Platelet Structure & Function

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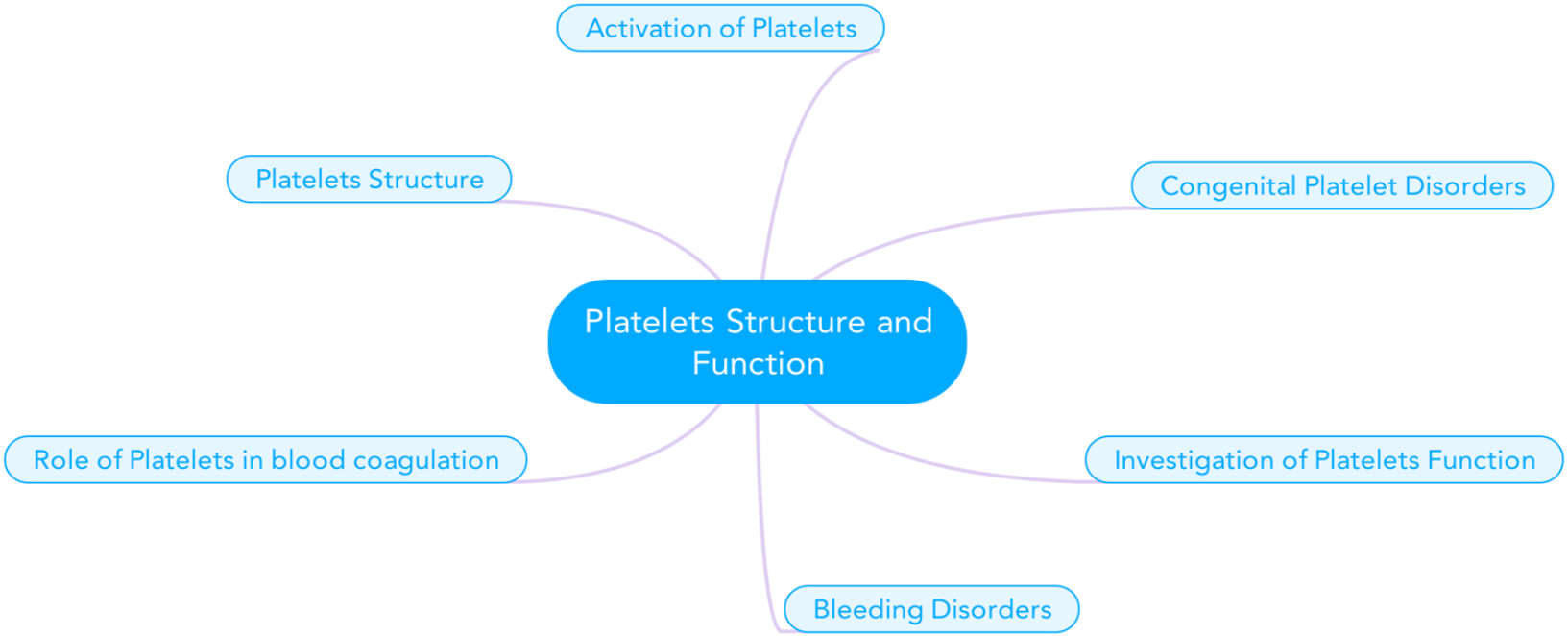
Mind map

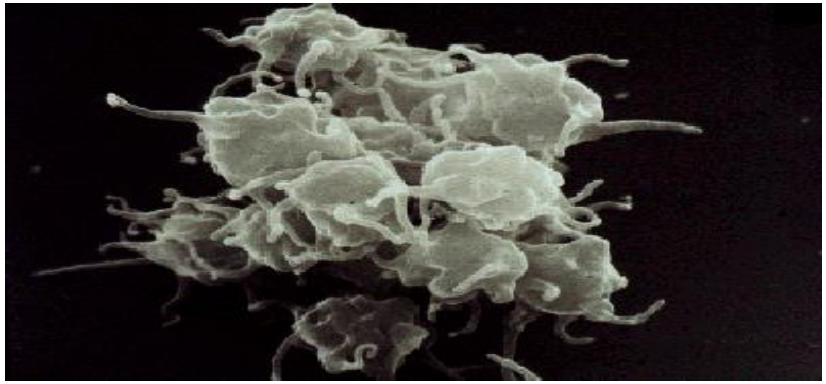

Activation of Platelets
Platelets Structure
Congenital Platelet Disorders
Platelets Structure and Function
Role of Platelets in blood coagulation
Investigation of Platelets Function
Bleeding Disorders

