Al-Rasheed University College Pharmacy Department

2nd Stage / 1st Semester

2021-2022

Platelets

Physiology lab #3

Done by:

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Platelets

- They are disc-shaped cells that are found in the blood, spleen.
- Platelets (Thrombocytes) are formed in the bone marrow by a precursor cells megakaryocytes.
- Platelets contains endoplasmic reticulum, lysosomes and Golgi complex that possess a variety of factors that contribute to platelet's function.
- Platelets flows inactively in the blood.
- In term of injury the following occurs:

Platelets is activated >> Changes its Shape into amoeboid figure with multiple pseudopods to enhance its function.

Platelet's functions

1- They secrete growth factors that stimulate mitosis in fibroblasts and smooth muscles, help to maintain the lining of blood vessels.

2- They form temporary platelet plugs to stop bleeding.

3- They secrete chemicals that attract neutrophils and monocytes to sites of inflammation.

4- They are capable of phagocytosis and destroy bacteria

5- They dissolve blood clots that have out-lasted their usefulness.

6- They secrete vasoconstrictors that cause vascular spasm in injured vessels.

Hemostasis

- It’s a process of arresting bleeding, preventing potential blood loss.
- Hemostasis is a multi-steps process which it includes;

1-Vascular spasm

2-Platelet plug formation

3-Clot retraction

4-Clot dissolution

5- Formation of fibrous tissue into the blood clot to close the whole vessel permanently

