Body Fluids And Circulation

Blood

Special Connective tissue Consisting of fluid matrix → plasma and formed Element.

Plasma : Straw Coloured, Viscous fluid.

Consist 55% of blood.

→ 92% of plasma is Water and proten Contribute 6-8%.

Fibrinogen : Protein need for Clotting and Coagulation of blood.

Globulins : Involve in defense mechanism.
Albumin : Help is Osmotic balance.

→ Plasma without clotting factors is Called Serum.

Formed Element

Constitute nearly 45% of blood.

- Esthrocytes : Red Blood Cells.
  most abundant Cells in blood.
  → Formed in red bone marrow.
  → Lack nucleus and biconcave in shape.

→ Have red Coloured iron Containing Complex protein, Haemoglobin

↓

12-16 gm in every 100 ml blood.

→ Life span – 120 days

→ Destroyed in Spleen.

▶ Leucocytes: White Blood Cells.

→ Lack Haemoglobin, Hence are Colourless.

→ Have nucleus and are short lived.

WBCs

Granulocytes

→ Neutrophils
→ Eosinophils
→ Basophils

Agranulocytes

→ Lymphocytes
→ Monocytes.

→ Neutrophils most abundant in WBCs. Basophils least in them.

→ Neutrophils and Monocytes are phagocytic Cells and destroy foreign Organism entering body.

→ Basophills secreate histamine, Serotonin heparin etc and involve in inflammatory reactions.

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→ Eosinophils resist infection and involve in allergic reaction.

⊙ Lymphocytes are of two major type 'B' and 'T' forms and are responsible for immune response.

▶ Thrombocytes : Platelets
→ produce from megakaryocytes

→ platelets release substance which involve in Coagulation of blood.

ABO BLOOD GROUPING

→ Based on presence or Absence of two surface antigens 'A' and 'B' on RBCs.

→ Blood of donor has to be matched with Blood of recipient before blood transfusion to avoid problem of Clumping.

→ 'O' group donor — Universal donor.
AB group donor — Universal recipients.

Rh grouping

- Based on Rh antigen similar to present in Rhesus monkey is observed on surface of RBCs.

Individual having RH antigen — Rh positive
Individual lack Rh antigen — Rh negative.

- Should be matched before transfusion.

▶ Rh incompatibility b/w Rh-ve pregnant mother and Rh+ve foetus.

- Rh antigens of foetus do not get exposed to Rh-ve blood of mother during first pregnancy because of placenta.
- During delivery there is possibility of exposure of maternal blood to small amount of Rh +ve blood from foetus.
- The mother starts preparing antibodies against Rh antigens in her blood.
- In subsequent pregancies, the Rh antibodies from mother (Rh-ve) leak into blood of foetus. and destroy foetal RBCs

→ These may be fatal or Cause anaemia and Jaundice to baby.

. The This Condition is Called Erythroblastosis foetalis.

COAGULATION OF BLOOD

⊙ Blood exhibits ~~Coo~~ Coagulation or Clotting in response to an injury or trauma to prevent loss of blood.

⊙ Clot or Coagulation formed of a network of threads Called Fibrins. in which dead and damaged element of blood are trapped.

⊙ Fibrins are formed by Conversion of inactive fibrinogens in plasma by Enzyme Thrombin.
  ↳ formed by inactive substance prothrombin
  ↳ Complex Enzyme thrombokinase required for above reaction.

⊙ Calcium ion play a Very important role in clotting.

Lymph [Tissue Fluid]

- As blood passes through Capillaries in tissue some water with small soluble substance move out into space b/w cell of tissue.
- The This fluid is called interstitial fluid or tissue fluid.
- Exchange of nutrient and gases b/w blood and cells is through this fluid.
- lymphatic System Collect fluid and drain it back to major veins.
- fluid present in lymphatic System is called lymph
  - ↳ Colourless and Contain lymphocytes.
- Fats are absorbed through lymph in lacteals present in intestinal Villi.

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CIRCULATORY PATHWAYS

⊙ Open Circulatory System : In which blood pumped by heart passes through large Vessels into open space or body Cavities Called Sinuses.

eg : Arthropods and Molluscus.

⊙ Closed Circulatory System : Blood pumped by heart is always Circulated through a Closed network of blood Vessels.

Fishes → 2-Chambered heart [Atrium and Ventricle]

Amphibians and reptiles → 3 Chambered heart [Two atria and a Ventricle]

Exception → Crocodile 4 chambered heart.

Birds and Mammals : 4 Chambered [two atria and two Ventricles.

⊙ Single Circulation: In fishes heart pump Out deoxygenated blood which is Oxygenated by gills and supplied to body parts from where deoxygenated blood is returned to heart.

⊙ Incomplete double Circulation: In amphibians and reptiles the left atrium receives Oxygenated blood from gills/lungs/skin and right atrium get deoxygenated blood from other parts and mixed up in single Ventricle ~~and~~ which pump mixed blood.

⊙ ~~Complete~~ Double Circulation: Oxygenated and deoxygenated blood received by left and right atria respectively passes on to Ventricles of same side.

Ventricles pump it Out without any mixing up.

HUMAN CIRCULATORY SYSTEM

▶ Heart: Situated b/w two lungs, slightly tilted to left.
Size → Clenched fist.
protected by pericardium.

→ Two smaller upper chamber → atria
→ Two larger lower chamber → Ventricles
→ Inter-atrial septum separates the left atria and right atria.

→ Inter-Ventricular septum separate left and right Ventricle.

→ Atrio-Ventricular septum separate atrium and Ventricles of same side.

→ The opening b/w right atrium and right Ventricle is guarded by tricuspid Valve.