Platelets structure

General characters

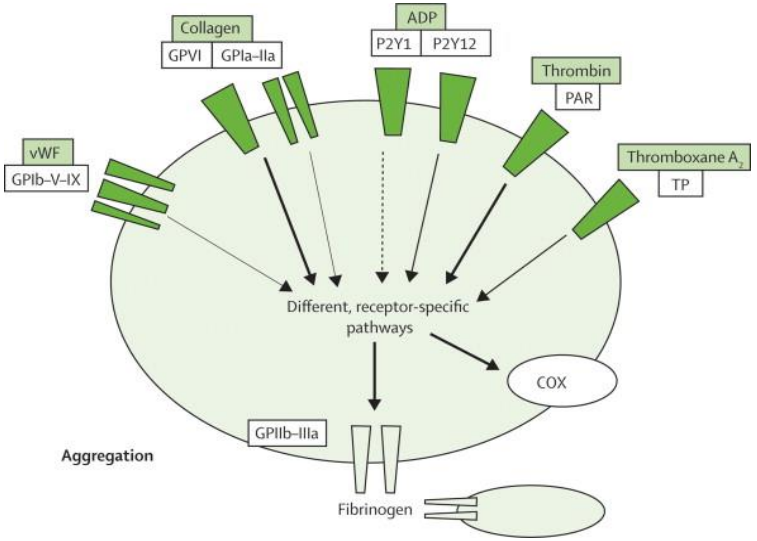
- **Anuclear** and discoid cell spherical when activate
- **Platelet count** = (150-300)x10^3/ml
- **Size:** 1.5–3.0 µm
- **Life span: 7–10 days**
- Sequestered in the spleen:

hypersplenism may lead to **low platelet counts**.



Platelets receptors :

1-GP IA and GP VI----- **collagen**
2-GP IB-IX-V ------- **VW factor**
3-**GP IIB-IIIA** ----- **fibrinogen and VWF**
4-**TP Alpha** ---------**TXA2**
5-**P2Y$_{12}$**--------- **ADP**



Platelets EM

1-Mitochondria

2-MIcrotubules

3-Alpha Granules

-von Will brand Factors

-Fibrinogen

-Chemokines (PF4,etc.)

-Thrombospondin

-P-selectin

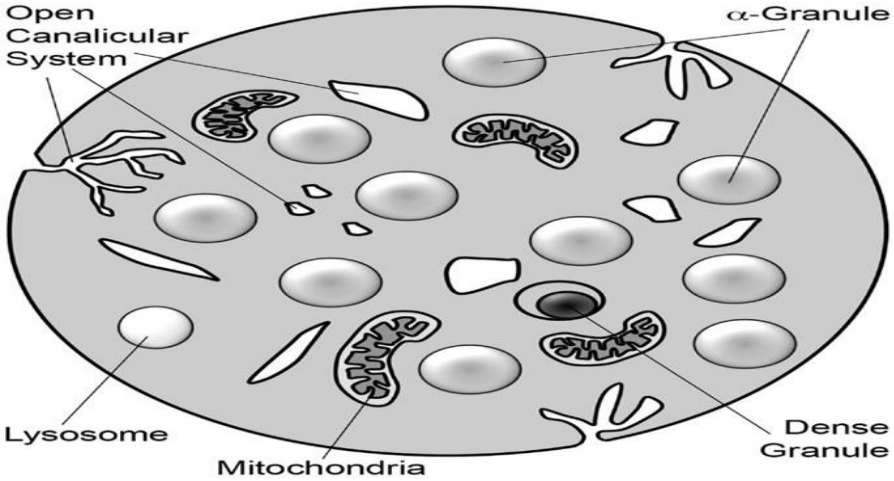
4-Dense Granules

-ADP/ATP

-Calcium

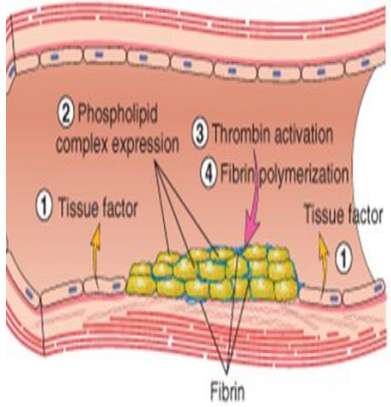
-Serotonin

5-open canalicular system



Hemostasis

1. VASCULAR PHASE
2. PLATELET PHASE
3. COAGULATION PHASE 4. 4-FIBRINOLYTIC PHASE



Platelets Activation

Adhesion

the platelet get activated after this stage when it contact with collagen after endothelial damage by:

