B.N.Bandodkar College of Science, Thane

T.Y.B.Sc – Paper II

Haematology

Blood platelets – Thrombocytes

Dr N.N. Patil

Blood platelets are non nucleated, round or oval, biconvex discs and have very important role in the haemostatic mechanism.
Average size is 2 to 4 μm,

Average number is 2,50000 to 4,50000 / cu.m.m. and Average life of platelet is about 8-11 days. They are destroyed in the spleen by reticulo- endothelial cells

It contains a central darkly stained granulomere(chromatomere) and outer hyalomere.

Under electron microscope the **hyelomere** shows a homogenous, fine,granular cytoplasm which contains

microtubules and microfilaments. Microfilaments contain a contractile protein thrombosthenin. Microtubules maintain the shape of platelets. They contain ATP, ADP, Histamine, Seratonin, prostaglandins, contractile protein Following adhesion to the injured vessels, these chemicals are released and this process is called platelet release.

Under electron microscope the **granulomere** shows numerous components like

α – granules which are lysosomal in function

Mitochondria

Glycogen granules

Sydersomes (Fe containg granules)

Ribosomes

System of tubules and vesicles

Seratonin containing granules

Platelets are rich in protein and phospholipids. They show property of sticking to the water soluble surfaces and rough or injured surfaces of blood capillaries .

Platelets show easy clumping and easy disintegration and liberation of Thrombokinase which activate clotting mechanism.

Production of Thrombocytes

Thrombocytes are produced by megakaryocytes which are present in the bone marrow .

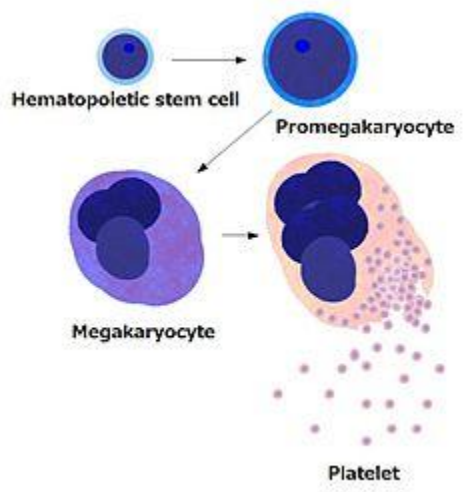
Thrombopoiesis i.e. production of thrombocytes takes place from Pluripotent Stem Cells which are committed to form megakaryoblast which form the premegakaryocytes from which after maturation form megakaryocytes.From megakaryocytes ,platelets are formed.

There are two concepts about platelet production

According to one concept , Platelets are formed in the cytoplasm of the megakaryocytes .They are released by dissolution of megakaryocyte.

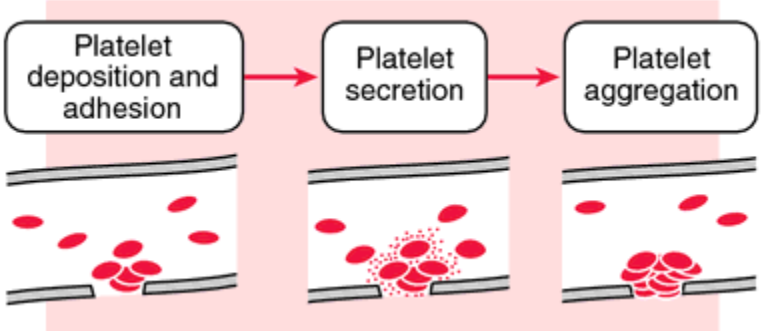
According to another concept Megakaryocyte is a large irregular cell with multilobed nucleus and many cytoplasmic processes.These processes are broken down by pinching of small bits of cytoplasm.Each fragment is surrounded by unit membrane.

Regulation of Thrombopoiesis Platelet production is regulated by a circulating substance called thrombopoietin or Thrombopoietic stimulating factor (TSF)which increases the formation of megakaryocytes from committed stem cells.



Functions of blood platelets

Plug formation : While in circulation ,Platelets are attracted towards injured capillary wall and form a plug by adhesion and aggregation which seals off the injured vessel



Role in clotting : Platelets help in the process of clotting by releasing the clotting factors, phospholipids and platelet factor III. Platelet factor III activates prothrombin to thrombin. Thrombosthenin from microfilament contracts like actin and myosin.

Role in clot retraction : Thrombosthenin , a contractile protein helps in clot retraction.

Platelets bring about **vaso constriction** by releasing histamine ,serotonin from disintegrated platelets.

When count falls below 50,000/cu.m.m., haemorrhage occurs below the skin and mucus membranes, purple spots appear on the body called as thrombocytic purpura.

Clotting time and bleeding time:

These are the tests for defects in the blood clotting and bleeding.

Clotting time: Time taken by blood to form a clot when blood vessel is ruptured is called as clotting time.

When small vessels are ruptured, local vasoconstriction together with deposition of platelets from blood, successfully seal the gap without the help of blood coagulation. But when large vessel is ruptured these two factors are not sufficient to seal the ruptured vessel and several other factors take part in the clotting process.

When blood vessel is ruptured ,blood platelets disintegrate and release thromboplastin which convert the prothrombin into thrombin.

Lack of fibrinogen, prothrombin and absence of any one factor from I to XIII , prevents coagulation of blood.

Clotting time is determined by following methods:

Capillary Glass Tube method :

In this method , the finger is pricked and the blood is made to flow into capillary glass tube (about 15 cm in length). A small bit of capillary tube is carefully broken off every 15 seconds until a fine thread of clotted blood appears while tube is broaken. The period between the appearance of blood on the finger and the formation of this thread is taken as the clotting time. Normal value by this method is 3-7 minutes.

Lee and White method :

3-5 ml of venous blood is taken in 3 test tubes and kept in a bath at 37 ^{0} C. the test tubes are tilted at every 30 sec.intervals and observed for solidification of blood. End point is noted for three tubes when liquid blood turns in to solid mass. Average of three is taken as clotting time.

Clotting time is prolonged in all conditions associated with low levels of clotting factors.

Bleeding time:

Bleeding is a process in which blood flows out through a wound or puncture of blood vessel. Normally bleeding is not allowed to continue without stop. Blood stops flowing after a short time due to clot formation. Inbetween period is called bleeding time.

When bleeding occurs the shed blood coagulates and bleeding vessel is plugged off by the clot and bleeding stops.

Absence of any clotting factor delays coagulation of blood e.g. lack of fibrinogen, prothrombin, absence of any clotting factor, and no. of blood platelets.

Bleeding time is determined by following method

Dukes method : The ear lobe is pricked and the escaping blood is dried every 15 sec.on the filter paper till bleeding stops. The time taken for this is noted. In this case, the arrest of bleeding is not due to clot formation but is due to formation of platelet plug and capillary contractility.The normal value is 2-6 minutes .

Bleeding time depends upon

1.**Number of platelets** in the blood if platelet count falls below 50,000/cu.m.m., bleeding time prolongs . Thrombocytopenia occurs due to poisoning of bone marrow , atropy of bone marrow (aplastic anaemia) and due to certain drugs

2. **Thromboasthenia** : Functional deficiency of platelets ei.e quality of platelets.

3. **fragility of capillary wall**

4. **the depth of the wound and reduction in proteins.**