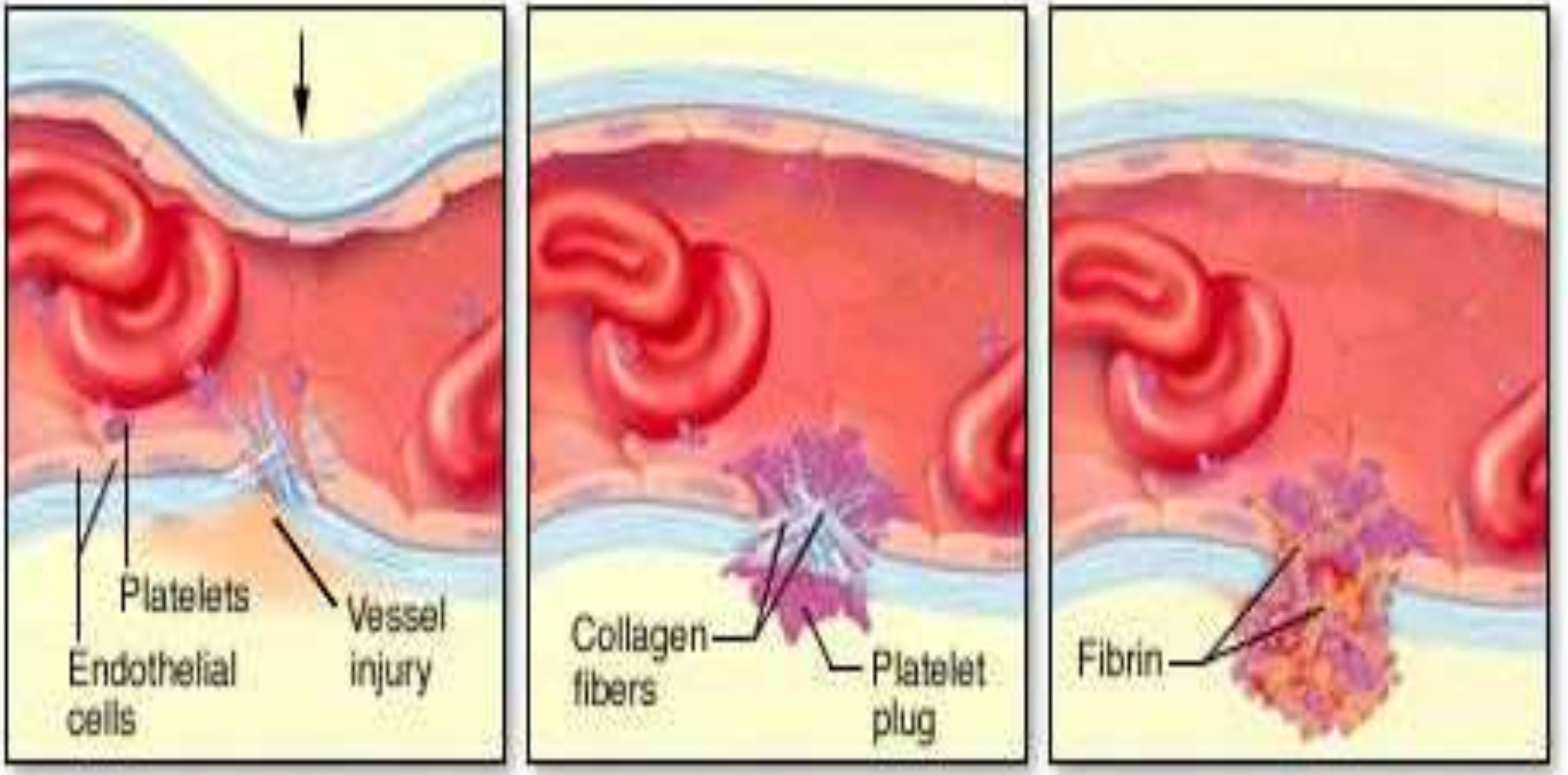
Vascular spasm

- Vascular spasm is an initial (primary), rapid body's response to injuries.

- Blood vessels constrict rapidly to prevent blood loss constructed by:

mediation of reflex neurogenic mechanism >> Local secretion of a potent vasoconstrictor (endothelin).

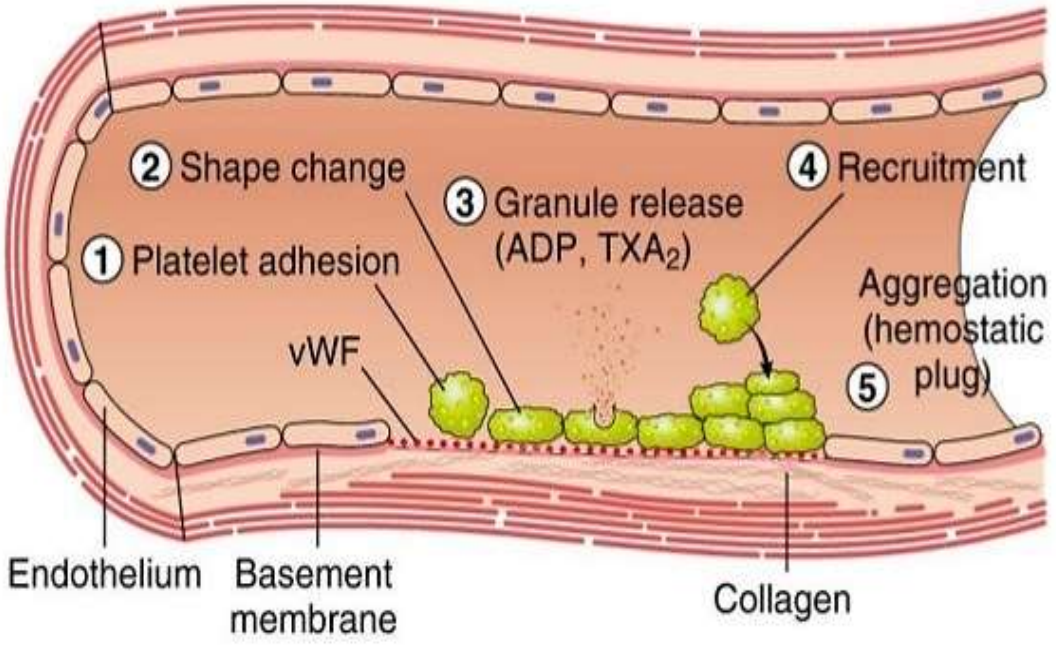
Effect is transient and bleeding might resume if not for activation of platelets and the coagulation cascade.



(a) Vasoconstriction (b) Platelet aggregation (c) Clot formation

Platelet Plug Formation

- It’s a multi-step process which possess events that occurs simultaneously;
- 1-Platelet adhesion
- 2-Platelet activation
- 3-Platelet aggregation
- 4-Expression of platelet factor III, coagulation factor V



Platelets Adhesion

- Platelets Adhesion is initiated when exposed collagen is contacted by platelets through a key protein (Von Willebrand factor).

