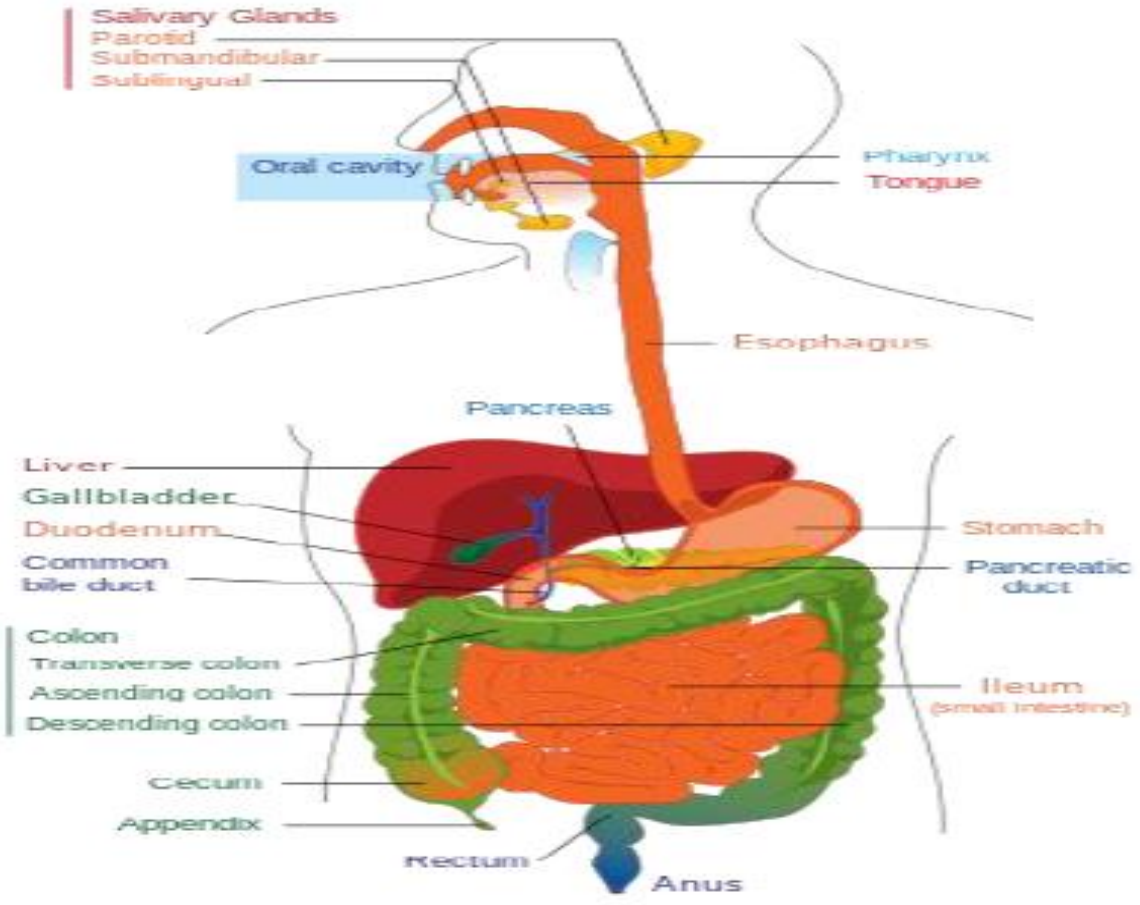


Figure (1) .The human digestive system.

Anatomy of the Digestive System
The digestive system consists of two main parts:
1-The gastrointestinal tract (GIT)
This tract is divided into the upper and lower gastrointestinal tracts:
Upper Gastrointestinal Tract
The upper gastrointestinal tract includes:
A- Oral cavity(Mouth)
B- Pharynx
C- Esophagus: the fibro muscular tube through which food passes, aided by peristaltic contractions, from the pharynx to the stomach.
D- Stomach: secretes protein-digesting enzymes called proteases and strong acids to aid in food digestion, before sending partially digested food to the small intestines.
E- Duodenum: the first section of the small intestine and may be the principal site for iron absorption

Lower Gastrointestinal Tract :-

The lower gastrointestinal tract includes most of the small intestine and all of the large intestine. According to some sources, it also includes the anus.
a-The small intestine has three parts:
 Duodenum: Here the digestive juices from the pancreas (digestive enzymes) and the gallbladder (bile) mix together. The digestive enzymes break down proteins and bile emulsify fats into micelles. The duodenum contains Brunner's glands which produce bicarbonate, and pancreatic juice contains bicarbonate to neutralize hydrochloric acid of the stomach.
 Jejunum:الصائم This is the midsection of the intestine, connecting the duodenum to the ileum. It contains the plaice circulars and villi to increase the surface area of that part of the GI Tract.
 Ileum: الامعاء الغليضهHas villi, where all soluble molecules are absorbed into the blood (capillaries and lacteals).
b-The large intestine has four parts:
 Cecum: The vermiform appendix is attached to the cecum.
 Colon: Includes the ascending colon, transverse colon, descending colon, and sigmoid flexure. The main function of the colon is to absorb water, but it also contains bacteria that produce beneficial vitamins like vitamin K.
 Rectum
 Anus
2-Accessory glands
The accessory glands consist of the salivary gland, liver, pancreas and gall bladder.

