AN OVERVIEW ON PATHOLOGY:CLINICAL CHEMISTRY OF BLOOD

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Abstract: The purpose of pathology is to inform the laboratory and clinical physician about the clinicopathologic significance of human disease. Clinical pathology, which includes clinical chemistry, haematology, and microbiology, is the gathering of samples for analytical testing carried out in a clinical laboratory. Simple blood testing, a light microscope introduction, a semi-auto analyzer introduction, anaemia, a WBC disorder, and hematologic value are all included in this review. Pathology reviews are carried out to make sure that the procedures for obtaining tissue don't negatively affect patient care, to make sure the study can be conducted with the available tissue, and to make sure all local, state, federal, and hospital regulations are followed.

Keywords: Blood, Red cell, Erythrocytes, Morphology, Haematology, etc.

I.   INTRODUCTION:

Clinical Chemistry:

Clinical chemistry quantifies the amounts of chemical components in bodily tissues and fluids by means of chemical reactions. The study of body fluid biochemistry is known as clinical chemistry. Measurements of the concentrations of components such as glucose, lipids, enzymes, electrolytes, hormones, proteins, and other metabolic products in samples of human blood and urine required for clinical examination are also made by clinical chemistry using techniques such as spectrophotometry, immunoassays, and electrophoresis. [1]

Blood: Blood is a unique body fluid. Red blood cells, white blood cells, platelets, and plasma are main four constituents. Blood performs delivering nutrients and oxygen to the tissues and lungs.

Serum: The fluid and solute part of blood that isn't involved in clotting is called serum. Serum contains all proteins that aren't involved in blood coagulation, as well as electrolytes, antibodies, antigens, hormones, and any external materials (such medications or microbes). Platelets, erythrocytes (red blood cells), leukocytes (white blood cells), and clotting factors are absent from serum. [2]

Urine: In humans and many other animals, urine is a liquid by product of metabolism. Via the ureters, urine travels from the kidneys to the bladder. Urine is expelled from the body through the urethra after urination. Many by products of cellular metabolism, such as urea, uric acid, and creatinine, are nitrogen-rich and need to be eliminated from the bloodstream. The mammalian body's nitrogenous wastes can be found via urinalysis.

Plasma: The membrane present in every cell that divides the inside of the cell from the external world is known as the plasma membrane, sometimes referred to as the cell membrane. Lipid bilayers that are semi permeable make up the plasma membrane. Materials enter and leave the cell through channels that are controlled by the plasma membrane.

Cerebrospinal Fluid: It is a clear, colourless body fluid found within the tissue that surrounds the brain and spinal cord of all vertebrates. CSF is produced by specialized cells in the choroid plexus of the ventricles of the brain, and absorbed in the arachnoid granulations. [3]

1. **Erythrocytes: Abnormal cells and their significance:**

Definition: It is important components of blood are erythrocytes, also known as red blood cells (RBCs). These blood cells move throughout the body, delivering oxygen from the lungs to every tissue. [4]

Clinical significance of RBC:

- Used to detect the anaemia
- Used to detect Haemorrhage
- Used to determine the of anaemia
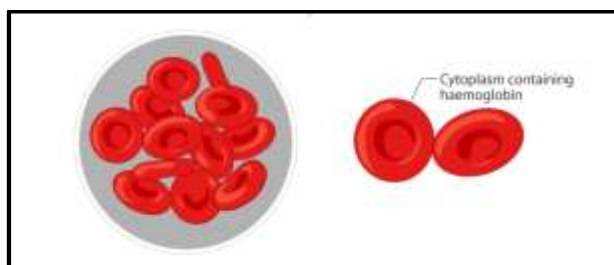- Used to help diagnose blood related condition such as iron deficiency anaemia. [5]

Fig. No. 1: Erythrocytes

2. **Anaemia:**

Definition: Anaemia from Greek word (anaemia) meaning lack of blood. It is a decrease in number of red blood cells (RBCs) or less than the normal quantity of haemoglobin in the blood.

Men: Hb 13.5 gm/100ml and

Women: Hb< 12.0 gm/100ml

Types of Anaemia:

1. **Nutritional Anaemia:**

- **Pernicious Anaemia**: Pernicious Anaemia, one of the causes of vitamin B12 deficiency, is an autoimmune condition that prevents your body from absorbing vitamin B12.
- **Iron deficiency Anaemia:** as its name implies iron deficiency Anaemia happens when your body doesn't have enough iron to make haemoglobin. Haemoglobin is the substance in your red cells that enables them to carry oxygen throughout your body.

