

Hemostasis

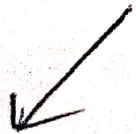
* Hemostasis is a sequence of responses that stop bleeding

* When Blood vessels are damaged (or) ruptured



Hemostasis response must be quick, localized and carefully controlled.

* Three Mechanisms reduce blood loss



Vascular spasm



Platelet plug
formation



Blood clotting
(coagulation)

(1) Vascular Spasm:-

When Arteries (or) Arterioles are damaged



Circularly Arranged Smooth Muscles in their wall contract Immediately.
(This reaction is called Vascular spasm)

* This reduces blood loss for several minutes to hours



during this time other hemostasis Mechanisms go into operation

(2) Platelet plug formation:-

* Platelets store chemicals within many vesicles and



Clotting factors, ADP, ATP, Ca^{2+} and Serotonin.

* It also contains enzymes that produce thromboxane A_2 ,
fibrin-stabilizing factors (strengthen a blood clot), lysosomes
some mitochondria, membrane system.



That take up & store Ca^{2+} and provide channels to release
contents of granules and glycogen.

* Within platelets there is a platelet derived growth factor
(PDGF)



A hormone that causes proliferation of vascular
Endothelial cell, vascular smooth muscle fibers and
Fibroblasts to help repair damaged Blood vessel walls

platelet plug Formation occurs as :-

- ① Initially, platelets contract and stick to parts of a damaged blood vessel such as collagen fibers and connective tissue of damaged endothelial cells. This process is called platelet Adhesion.
- ② Due to Adhesion the platelets become activated, and their characteristics change dramatically. They extend many projections to contact and interact with one another and begin to liberate content of their vesicles. This phase is called platelet release reaction.



Liberate ADP and Thromboxane A₂



Activate nearby platelets serotonin and thromboxane A₂ function as vasoconstrictors so reduce blood flow through injured vessel.



- ③ Release of ADP makes other platelets in the area sticky causes other platelets to adhere to originally activated platelets. This gathering of platelets is called platelet Aggregation. This Accumulation and Attachment of large number of platelets to form a mass called a platelet plug (very effective to prevent blood loss).

(3) Blood clotting :-

Blood clotting involves several reactions that may be divided into 3 stages.

(a) Formation of prothrombinase :-

Two pathways called Extrinsic pathway and Intrinsic Pathway lead to formation of prothrombinase.

Extrinsic pathway (Rapid)

↓
Tissue Trauma releases Tissue
Protein called Tissue Factors (TF)
(or) Thromboplastin.

↓
TF in presence of Ca^{2+} begins
Sequence of reactions and
Activates clotting Factor X

↓
Activated clotting Factor X
combines with Factor V in the
presence of Ca^{2+} to form
Active Enzyme prothrombinase

(b) conversion of prothrombin into Thrombin

Prothrombinase and Ca^{2+} converts prothrombin (A plasma protein
formed by the liver) into enzyme thrombin.

(c) Conversion of Fibrinogen into Fibrin

Thrombin in the presence of Ca^{2+} converts soluble Fibrinogen
into insoluble Fibrin Threads.

Thrombin also activates factor XIII which strengthens and
stabilizes the Fibrin threads into a sturdy clot.

* Normal coagulation requires vitamin K and is followed by
clot retraction (tightening of clot) and ultimately

Fibrinolysis (dissolution of clot)

clotting in an unbroken blood vessel is called Thrombosis.

Intrinsic pathway (Slow)

↓
Blood Trauma due to damaged
Endothelial cell and damaged
Platelets Activates clotting Factor
(XII)

↓
Activated clotting Factor XII
begins a sequence of reaction
that Activates clotting Factor X
in presence of Ca^{2+} , platelet
Phospholipids

↓
Activated clotting Factor X
combine with factor V to
form prothrombinase