Oral Medicine

LABORATORY INVESTIGATIONS

Lecture 4

Dr. Mohanad Jameel

Biochemical Tests

Diabetes tests

1. Fasting plasma glucose (FPG) test or (Fasting blood sugar):

The FPG blood test measures blood glucose level at a single point in time.
For the most reliable results, it is best to have this test in the morning, after you fast for at least 8 hours.
Fasting means having nothing to eat or drink except sips of water.
Normally 120-140 mg/dl

2. Random plasma glucose (RPG) test

The RPG test to diagnose diabetes when diabetes symptoms are present and we don't want to wait until you have fasted.
Do not need to fast overnight for the RPG test. Therefore, this blood test can do at any time.
Over 200 mg/dl is diabetes

3. Hemoglobin A1c (HbA1c)

HbA1c or glycated haemoglobin is a form of haemoglobin that is chemically linked to a glucose. Therefore, this test used to identify the three-month average plasma glucose concentration. The test is limited to a three-month average because the lifespan of a red blood cell is four months (120 days).

One advantage of using HbA1c for diagnosis is that the test does not require a fasting blood sample. The A1C test is not accurate in people with anemia.

The test result as a percentage, such as an A1C of 7 percent. The higher the percentage, reflect the higher average blood glucose levels.

People with diabetes also use information from the A1C test to help monitor and manage their diabetes.

Normal value: below 5.7%, prediabetes 5.7- 6.4%, diabetes above 6.5%.

4. Oral glucose tolerance test (OGTT)

The OGTT measures blood glucose after fast for at least 8 hours. Then, first blood draw. After that, patient will drink liquid containing glucose, then blood drawn every hour for 2 to 3 hours.

It used to diagnose gestational diabetes, so high blood glucose levels at any two or more blood test times during the OGTT— fasting, 1 hour, 2 hours, or 3 hours—mean gestational diabetes.

The OGTT helps to detect type 2 diabetes and prediabetes better than the FPG test. However, the OGTT is a more expensive test and is not as easy to give.

Normal value is **below 139 mg/dl** , prediabetes **140-199 mg/dl** , diabetes above **200 mg/dl**

Liver Function tests:

Alanine transaminase (ALT) test.

ALT is an enzyme that helps break down proteins and is found mainly in the liver.
High levels in blood could means liver damage.
Normal value 0-35 IU/L in male, 0-20 IU/L in female.

Alkaline phosphatase (ALP) test.

ALP is an enzyme in the liver, bile ducts and bone. The patient might have high levels if have liver damage or disease, a blocked bile duct, or bone disease.
Normal value 30-80 IU/L

Albumin and total protein test.

Two main proteins: albumin and globulin. Low levels can mean liver damage or disease.
Normal values:
S. Albumin = 3.6- 4.5 g/dl.
S. globulin = 2.6- 3.5 g/dl.
Total protein= 6.7-8.3 g/dl.

Aspartate transaminase (AST) test.

AST is another enzyme found in the liver. High blood levels could be a sign of liver damage or disease.

Normal value: 8 - 33 U/L

Bilirubin test.

Bilirubin is made when red blood cells break down. Usually, the liver cleans bilirubin out of the body. If high levels in blood, a problem called jaundice, and means liver damage.

S.bilirubin up to 1mg/dl.

Gamma-glutamyl transferase (GGT) test.

High levels of the GGT enzyme could point to liver or bile duct damage.

Normal value: 9 - 48 U/L

Lactate dehydrogenase (LDH) test.

LD is another enzyme that’s high when have liver damage, but there are other important conditions can raise its level such as acute MI.

Normal value: 140 -280 U/L

kidney function tests

The usual blood tests which check that the kidneys are working properly by measuring the levels of urea, creatinine and certain dissolved salts.

1.Urea

Is a waste product formed from the breakdown of proteins. Urea is usually passed out in the urine. A high blood level of urea ('uraemia') indicates that the kidneys may not be working properly, or that you have a low body water content (dehydrated). **Normal value: S.urea =15-50mg/dl.**

2. Creatinine

Is a waste product made by the muscles. Creatinine passes into the blood stream, and is usually passed out in urine.

A high blood level of creatinine indicates that the kidneys may not be working properly.

Creatinine is usually a more accurate marker of kidney function than urea.

The effect of muscle mass needs to be taken into account.

A person with a lot of muscle and little fat on their body is likely to have a higher creatinine than a person who has a lot of fat and little muscle.

Normal value: S. creatinin up to 1mg/dl.

3. Estimated glomerular filtration rate (eGFR):

It estimates how much blood passes through the glomeruli each minute (glomeruli are the tiny filters in the kidneys that filter waste from the blood). It provides a guide to kidney function. Although the level of creatinine in the blood is a useful guide to kidney function, the eGFR is a more accurate measure.