2. **Inherited Anaemia:**

- Sickle cell Anaemia: Sickle cell Anaemia changes your red blood cells' shape, turning round flexible dices into stiff and sticky sickle cells that block blood flow
- Fanconi Anaemia: Fanconi Anaemia is a rare blood disorder. Anaemia is one sign of Fanconi Anaemia.
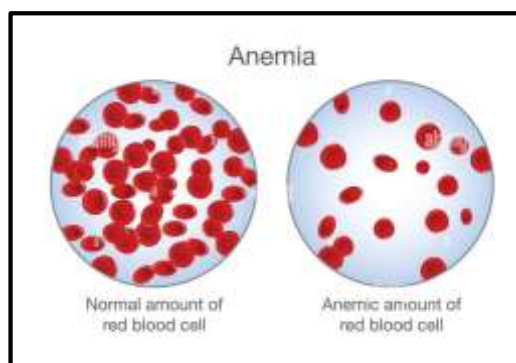- Diamond- Blackfan Anaemia: This inherited disorder keeps your bone marrow from making enough red blood cell.[6]

Fig. No. 2: Amount of RBC

Symptoms of Anaemia:

- Shortness of breath: This is the feeling you can't catch your breath or take a deep breath
- Dizziness: is feeling lightheaded or unsteady on your feet.

- Fast or irregular heartbeat (arrhythmia): This is when your heart feels like its racing or skipping beats.

- Headache: Iron-deficiency Anaemia and Anaemia caused by low haemoglobin may cause headache

- Pale or yellow skin: Your skin colour may be paler than usual.

- Chest pain: This may feel like something is pressing on or squeezing your chest.[7]

Diagnosis of Anaemia: A complete blood count test will measure your red blood cells, haemoglobin and other parts of your blood.

3. **Disorder of WBC:** Two major types of white blood cell disorders.

    a. Proliferative disorder:

    b. Leukopenia's disorder:

In the **proliferative disorders**, there is an increase in the number of white blood cells. This increase is commonly a reaction due to infection, but may, less commonly, be related to some types of cancer.

In **leukopenias**, there is a decrease in the number of white blood cells, which can be caused by cells being destroyed by an illness or by other conditions.

Both leukopenia and neutropenia can cause deficiency in the immune system, which can increase risk of infection. Treatment of leukopenia and neutropenia are aimed at the underlying cause of the change in cell counts.
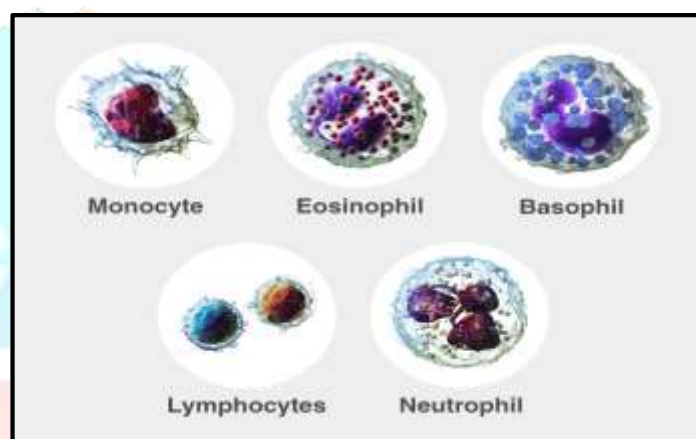

Fig. No. 3: White Blood Cell

Diagnosis of WBC:

One of the first tested to diagnose a white blood cell disorder is a complete blood count (CBC). This test measures all of the different types of blood cells in a sample of blood. It also measures the proportion of individual blood cells, which can help narrow the possible causes. The lab results are compared to a reference range of high and low values. Anything between the high and low values is considered normal. Anything above or below the reference range of values is considered abnormal. The reference range for the total white blood cell (WBC) count can vary from one lab to the next but is typically described as follows:

Males: 5,000 to 10,000 cells per micro liter of blood (cells/mL)

Females: 4,500 to 11,000 cells/ml.

New born under two weeks of age: 9,000 10 30,000 cells/ml

Children and adolescents: 5,000 to 10,000 cells/mL

The treatment of white blood cell disorders differs according to the cause. Some treatments are used to cure the disease, while others simply manage the disease and keep it in check. Others still are used to relieve symptoms or help normalize the white blood cell count.

Possible Treatments Include:

Antibiotics: Used to treat bacterial infections.

Anti-parasitic drugs: Used to treat parasitic infections that cause eosinophilia.

Whole blood transfusion: Used to replenish the blood supply when there aren't enough **healthy blood cells**

Colony-stimulating factors (CSF): Medications that increase white blood cell production in the bone marrow.