Function of digestive system

 The digestive system responsible for consuming and digesting foodstuffs, absorbing nutrients, and expelling waste, and this the main function of digestive system.

The time taken for food or other ingested objects to transit through the gastrointestinal tract varies depending on many factors, but roughly, it takes less than an hour after a meal for 50% of stomach contents to empty into the intestines and total emptying of the stomach takes around 2 hours. Subsequently, 50% emptying of the small intestine takes 1 to 2 hours. Finally, transit through the colon takes 12 to 50 hours with wide variation between individuals.

 Immune barrier

The gastrointestinal tract is also a prominent part of the immune system. The surface area of the digestive tract is estimated to be the surface area of a football field. With such a large exposure, the immune system must work hard to prevent pathogens from entering into blood and lymph.

The low pH (ranging from 1 to 4) of the stomach is fatal for many microorganisms that enter it. Similarly, mucus (containing IgA antibodies) neutralizes many of these microorganisms. Other factors in the GI tract help with immune function as well, including enzymes in saliva and bile Health-enhancing intestinal bacteria of the gut flora serve to prevent the overgrowth of potentially harmful bacteria in the gut. These two types of bacteria compete for space and "food," as there is limited resources within the intestinal tract. A ratio of 80-85% beneficial to 15-20% potentially harmful bacteria generally is considered normal within the intestines. Microorganisms also are kept at bay by an extensive immune system comprising the gut-associated lymphoid tissue (GALT).

 Normal Gastrointestinal Microbes (normal flora) Bacteria make up most of the flora in the colon and up to 60% of the dry mass of feces. Somewhere between 300 and 1000 different species live in the gut. Fungi and protozoa also make up a part of the gut flora, but little is known about their activities.

The microorganisms perform a host of useful functions, such as:

1-Fermenting unused energy substrates **2**-Training the immune system, **3**-Preventing growth of harmful, pathogenic bacteria,**4**- Regulating the development of the gut, **5**-Producing vitamins for the host (such as biotin and vitamin K), and **6**-Producing hormones to direct the host to store fats.

Stool or Feces:-

Define as: A wastes of food digestion which did not absorbed.

Normal stool characteristics:

Brown in color, soft, homogenized, do not contain blood, mucus, pus, .bacteria, fungi, parasites or viruses, looks like cylinder , PH=6, contain less than 2-5mg/g stool reducing factors and its quantity around 200g/day.

Diseases of digestive system

There are a number of diseases and conditions affecting the gastrointestinal system, including:

Infection: Gastroenteritis is an inflammation of the intestines. It occurs more frequently than any other disease of the intestines.

-Classification of infection in the digestive system

Infections in the digestive system are classified in two groups:

Exogenous infections –pathogens that come into the body

–organisms that are part of the normal microbial flora

Exogenous infections:-

**C. difficile* and other exogenous infections are frequently acquired in hospital environments.

**Helicobacter pylori* spreads through oral-oral or fecal-oral contact.

*Exogenous infection can cause nausea and vomiting within 6 hours.

Endogenous infections:-

*Endogenous infection are caused by organisms that are part of normal flora.

Streptococcus and ***Enterococcus*** are example.

In the right circumstances the can cause: -

-Dental disease.

-Infection of bowel, appendix and liver.

-Diverticular abscesses.

