Pathology of Blood and urine

Pathology :- It is a branch of Science which deals with the study of diseases and also deals with causes, effected, mechanisms and nature of disease.

∴ Blood ∴

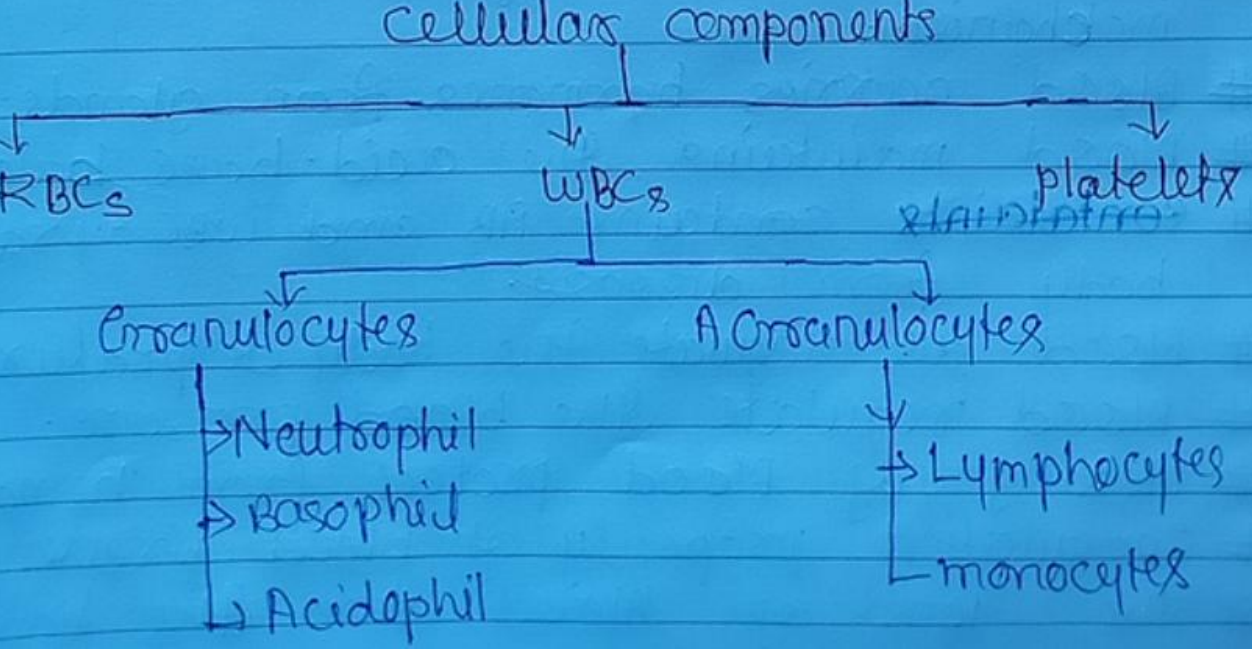
Blood is a fluid connective tissue circulated throughout the body containing Blood cells and plasma.

Circulate in closed system of vessels
Total volume of Blood approximately 6 litter.
pH of Blood 7.4 (Slightly alkaline).

composition of Blood :-

Blood composed of -

① Plasma - 55%.
② cellular components - 45%.
Ex - RBCs, WBCs, platelets.



:: Plasma ::

Occupies 55% of Blood.
fluid components of Blood in which the cellular components are suspended.
composition of plasma -

→ Water - 91%.
→ Non diffusible constituents - (protein)
Albumin, globulin, fibrinogen and enzymes.

→ Diffusible constituents :-
Harmones and Vitamins
Anabolic constituents - glucose, Amino acid, fatty acid, Triglyceride.
Electrolytes -
Na, K, Ca, Mg,

:: function of Blood ::

Transport oxygen and nutrients.
Blood transports waste product.
Blood act as a great defensive mechanism.
Blood carries harmones from glands.
Blood maintains the acid-base balance.
[redacted] contains AB and WBC - protect body from disease.
Blood also regulate the body temprature
Blood regulate the blood pressure.
clotting of Blood protect from hemorrhage.
Coagulation property of blood prevents the loss of Blood from the body.