- VWF is secreted by megakaryocytes, platelets, blood vessel.

- VWF contributes by binding to platelet's surface receptors and to collagen >> Promoting platelets adherence to collagen.

Platelets Activation

- Platelet-collagen adherence by VWF stimulate platelets to secrete:

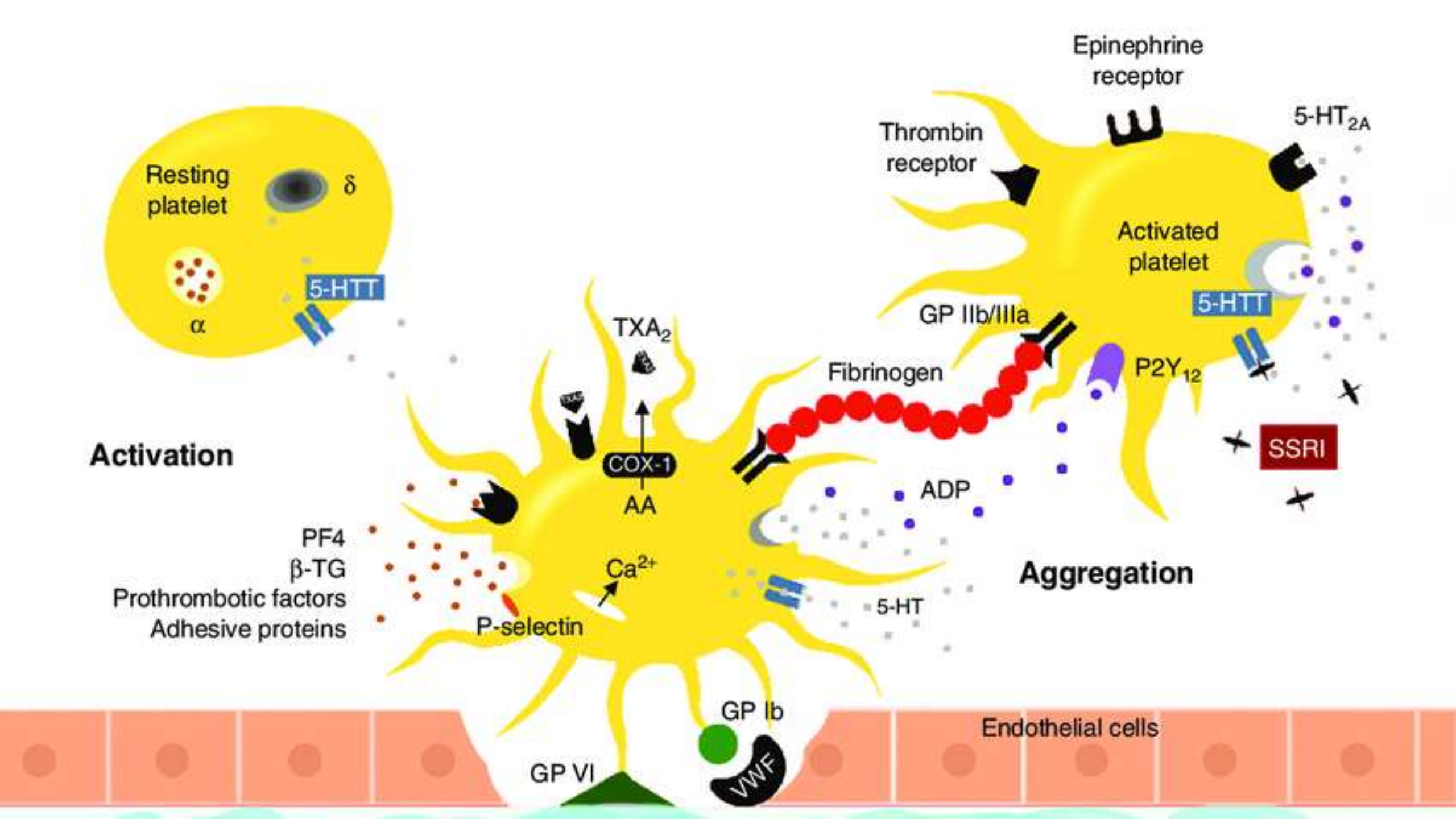
1- Adenosine diphosphate (ADP).