The normal value for eGFR is 90-120 ml/min.
An eGFR below 60 ml/min suggests that some kidney damage has occurred. The value becomes lower with increasing severity of kidney damage.

4. Dissolved Salts

That are routinely measured are sodium, potassium, chloride and bicarbonate. They are sometimes referred to as '**electrolytes'.**

Abnormal blood levels of any of these may be due to a kidney problem. (Some other conditions may also alter the salt balance in the blood).

Lipid profile

The test includes basic parameters:

1. **Total cholesterol**, normally= up to 200mg/dl.
2. **Triglycerides (TG),** normally= 90-180mg/dl.
3. **HDL (high density lipoprotein),** normally more than 40 mg/dl.
4. **LDL (low density lipoprotein),** normally less than 130mg/dl.

Cholesterol is a type of fat or lipid that is produced in the liver and is necessary for the proper functioning of the body .

When cholesterol levels are in the normal range, in a healthy body, the blood flows freely through the veins and arteries.

When the cholesterol levels are high, it starts forming clots (plaques) in the blood vessels causing hypertension (high BP), angina (chest pain), heart attacks, strokes and peripheral vascular diseases.

HDL transporting them from the blood vessels to the liver for excretion.
LDL adds cholesterol to blood by transporting it from the liver.

Urinlysis

1.Glycosuria :

Used in diagnosis of diabetes mellitus.

2. Ketonuria:

This may be a sign of diabetic ketoasidosis.

3. Bilirubin or urobilinogen:

Either of these may indicate hepatobiliary disorders or hemolytic anemia.

4. Proteinuria:

Is increased levels of protein in the urine. This condition can be a sign of kidney damage.
Normal value of protein in urea 2-8 mg/dl.

5. Haematuria:

Presence of blood in urine, may be due to menstruation or indicate renal or urinary tract diseases.

Immunological investigations

Also called (antibody tests), these tests are performed on serum to measure concentration of specific antibody against specific pathogen or antigen.

The main reasons for using of immunological tests are:

1. Confirm of exposure to an infection or foreign agent.
2. Evaluate of protection level (immune status) against particular micro-organisms.
3. Diagnosis of autoimmune conditions.
4. Diagnosis of allergy.
5. Diagnosis of the reason of transfusion reaction or a rejection of transplanted organ.

1. Rhumatoid factor:

Are protein produced by immune system that can attack healthy tissue in the body. High levels of rheumatoid factor in the blood are most often associated with autoimmune diseases, such as rheumatoid arthritis and sjogren syndrome.

2. Anti nuclear antibody ANA:

Are a type of antibody called an autoantibody, normally negative or titer less than 1:10. It is higher in case of rheumatoid arthritis, sjogren syndrome, systemic lupus erythromatosis.
It includes: **anti DNA antibody & anti double strand DNA test**.

3. Viral Hepititis Tests:

a. Hepititis A Viruse (HAV):

HAV IgM	• Presence indicates current or recent infection. A negative result indicates absence of infection.
HAV IgG	• Presence indicates past infection.
HAV total Ab	• Presence of total (IgM and IgG) HAV antibody indicate current and past infection.

b. Hepititis B Viruse (HBV):

HBsAg	• Presence indicates that a person has HBV infection and is infectious.
HBcAb, total	• Presence indicates past or current HBV infection.
HBcAbIgM	• Presence usually indicates HBV infection within the preceding 4 - 6 months (i.e. acute infection).
HBeAb	• Presence indicates resolving infection or response to therapy.
HBeAg	• Presence indicates active viral replication and high infectivity.
HBsAb	• Presence indicates resolution and immunity against HBV infection or response to vaccination.

C. Hepititis C Viruse (HCV):

HCV RNA

- Presence indicates current infection. A negative result indicates absence of current infection.

HCV Ab

- Presence (with detectable HCV RNA) indicates current infection.

A positive result coincident with a negative HCV RNA test may indicate a resolved infection.