RBCs (Red Blood cell)

Erythrocytes :-

These are small circular disc shaped cells which are suspended in blood.
All the cell of this group appears as a red colour and thus the blood becomes a red coloured.
The normal RBC count — 4·5 — 5 million/mm^3 of blood.
Total life spend of RBCs — 120 days.
RBCs having diameter 7·2 μ.
RBCs is produced in the red bone marrow.
RBCs have a no nucleus.
formation of RBC,s is known as erythropoiesis.

formation of Erythrocytes —

↓

Red blood cell formation

↓

New RBCs made in bone marrow

↓

Old RBCs destroyed in liver and spleen.

↓

Kidney secretes hormones called erythropoietin that increases production of RBCs, when O_2 is low.

The RBCs contains a respiratory pigment known as Haemoglobin.
Haemoglobin enclosed in the stroma of

Haemoglobin → is a complex protein of high molecular weight.
It consists of a protein material called as globin and non-protein material called as Haem.
"Haem" contains 'iron' which gives red colour of Haemoglobin.

Function of RBCs :-

It carry oxygen in the form of oxyhaemoglubin.
It transport CO_2 in the form of carbaxyhaemglobin.
It maintains acid-base balanced of blood.
It help to maintain the viscosity of blood.
It maintains the iron balanced of the body.
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Disease of Erythrocytes :-

① Polycythemia
② Iron deficiency anemia
③ Megaloblastic anemia
④ Sickle cell anemia
⑤ Hemolytic anemia
⑥ Thalasemia anemia.

① Polycythemia :-

An Abnormal increase in RBCs in the blood is known as polycythemia.
Due to increase in number of erythrocytes or increase the formation of RBCs
The Viscosity of blood increases and this also increase Blood pressure.

Types of polycythemia —

① primary polycythemia :- In this case along with increased number of RBC,s, the bone marrow is markedly hyperplastic.
Thus the skin and mucous membranes of the mouth are red.
The conjunctiva is also red.

② Secondry polycythemia :- In this case there is large number increase of in red blood cells in the condition of insufficient oxygen.

Symptems —

① Headache. ② weakness ③ Tiredness
④ Red face & red eyes ⑤ Thrombobodic complication.

2 Iron deficiency anaemia —

It is also known as microcytic anaemia.
The deficiency of Iron causes the bone marrow to produce small in number of Red cells.
RBCs are pale and less in number.
The main cause of this anaemia is Iron deficiency is followed by the bone marrow dippression.

The iron deficiency may be due to -

- Dietary deficiency of iron.
- Hookworm infestation.
- Lack of HCl in stomuc, where HCl is required for normal absorption of iron.

Symptoms :-

Weakness
Tiredness
Shortness of breath
low level of Haemoglobin
pale colour of Skin and nails.

- Treatment :-

Iron therapy through the diet.
Antiworm drug should be used to kill the Hookworm.

megaloblastic anaemia

It is also known as macrocytic anaemia.
It occurs due to the stopped development of erythrocytes at megaloblastic stage.
It is because of deficiency of Vit. B_{12} and folic acid.
It is characterised by the large size of red cells than normal.
The life span of these cells also reduced.
The average size of RBCs is greater than

normal, hence it is termed as megaloblastic anaemia.

The deficiency of Vit. B_{12} is the result of absence of intrinsic factor from the gastric secration.

The main character of this anaemia are given below -

much large RBCs than normal.
Immature RBCs appear in blood circulation due to decrease in physiology.
Lack of Vitamine B_{12}.

Symptoms -

Glossitis (inflammation of tongue) anorexia (loss of eppetite) diarrhoea, loss of weight.
Weakness of limbs.
General nervausness.
very reduce RBC count.

Treatment -

Increase dietery intake of Vit. B_{12} or Vit. B_{12} tablets as therapeutic treatment.
intramuscular injection of Vit. B_{12}.

Pernicious Anaemia

A Decrease in red blood cells, when the body can not absorb enough Vitamin B_{12}.
Absence of Intrinsic factor.
It is an oxygen specifics autoimmune disease. In which the body immune system attacks in the lining of stomach.
It was considered as a deadly disease due to the lack of available treatment.

⇒ Causes :-

Intrinsic factor (If) is a glycoprotein made in the stomach that is necessary for the absorption of Vitamin B_{12}.
When the stomach does not make enough If, the intestine can not properly absorb the Vitamine B_{12}.
As a result it can cause permanent damage to nerve and other organs.
Also parietal cells located within the gastric mucosa are destroyed.
It also raises risk for developing stomach cancer.