1-GP IA,GP VI (Directly)

Or

2-(GP IB) > VW factor (Indirectly)

shape change

(Activation)

Aggregation:

Fibrinogen is needed to join platelets to each other via platelet **fibrinogen receptors** (***GP IIb /IIIa***

Releasing:

1. **ADP**
2. **5HT** vasoconstriction
3. **Platelet phospholipid** (PF3) clot formation.
4. **Thromboxane A2** (TXA2) is a prostaglandin formed from arachidonic acid

Function:

-vasoconstriction

- platelet aggregation

- **TXA2 & serotonin** activate other platelets and are vasoconstrictors decrease blood flow
- **TXA2** inhibited by aspirin (NSAIDS).
- **ADP*** activate other platelets and enhance stickiness and aggregation.

clot formation:

Myosin and actin filaments in platelets are stimulated to contract during aggregation further reinforcing the plug and help release of granule contents

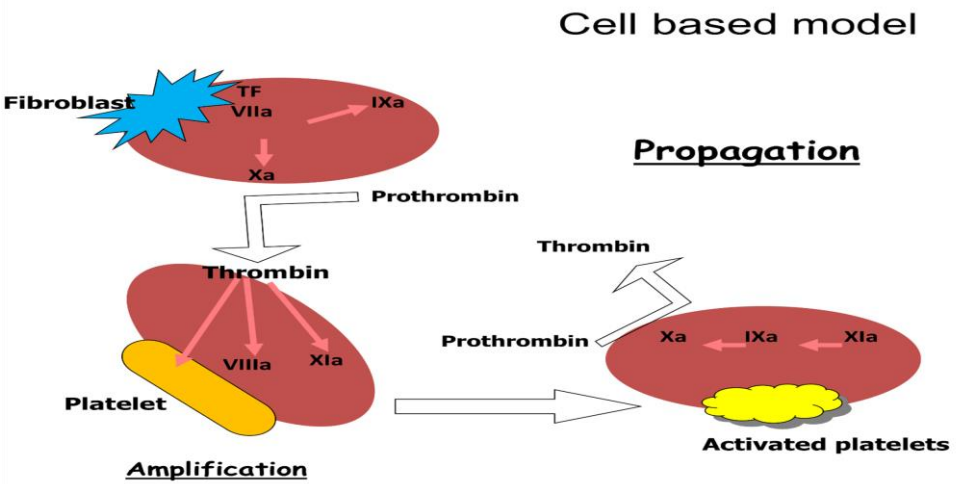
*ADP=Adenosine Diphosphate.

Role of platelets in blood coagulation

1-Initiation

2-Amplification

3-Propagation



Platelet Function :

1- maintenance of vascular integrity:

- by initial arrest of bleeding by platelet plug formation.
- Stabilization of hemostatic plug by contributing to fibrin formation.