→ Opening b/w left atrium and left Ventricle is guarded by bicuspid Valve.

→ The Openings of right and left Ventricles into pulmonary artery and aorta respectively are with semilunar Valves.

→ Valves prevent any back flow.

⊙ Entire heart is made up of Cardiac muscles.

⊙ Specialised Cardiac musclature Called Nodal tissue is also present.

⊙ A patch of nodal tissue present in right upper Corner of right atrium Called Sino-atrial Node [SAN]

⊙ A patch is seen in lower left Corner of atrium close to atrio-Ventricular Septum Called atrio-Ventricular node [AVN]

⊙ Bundles of nodal fibre Continue from AVN passes through ~~inter Ventric~~ atrio-Ventricular Septa to emerge on top of inter Ventricular Septum and divide into right and left bundle.

→ These branch give rise minute fibre and are Called purkinje fibres.

~~Pur~~ Purkinje fibre along with right and left bundle are known as bundle of His.

⊙ Nodal tissue → Autoexcitable.
→ SAN responsible for initiating and maintaining the rhythmic Contractile activity of heart.

→ SAN → Pacemaker
→ Heart beat 70-75 times/minute.

CARDIAC CYCLE

⊙ All four chambers of heart are in relaxed state i.e Diastole.

⊙ SAN generate an action potential which stimulates both atria to undergo Contraction - the atrial Systole.

increase flow of blood into Ventricle by 30%.

⊙ Action potential is Conducted to Ventricular side by AVN and AV bundles from where bundle of His transmit it through entire Ventricular musculature.

Cause Contraction of Ventricular muscles i.e Ventricular Systole and atria undergo relaxation [Diastole].

⊙ Ventricular Systole increases the Ventricular pressure Causing closure of tricupsid

⊙ Ventricular pressure increase further, the Semilunar Valves guarding the pulmonary artery and the aorta are open. allowing blood in Ventricles to flow through these Vessels into Circulatory pathway.

⊙ Ventricles now relax [Ventricular diastole] and Ventrical pressure ~~Caus~~ falls Causing closure of Semilunar Valves which prevent backflow of blood into Ventricles.

⊙ Tricuspid and bicuspid Valves are pushed open by pressure in atria exerted by blood which was being emptid into them by Veins. The process Continues.

⊙ Cardiac Cycle :- Sequental event in heart which is Cyclically repeated.

⊙ During a Cardiac Cycle Ventricles pump 70 ml of blood which is Called Stroke Volume

⊙ Cardiac Output: It is defined as Volume of blood pumped out by each Ventricle per minute.

average - 5000 ml or 5L

Cardiac Output ⇒ Stroke Volume × Heartbeat

⊙ During each Cycle two sound are produced.

lub: associated with closure of tricuspid and bicuspid.

dub: Associated with closure of semilunar Valves.

ELECTROCARDIOGRAPH [ECG]

⊙ ECG is a graphical representation of electrical activity of heart during a Cardiac Cycle.

⊙ A patient is Connected to the machine with three electrical leads [One to each wrist and to left ankle].

⊙ Each peak in ECG identified with letter from P to T

P wave → Excitation of atria
QRS Complex → Depolarisation [Excitation] of Ventricles.

T wave → Repolarisation [Relaxation] of Ventricles.

→ By Counting the number of QRS Complex occur in a time period, one can determine heart beat rate of individual.

DOUBLE CIRCULATION

⊙ Right Ventricle pump blood in pulmonary artery.
⊙ Left Ventricle pump blood in Aorta.

⊙ Pulmonary Circulation :

→ ~~Pulmonar~~ Deoxygenated blood pumped into pulmonary artery is passed to lungs

→ from lungs Oxygenated blood is carried by pulmonary veins into left atrium.

⊙ Oxygenated blood entering the aorta is carried by network of arteries, arterioles and capillaries to tissue.

→ from tissue deoxygenated blood is collected by system of Venules

Veins and Vena Cava and emptied into righ atrium.

⊙ A unique Vascular Connection exist b/w digestive tract and liver called Hepatic portal System.

Hepatic Veins carries blood from intestine to liver before it is delivered to Circulation.

REGULATION OF CARDIAC ACTIVITY

⊙ Heart is Myogenic.

→ Neural centre in medulla oblangata moderate Cardiac function through autonomic nervous System [ANS]

→ Neural signal through Sympathetic nerves increase the rate of heart beat and also Cardiac Output.

→ Parasympathetic nerves decrease the rate of heart beat and thereby Cardiac Output.

→ Adrenal medullary hormones also increase Cardiac Output.

HYPERTENSION : High blood pressure

⊙ Term for B.P higher than 120/80

120 mm of Hg is Systolic
80 mm of Hg is Diatolic

⊙ ~~He~~ High blood pressure lead to heart disease and also affects Vital Organs like brain and Kidney.

CORONARY ARTERY DISEASE

→ also referred to as Artherosclerosis.
→ affect Vessels that Supply blood to heart muscle.
→ Caused by deposit of Calcium, fat, Cholestrol and fiberous tissue
→ Make lumens of arteries narrower.

ANGINA

→ also Called Angina pectoris
→ Symptom of acute ~~cha~~ chest pain appears when no enough Oxygen is reaching the heart muscle.
→ Common among middle age and elderly

HERT FAILURE :

→ Means State of heart when it is not pumping blood effectively enough to meet need of body.

→ Sometime Called Congestion heart failure because Congestion of lungs is One of the main Symptoms of disease.

Cardiac arrest [Heart stop beating]
Heart attack [Heart muscles is ~~sudde~~ suddenly damaged by inadequate blood supply].