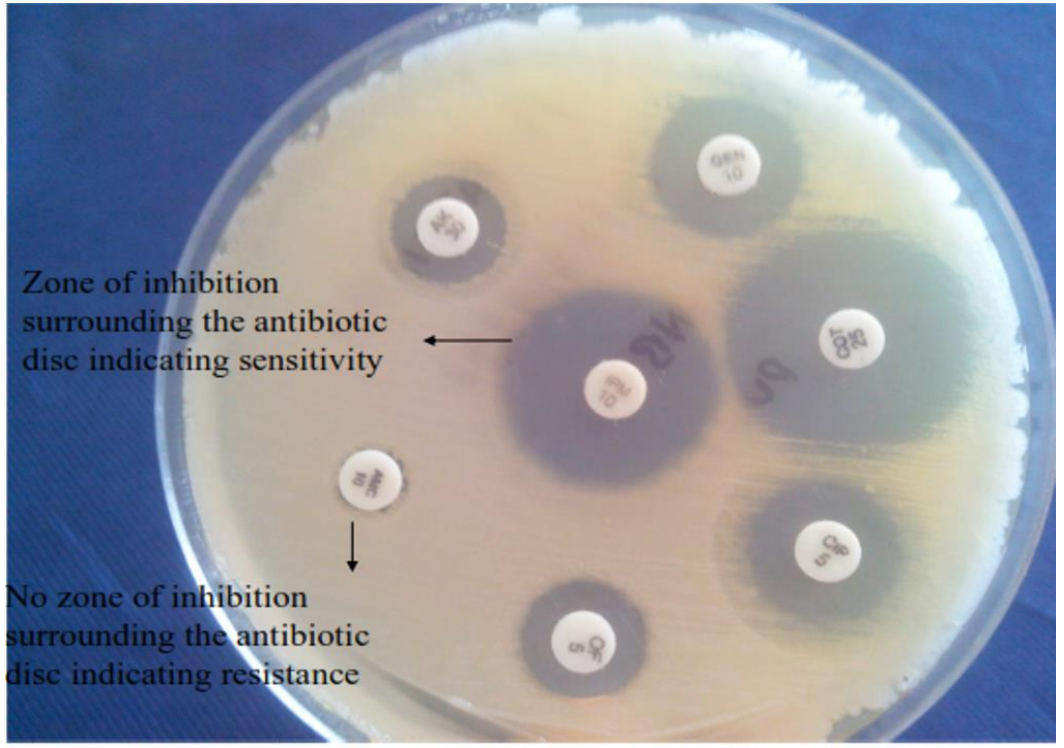
Microbiological Tests

1. Culture and antibiotic sensitivity tests:

It useful in:

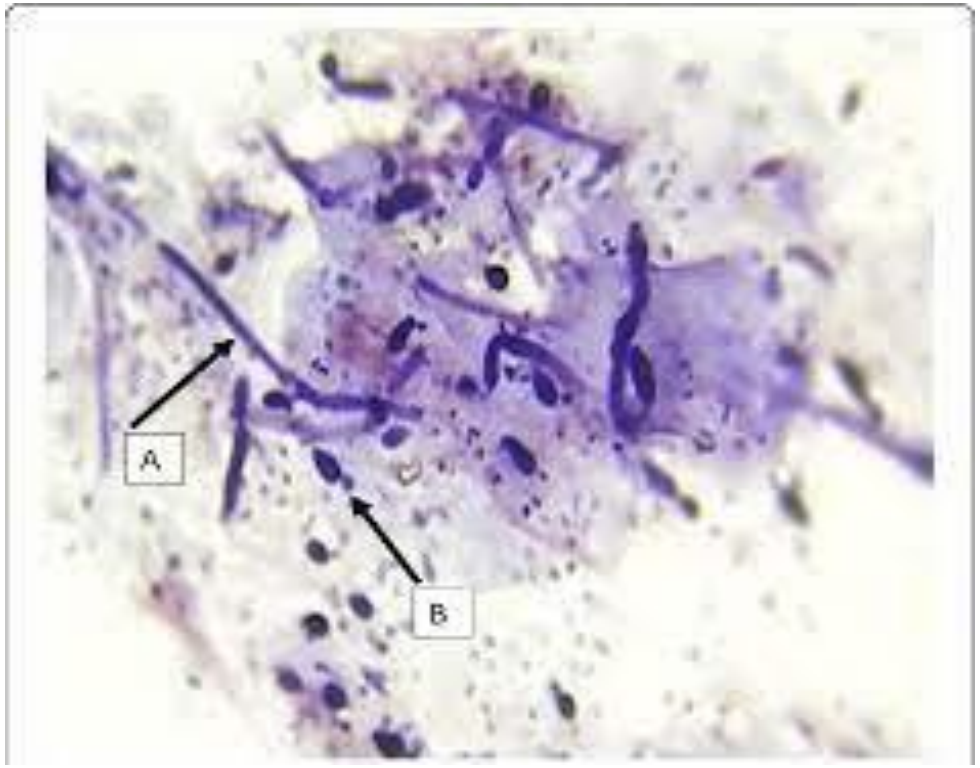
a) Identification of species and strain of bacteria and detection of unusual pathogens, e.g actinomycosis in soft tissue infection.

b) Determination of the most effective antibiotic that inhibiting the growth of bacteria.



2. Fungi

By the direct smear from the area stained by the periodic acid shift or gram stain and the presence of the typical hyphae indicate the Candida proliferation.