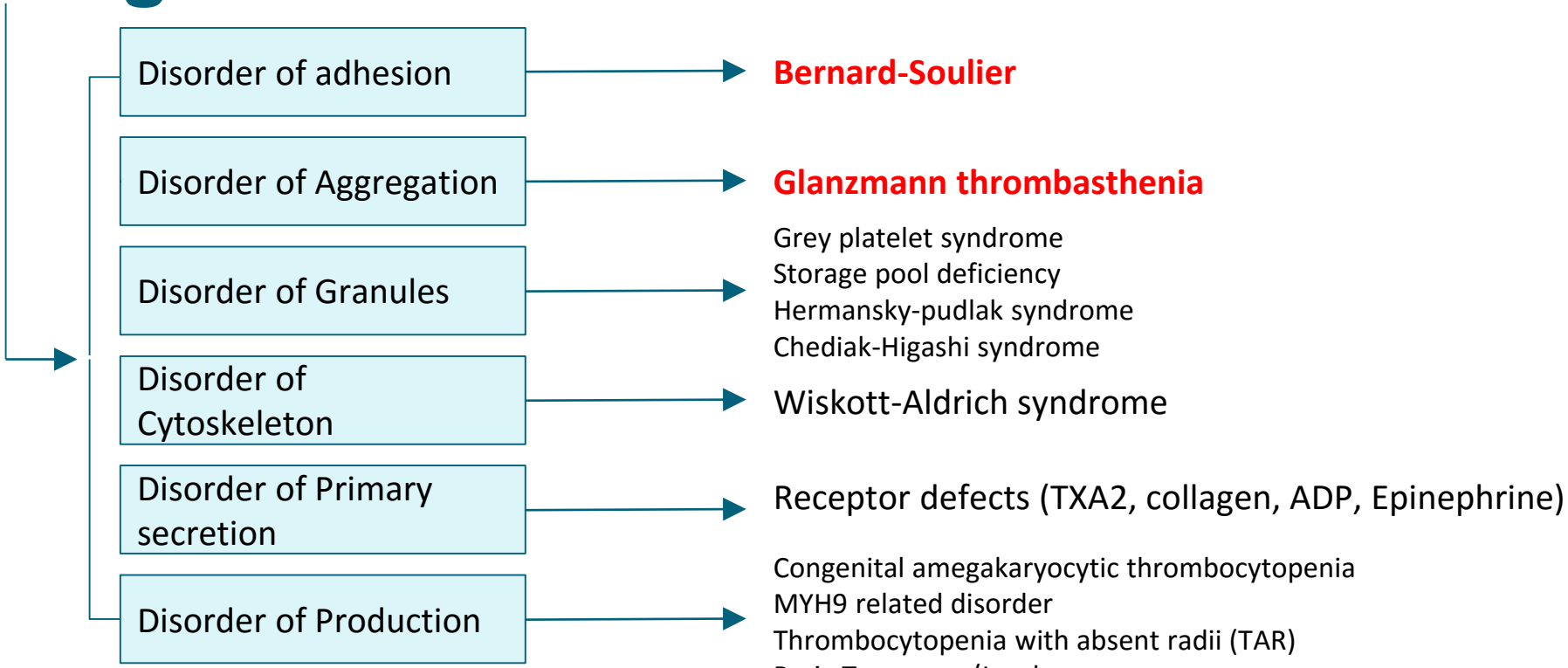
2-Adequate number of Platelets is essential to participate optimally in hemostasis.

Bleeding disorders

❖Thrombocytopenia (deficiency in platelet number):-

- Decrease Production:
  - Ex.. Leukemia, Lymphoma, anemias, Viruses(chickenpox, parvovirus, AIDS), chemotherapy & radiation, alcohol excess, Medication(diuretics, chloramphenicol).
- Increased Destruction:
  - Ex.. Autoimmune disease, Medication(vancomycin, rifampin,heparin), Surgery, Infection, Pregnancy.
- Abnormal Destruction
  - Splenomegaly.
- Pseudothrombocytopenia:
  - عددها كويس لكن استيعابها بطيء وما تتحرك الا بالقوة يعني تصير كسولة ووجودها زي عدمها ويصير كأنه فيه ثرمبوسايتوبينيا
  - Partial clotting of specimen, EDTA-platelet clumping, Platelet satellitism around WBCs, Cold agglutinins and Giant platelets.