Symptoms —:-

Symptoms are similar to megaloblastic anaemia.
Shortness of breathing, Tiredness & weakness.

most imp. :-: Sickle cell anaemia :-:

Sickle cell anaemia is also called as Sickle cell disease.
In this anaemia there is abnormal formation of RBC and they are having a sickle shaped.
It is a genetic disorder.
The main reasion for this anaemia is the bone marrow produce abnormal types of Haemoglobin.
It is a Haemoglobin "S" types instead of normal Haemoglobin "A".
Haemoglobin "S" peculiar sensitive to a lowered O_2 supply.
Red cell with this types of Haemoglobin form sickle shape, when subjected to lowered oxygen concentration.

Sickle cell do not pass through the small capillaries hance, may block the blood supply to vital organs of the body.

Symptoms —:-

The shapes of RBCs becomes sickle shaped.
General tissue damage ~~to~~ due to local necrosis.

Severe abdominal pain followed by excreation of dark urine.
Blockage of blood capillaries may block the blood supply to the vital organs.
Decreased oxygen supply to the body organ.

Treatment :-

The sickle cell patient should avoid situations where a lowered concentration of oxygen may be present.
Reaching high attitudes and air polluted areas should be avoided.
Patient should prompt medical care in case of cold pneumonia.

Haemolytic anaemia

It is the condition of abnormal destruction of RBCs in blood called Haemolysis.
Such destruction may occurs in the blood steam.
Abnormal breakdown of Red blood cells either in the blood vessels (intravascular Hamolysis or elsewhere in the Human body.
Haemolytic anaemia is either inheriated or acquired.

Symptoms :-

fatigue and shortness of breath.
poisioning by various substances like, lead, mercury, arsenic etc.
Toxins produced by bacteria called — Streptococcus Haemolyticus.
Decreas Haemoglobin content
very pale skin
Low O_2 carrying capacity.

Treatment :-

Proper blood transfusion to compensate RBCs loss is the main treatment.
Antidotes in the case of poisoning.
use preventing measures for Streptococcal infection.

:: Thalassemia ::

Thalassemia is an inherited blood disorder.
in which the body produce an abnormal form of Haemoglobins.
which result the excessive destruction of Red blood cell and farther leads to anaemia.

Types of Thalassemia —

1. Alpha - Thalassemia
2. Beta - Thalassemia

① Alpha - Thalassemia -

Alpha Thalassemia is the result of absent synthesis of alpha globin chain leading to beta globin chains.

Alpha globin chain production is controlled by <u>two</u> genes on each chromosome 16.

② Beta Thalassemia -

β-Thalassemia is the result of absent synthesis of β-globin chain. leading to excess of alpha globin chains.

β-globin synthesis is controlled by <u>one</u> genes on each chromosome 11.

Symptoms -:-

Iron overload.
Bone deformities.
Enlarged of Spleen.

Treatment -:-

Blood transfusion is main treatment for people who moderate Thalassemia.

IRCS provide calferal to remove Excessive iron from the body.

White blood cell —

It is also known as leucocytes.
The leucocytes are a colourless cell containing irragular shaped large nucleus and are named as WBCs.

Normal count of leucocytes 4500 – 11000/L. (6000 – 10000 /cubemm).

leucocytes cells are classified into two types.

:leucocytes:

↓ Granulocytes (75%.)

(i) Neutrophils 70%. (many lobes)
(ii) Basophils 1%. (byto Kidery shape)
(iii) eosinophils / Acidophils 4%. (bylobes)

↓
All these cell contains granules in their cytoplasm or .

↓ Agranulocytes (25%.)

↓
(i) lymphocytes (cycles) 20%. Now
(ii) monocytes (Kidney

Granulocyte :-

They constitute about 75%.
These cells contains granules in the cytoplasm Hance called Granulocytes.

① Neutrophils –:–

The granules of these cell are stained by neutral dye. and the nucleus of these cell have a many lobes.

Function –:–

they ingest the microbes and destroy it by phagocytosis.

② Basophils –:–

The granules of these cell are stained by Basic dye.
The nucleus of these cells is usually kidney shape.

Function –:–

they are responsible for the destruction of product of antigen–antibody reaction.

③ Eosinophils / Acidophils –:–

The granules of these cell are stained by Acidic dye. (eosinophils red a.d)
Nucleus is bi-lobes.

Functions –:–

phagocytosis.