3. Virology:

Tissue culture, antigen detection, identification of genetic material (PCR)

Cytopathological and Histopathological Tests

Cytology:

Is the microscopic examination of a single cell type, as often found in fluid specimens to study of the microscopic appearance of cells, especially for the diagnosis of certain pathological conditions such as pemphigus vulgaris and malignancies.

Biopsy (Histopathological test):

Is the removal of a part or whole lesion by using of a sharp dissection to avoid crushing then fixation in 10% neutral buffered formalin or similar fixative solution and send to histopathological examination to examine tissue under a microscope to provide information about signs and extent of disease.

Types of biopsy:

1- Incisional biopsy:

It is indicated in case of distributed or diffuse large lesion by taken of part of the lesion and another from normal surrounding tissue. This method is used to determine diagnosis before treatment. e.g white lesion like lichen planus.

2. Excisional biopsy:

In this case the entire lesion is removed as in small lesions like papilloma or mucocel.
This biopsy used to confirm diagnosis.

3. Fine needle aspiration (FNA)

Is sometimes considered a cytology test and is sometimes considered a biopsy. During fine-needle aspiration, a long, thin needle is inserted into the suspicious area.

A syringe is used to draw out fluid and cells for analysis & smeared on slide.

It is rapid & usually effective in case of cystic lesion or deep cavities when other types of biopsy can’t be used.

In addition, differentiation of malignant from benign neoplasm although it is not completely conclusive.

Usually small size of the needle is used to avoid damage of vital structure & it is valuable in case when incisional biopsy contra indicated as in pleomorphic adenoma or other types of malignant lesions in parotide gland.

Disadvantage: it requires experience, small specimen may be unrepresentative, definitive diagnosis is not always possible

4. Core needle biopsy:

A larger needle with a cutting tip is used during core needle biopsy to draw a column of tissue out of a suspicious area.

The sample are larger than FNA & preserve architecture of tissue, give more definitive diagnosis than FNA, but there is increase of the risk of seeding of neoplasm into the tissue & risk of damaging vital structures.

It is used when incisional biopsy is inaccessible e.g. laryngeal tumor.

4. Exfoliative cytology:

It includes scraping the surface of a possible mucosal lesion with a knife and spreading a small layer of the scrape onto a glass slide so that the cells in the scrape can be stained and examined under a microscope.

Most useful in detecting virally damaged cells, acantholytic cells of pemphigus or candidal hyphea, but it unreliable in diagnosis of cancer.

The main disadvantage that examination of cells that scraped from the surface of the lesion does not provide information about deeper layers.

5. Brush biopsy:

By using of a round stiff –bristle brush to collect cells

from surface and subsurface layer of a lesion by vigorous

abrasion.

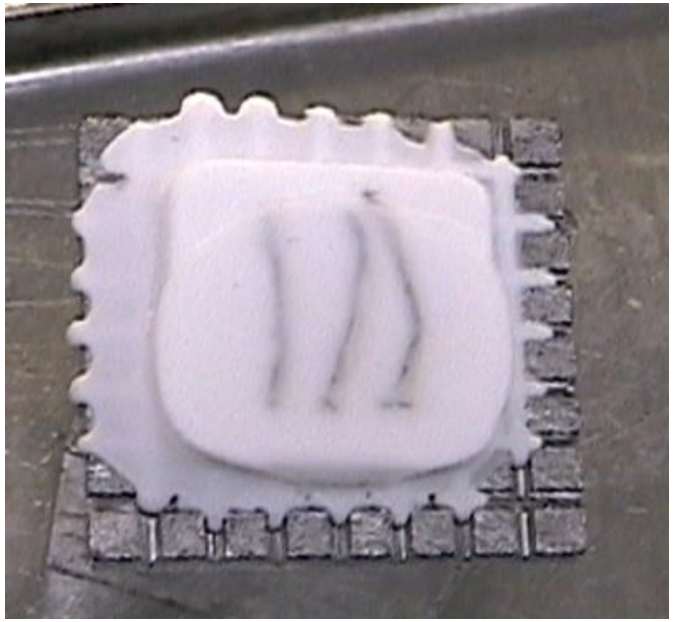
6. Frozen section biopsy

Is a specific type of biopsy procedure that allows a surgeon to establish a rapid diagnosis of a suspicious mass during surgery. The technical name for this procedure is **cryosection.**

Frozen sections allows a stained slide to examined within 10 min of taking the specimen, the tissue is send fresh to lab.

To be quickly frozen to about -70 ^{o}c by liquid nitrogen or dry ice, section is cut on refrigerated microtome and stained

The main advantage: is the time is too little so frozen section can be established at operation to determine whether tumor benign or malignant.



The disadvantages: the section appear different from fixed material, also freezing artifacts can distort the cellular picture, and definitive diagnosis some times impossible