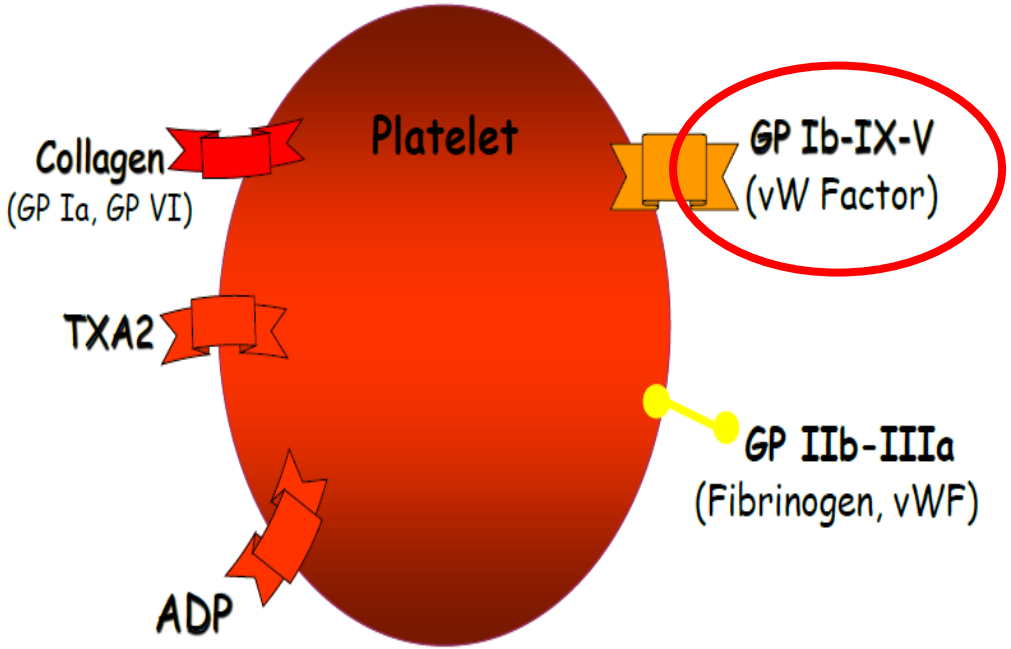
Congenital Platelet Disorders



Bernard-Soulier syndrome

Disorder of Adhesion

- Called hemorrhagic parous thrombocytic dystrophy.
- Rare autosomal recessive coagulopathy (bleeding disorder).
- Deficiency of ***glycoprotein Ib*** **(Gp Ib)**, the receptor for **von Willebrand factor**.
- BSS is a giant platelet disorder, meaning that it is characterized by abnormally large platelets.

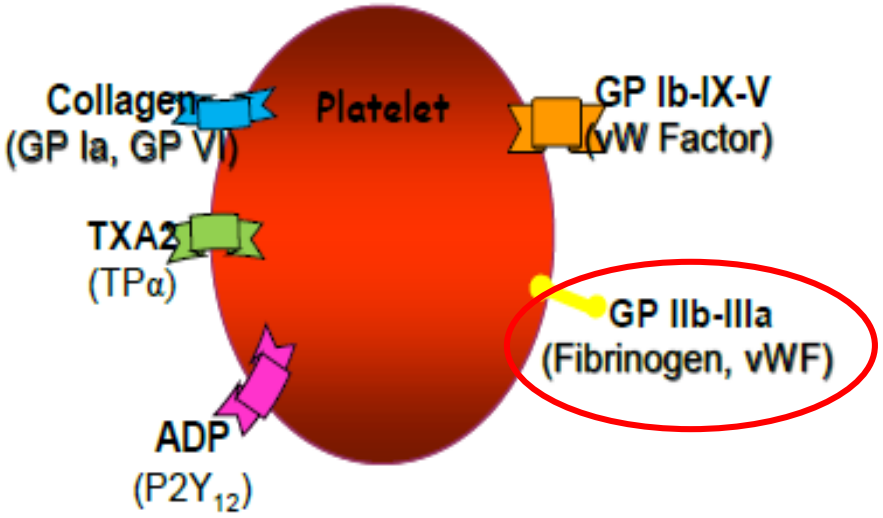


Glanzmann Thrombasthenia

Disorder of Aggregation

- Is an abnormality of the platelets. It is an extremely rare coagulopathy
- Deficiency or low levels of **glycoprotein IIb/IIIa (Gp IIb/IIIa),** which is a receptor for **fibrinogen**. As a result -->

  no fibrinogen bridging of platelets to other platelets can occur, and the bleeding time is significantly prolonged (↓ Aggregation).



Laboratory Testing of Platelet Function

- **Bleeding time**
- Electron-microscopy
- Platelet count & shape
- **Platelet aggregation**
- Platelet function analyzer
- Flow-cytometry
- Granule release products

a sharp pointed used to pierce the tip of finger or lobe of ear normally the bleeding last for 1-6 min if it is prolonged that's mean lack of platelet

Bleeding Time
15:00 Min

A platelet aggregation test requires a blood sample. The sample will be examined to see how the platelets are distributed through the plasma. Plasma is the liquid part of the blood. The lab technician will also add certain chemicals to your blood sample to test how quickly your platelets form a clot. also called aggregometry.