Agranulocytes —

These are mononuclear cells.
They do not show the presence of granules in their cytoplasm.
#

① lymphocytes —:—

These are produced in the lymph glands, Hance called as lymphocytes.

Types of lymphocytes —

There are two Types of lymphocytes are present —

(i) Small lymphocytes —:—

The nucleus is thin, rim round shape the nucleus and stained by the Basic dye.

(ii) Large lymphocytes —:—

The nucleus is oval rounded kidney shape and it stained by Basic dye.

<u>function</u> —:—

They are responsible for the developing immunity against the foreign substance like, microorganism.

Disease of Leucocytes or related to WBCs

1. leucocytosis
2. leucopenia
3. leukemia
4. Eosinophilia

1 - leucocytosis

It is the abnormal condition in which there is increase in the total WBCs count in the blood above normal range.
(above 11000 / cubic mm)

It is observed in the some respiratory disease like allergic bronchits.

causes -:

Pyogenic infections
myeloid Leukemia
myocardia infections
Acute Haemorrhage
Malignany of liver or intestine.

Treatment -:-

In the most cases, treatment for leucocytosis is not necessary.

2. Leucopenia

This is the condition in which there is a decrease in WBC count below 4000/mm of blood.
commonaly this disease is caused due to fall in count of neutrophil cells.

causes :-

Infection.
Aplastic anaemia.
Malignant lymphoma
Multiple myeloma.
Sensitivity to drug (Sulpha drug).

Treatment

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leukemia

It is malignant disease of Bone marrow that result in uncontrolled ~~w~~ increase in production of WBCs in blood.
Immature form of WBCs make their appearance in the circulating blood in leukaemia condition.
It is also called as cancer of blood.

causes of leukaemia :-

* Ionising radition is produced by X-Ray or radioactive Isotops are known to cause malignant changes in the precursor of WBCs.
The genetic material of the cells is changed. Some cell die while Other Reproduce at abnormally rate.

* Some chemical used in general or work enviroments are known to changes the gentic make up of WBCs precursors in the bone marrow.

* Drug used in cancer
* Retroviruses
* Genetic disorder.

:: Eosinophilia ::

It is the abnormal condition of indicated by increased in number of Eosinophils cell in the blood.

for Example :- Eosinophil increase in condition of malaria, dengue, and treatment of antiboitics.

causes :-

Allergic asthma
Skin disease.

Drug Allergy.
parasytic infection.

Lymphocytes :-

lymphocytes are non-granular leucocytes. which are present in blood and lymph, lympho organs and other tissue.

the normal count of lyphocytes is 20 - 25%. in the total volume/count of WBCs.

lymphocytes are made in lymphoid tissue and lymph node which are present in spleen, liver and bone marrow.

there are two types of lymphocytes —

① Small lymphocytes (T-cells)] Immunological classification.
② large lymphocytes (B-cells)]

T-cell :- It attacks ~~only~~ the foreign partical ~~outside~~ inside the cells. (7 - 10 µ.)

B-cell :- It attacks the foreign partical outside of the cell. (20µ)

Functions of lymphocytes :-

* T-cells :-

Have thymus antigen on surface.

Undergo blast Transformation with the phytohaemaglutinin.

* B- cells —:-

Have immunoglobulines on their Surface.
Have microvilli on their Surface.
Under go blast transformation with endotoxins.

They are responsible for the formation of antibodies.
They manufactures β & γ serum globulins.
They are play an important role in the defensive mechanism.
They help in the repairment in inflamed tissue.
The small lymphocytes have very long life span and play an important role in the immunity.

Abnormalities of lymphocytes -:-

① lymphocytosis —
② lymphopenia
③ leukaemias of lymphocytes
④ lymphoma —

lymphocytosis

Absolute count exceeds 4×10^6/ml

causes / Associated with -

Pertussis
lymphatic leukaemias
chronic infection.
Measels, mumps, Rubella, and ~~chicken~~ chicken-pox.

2 :- lymphocypenia :-

Absolute caunt less than 1.5×10^6/ml

causes / Associated with.-

* Administration of ACTH.
* Advanced hodgkin's disease.
* Excessive radiation :-

:- Platelets :-

:- Platelet is also known as thrombocytes.
Round shaped cell with biconcave surface.
these are minute spherical structures present in the blood.
they are produce by large cell - (megakaryates present in bone marrow)