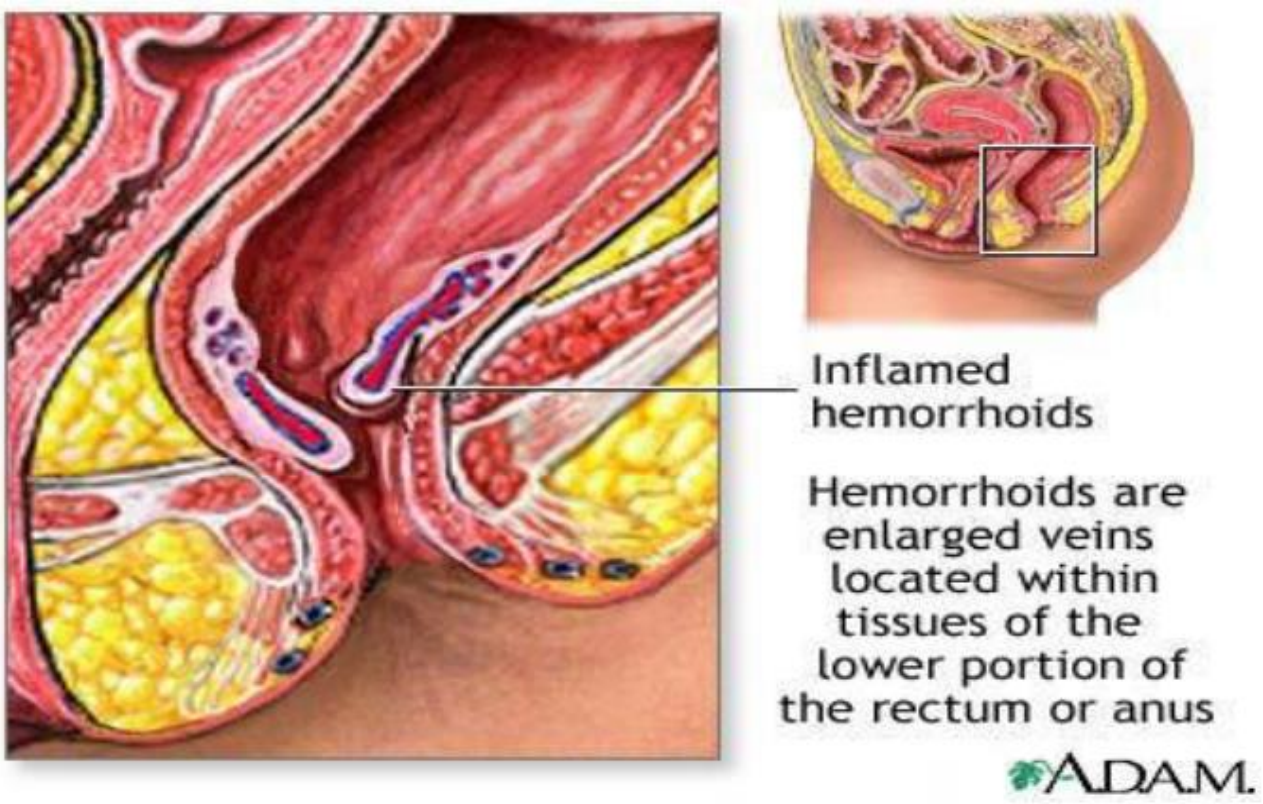
*Cancer:- may occur at any point in the gastrointestinal tract, and includes mouth cancer, tongue cancer, esophageal cancer, stomach cancer, and colorectal cancer.

Inflammatory conditions: **Ileitis** is an inflammation of the ileum; **Colitis** is an inflammation of the intestine, **Appendicitis**: Is inflammation of the vermiform appendix located at the caecum. This is a potentially fatal condition if left untreated; most cases of appendicitis require surgical intervention.

 Diverticular disease: Is a condition that is very common in older people. It usually affects the large intestine and the small intestine as well.

Diverticulosis occurs when pouches form on the intestinal wall. Once the pouches become inflamed it is known as diverticulitis, (the patients stool is red and bloody).

- Cholelithiasis, gallstones in the gallbladder
- Peptic ulcer, open sore in the lining of the stomach or duodenum
- Anal fistula, abnormal tube-like passageway near the anus.
- Dysentery, painful, inflamed intestines commonly caused by bacterial infection.
- Hemorrhoids, swollen, twisted, varicose veins in the rectal region



Symptoms

Several symptoms are used to indicate problems with the gastrointestinal tract:-

- **Nausea,** unpleasant sensation in the stomach associated with a tendency to vomiting.

Vomiting :-which may include regurgitation of food (due to GIT inflammation, acute pain, drugs, pregnancy, emotions)or the vomiting of blood (**as** in upper GIT bleeding (Haematomesis))**.**

- **Melena,** black, tarry stools; feces containing digested blood (which isa sign of upper GIT bleeding)**.**

 Diarrhea, the passage of liquid or more frequent stools (watery), more than three times in a day and more than 200g/day, and with incontinence. There are two types of diarrhea: Acute and chronic diarrhea.

-Acute Diarrhea : short in time , do not need any medication unless the patient is immunecomprised. Most cases (90%) are due to ingestion of contaminated food with bacteria or its toxin ,viruses and parasites, the rest (10%) are due to medication drugs like antibiotics.
-Chronic Diarrhea: long in time (more than one month), need medication for dehydration because of losing K, Mg, Na salts which may cause death. The causes of chronic Diarrhea are colitis, mal-absorption, colon cancer, irritation of small intestine with some drugs.
 Constipation, which refers to the passage of fewer and hardened stools (difficulty in passing stools (feces)), due to: pregnancy, GIT obstructions with tumors, diverticulum and hemorrhoids, Age.
 Dysphagia, difficulty in swallowing.
 Eructation, gas expelled from the stomach through the mouth
 Flatus, gas expelled through the anus.
 Jaundice (icterus), yellow-orange coloration of the skin and whites of the eyes caused by high levels of bilirubin in the blood (hyperbilirubinemia)
 Statorrhea, fat in the feces; frothy, foul-smelling fecal matter, due to mal-absorption which result from pancreatic diseases.