Glucocorticoids: Hormones that can help stimulate blood cell production.

Immuno-suppressants: Medications that reduce the immune response in people with autoimmune diseases. [8]

Devices used for pathology of Blood:

1. Light Microscope:

Microscopes are devices made to image objects too small to be seen with the human eye in a magnified visual or photographic format. Three things the microscope needs to do are: isolate the details in the image, create a magnified image of the specimen, and make the details visible to the camera or human eye. [9, 10, 11]

Fig. No. 4: Light Microscope

2. Semi-Auto Analyzer:

An automate analyzer is a medical laboratory device that can swiftly and with little human assistance measure various chemical and other properties in a variety of biological samples.

Method:

- The technician performs the initial step, which involves mixing the reagent and incubating it externally.

- The remaining steps of the process, including setting the incubation temperature, setting it to zero, and showing the photometric reading, resulted in an automatic printing display. The analyzer handled data management and processing. [12]

Fig. No. 5: Semi Auto Analyser

Various tests performed using semi auto analyzer:

- BUN (Blood urea Nitrogen) it is in form about how well were kidney works.

- Uric Acid Test

- CBC (complete blood count).[13]

Analysis of Normal and Abnormal Constituents of blood and urine:

Blood count	Male	Female
Red blood cell	4.35 trillion to 5.65 trillion cells/L	3.92 trillion to 5.13 trillion cells/L
Haemoglobin	13.2 to 16..6 grams/dl	11.6 to 15 grams/dl
Hematocrit	38.3% to 48.6%	35 to 44.9%
White blood cell	3.4 billon to 9.6 billon	_
Erythrocytes	5.0 to 6.0 million	4.5 to 5.5 million
Platelets	135 billon to 317 billon	157 billon to 371 billon
MCH	25.4 to 34.4 pg/cell	25.4 to 34.4 pg/cell

Table No. 1: Hematologic Values in Male and Female

Test for Thyroid Function:

- **In the Blood:** Gilli-international in Blood Adults typically test between 0.40 and 4.50 mIU/ml (units per litre of blood). 14. Thyroxin tests are used to diagnose hypothyroidism and hyperthyroidism and to track the effectiveness of thyroid disorder treatments. Hypothyroidism is characterized by low T4, while hyperthyroidism may be indicated by high T4 levels.

- **In the urine:** Adults typically have normal TSH levels between 0.4 and 4.5 mill units per litre (mU/L). Elevated or decreased levels may suggest a thyroid condition. [14]

Test for Glucose:

- **In the Blood:** A fasting blood sugar level of 99 mg/dl or less is considered normal; a level of 100 to 125 mg/dl suggests prediabetes; a level of 126 mg/dl or more indicates diabetes.

- **In the urine:** Normally, there is very little to no glucose in urine. However, your kidneys will excrete part of the excess glucose through urine if your blood glucose level is too high. Therefore, a high urine glucose level could indicate a high blood glucose level as well, which could be an indication of diabetes.[15]

Test for Urea:

- **In the Blood:** A normal range is generally 6 to 24 mg/dL (2.1 to 8.5 mmol/L). The reference range the lab uses and your age, however, may cause normal ranges to change. Get an explanation of your results from your doctor.

- **In the Urine:** The normal range for values is 428.4 to 714 mmol/day (12 to 20 grams per 24 hours). Lab to lab, normal value ranges can differ slightly. Certain laboratories employ distinct metrics or examine distinct specimens. Discuss the meaning of the particular test results you received with your provider. [16]

II. RESULT:

Pathophysiology is the study of physiological disturbances and underlying abnormalities that underlie disease, as well as biological pathology. Now that we have studied this subject, we understand the following: How to calculate a white blood cell count and what role they play in different body functions How bleeding time is calculated and why it matters in a number of situations, including surgeries, accidents, etc., How to determine blood clotting firm's significance Blood RBC count calculation, significance, and numerous disorders associated with RBCs, How to evaluate the haemoglobin content of blood, its significance, and any illnesses.

How to use a light microscope and its various components, Details regarding the semi-automated analyzer and the various tests that are performed with it.

III. CONCLUSION:

Pathophysiology characterizes the abnormal or undesirable situation, whereas pathophysiology tries to explain the functional changes that are taking place within an individual as a result of a disease or pathologic state. This report includes the results for displaying pathology information. As a result, the results format may provide more than just a lab output; it may also provide a helpful tool that can be distributed. The ultimate objective is to improve their health and other physiological abnormalities that affect people by better understanding and managing their illness.

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