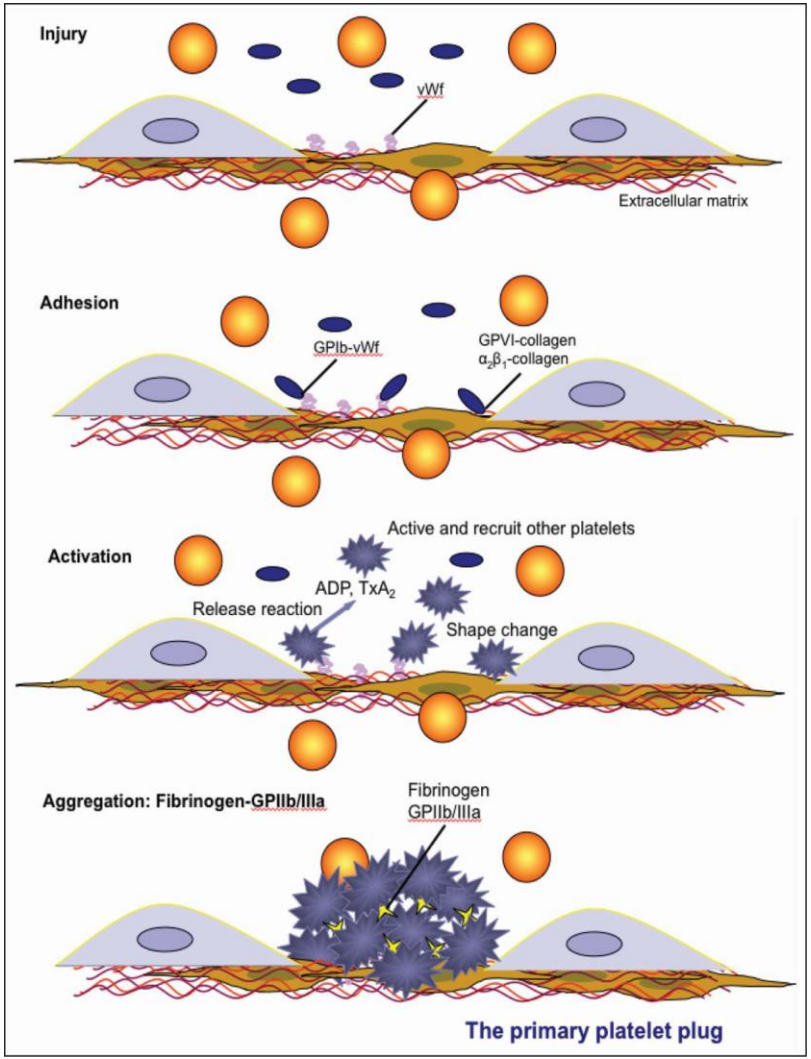
(PRP) Platelet rich plasma: provide information on time course of platelet activation.

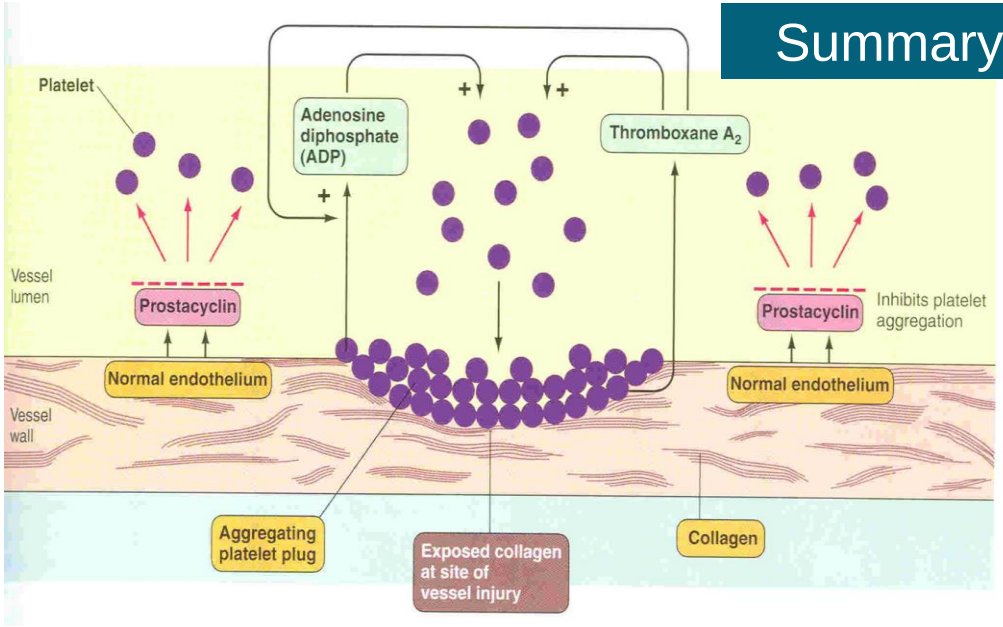
Agonists :