2- thromboxane.

3- vasoconstriction substances (serotonin, epinephrine).

Platelets Aggregation

- Platelet's aggregation is initiated when;
- ADP stimulation causes morphological changes to the platelets >> Expression of receptors on their surfaces >> binds to fibrinogen.
- Fibrinogen forms a bridge between platelets >> formation of platelet plug (Fibrin).
- ADP stimulates the production of thromboxane A2 (TXA2) which supports further platelets aggregation.
- Activated platelets express phospholipids (platelet factor III) and coagulation factor V which are important part of clot formation.


Epinephrine receptor
Thrombin receptor
5-HT2A
Resting platelet
δ
α
5-HTT
Activated platelet
5-HTT
GP IIb/IIIa
TXA2
Fibrinogen
P2Y12
Activation
COX-1
AA
SSRI
ADP
PF4
β-TG
Prothrombotic factors
Adhesive proteins
Ca2+
P-selectin
5-HT
Aggregation
GP Ib
Endothelial cells
GP VI
VWF

Clot Formation (Coagulation)

- **Blood clot**: it's a gel-like clumps of proteins, network of threadlike protein fibers known as thrombus that arrest blood cells, platelets leakage.

- **Coagulation has 2 distinguished pathways;**

Intrinsic pathway: Initiated with chemicals inside the blood. It starts when plasma factor XII is activated by contacting the collagen layer of a damaged blood vessel.

Extrinsic pathway: initiated with chemicals outside the blood. It starts with tissue factor III (thromboplastin) which is released from damaged tissues (outside plasma).

Control of clot formation

- Control over clot formation is a critical step. It prevents coagulation from spreading from site of initiation to the entire circulatory system.

- Blood contains several anticoagulants to prevent unwanted events of clotting;

  Anti-Thrombin (Produced by the liver)

  Heparin (Produced by basophiles)

Clot retraction

- the process by which a blood clot becomes smaller and draws the edges of a broken blood vessel together . which involves the shortening of fibrin threads and the squeezing out of excess serum.
- 5- Clot Dissolution
- 6- Formation of fibrous tissue

Clotting enhancing factor

- Contact with a foreign body >> Application of gauze aids very considerably in the speedy formation of a clot and arrest of hemorrhage.

- Temperature at site of injury is slightly higher than that of body. WHY?

Clotting retarding factor

- Storing blood in a sodium OR potassium citrate solution >> reduce clotting risk.
- Local application of cold bandage.

Determination of Bleeding Time & Clotting Time

- Bleeding time: Is the time it takes to stop bleeding.
- It measures the primary phase of hemostasis; (The interaction of platelets with the blood vessel wall and the formation of a hemostatic plug).
- The normal value for bleeding time is 1- 5 min.
- Duration of bleeding time depends on quantity and quality of platelets and ability of blood vessels to constrict.

Bleeding time procedure

1- Clean the tip of your finger with 70% alcohol, and then dry it with a piece of cotton.

2- Puncture the finger with sterile lancet and record the time.

3-At 15 sec intervals wipe the blood drop away completely with filter paper.

4- Continue this procedure until no more blood stains appear on the filter paper.

5-Count the number of blood spots and divide it on 4 to obtain bleeding time in minutes

Clotting time

- It is the time required to form a fibrin clot from the beginning of shedding of blood.
- In the normal case, clotting time is 5-12 min.

Procedure

1- clean the tip of your finger with 70% alcohol, and then dry it with a piece of cotton

2- Puncture the finger with sterile lancet and obtain large drop of blood (Note the time when the drop appears)

3- Rapidly draw blood into a non-heparinized capillary by holding the tube in a horizontal position >> Allow blood to rise at least half the tube

4- Wait 3 min from the starting of filling and break of a small piece of the capillary tube. Repeat every 30 sec until you notice that the blood has clotted (clotting has occurred when a fine fibrin thread is visible between the two pieces of tubing)

5- Note the time when clotting first is seen. Divide the number of pieces on 2 to obtain clotting time in min.

6- do not forget the addition of waiting time to the results


THANK YOU FOR LISTENING
SPIDERMAN SAYS PERFECT