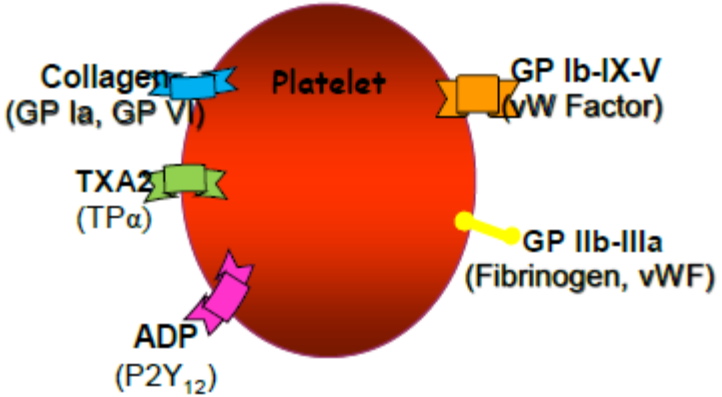
ADP	Arachidonic acid
Collagen	Adrenaline
Ristocetin	Thrombin

Platelet aggregometry
9:36 Min

Summary


Injury
vWf
Extracellular matrix
Adhesion
GPIb-vWf
GPVI-collagen
$\alpha_2\beta_1$-collagen
Activation
Active and recruit other platelets
ADP, TxA_2
Release reaction
Shape change
Aggregation: Fibrinogen-GPIIb/IIIa
Fibrinogen
GPIIb/IIIa
The primary platelet plug


Platelet
Adenosine diphosphate (ADP)
Thromboxane A_2
Vessel lumen
Prostacyclin
Prostacyclin
Inhibits platelet aggregation
Normal endothelium
Normal endothelium
Vessel wall
Aggregating platelet plug
Exposed collagen at site of vessel injury
Collagen


Collagen
(GP Ia, GP VI)
Platelet
GP Ib-IX-V
(vW Factor)
TXA2
(TPα)
GP IIb-IIIa
(Fibrinogen, vWF)
ADP
($P2Y_{12}$)

MCQs

Answer key: 1:B , 2:D , 3:C, 4:A , 5:D , 6:D

1-what is the receptor for Fibrinogen in aggregation:

A.GP IB-IX-V.
B.GP IIB-IIIA.
C.$P2Y_{12}$.
D.TP Alpha.

2-Platelets Secrete:

A.ADP.
B.Thromboxane A2.
C.PF3
D.All of the Above.

3-Thrombocytopenia due to increased destruction:

A.Leukemia.
B.HIV.
C.Pregnancy.
D.Chemotherapy.

4-Activation of platelets when they bind with which Receptor:

A.GP IB
B.GP IIB-IIIA.
C.$P2Y_{12}$.
D.TP Alpha.

5-Alpha Granules Contain:

A.ADP/ATP
B.Serotonin
C.Calcium
D.Fibrinogen

6-Normal Platelets Count:

A.(100-250)x103/ml
B.(200-400)x103/ml
C.(15-30)x103/ml
D.(150-300)x103/ml

SAQs

Q1:What are the stages of platelets in coagulation?

Ans:
1-Adhesion
2-Activation
3-Secretion
4-Clot Formation (Retraction)

Q2:platelets in EM are composed of:

Ans:
1-Mitochondria, 2-MIcrotubules, 3-Alpha Granules, 4-Dense Granules, 5-open canalicular system.

Q3:How Thrombocytopenia occurs:

Ans: due to: decreased production, increased destruction, Abnormal Destruction and pseudothrombocytopenia.

Q4:Investigations that we can do them in detect the platelets function:

Ans:
1- Bleeding time. 2- Platelet count. 3- Electron-microscopy .
4-Platelet Aggregation. 5- Platelet function analyzer. 6- Flow-cytometry. 7- Granule release products

Thanks for checking our work

Good Luck

Done by:

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we never dreamt of success, we worked for it.