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Topic: Blood Coagulation

Blood Coagulation

Coagulation:

The process by which a blood clot is formed. The formation of a clot is often referred to as secondary hemostasis, because it forms the second stage in the process of arresting the loss of blood from a ruptured vessel.

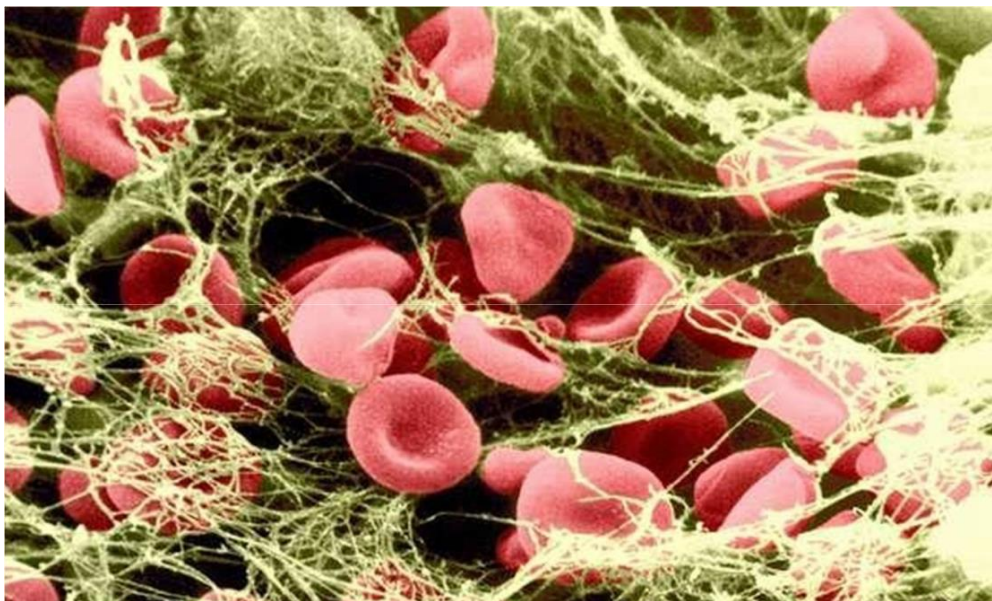


Fig: fibrin in blood clotting

[Red blood cells (erythrocytes) trapped in a mesh of fibrin threads.]

The first stage, primary hemostasis, is characterized by blood vessel constriction (vasoconstriction) and platelet aggregation at the site of vessel injury.

Clotting is a sequential process that involves the interaction of numerous blood components called coagulation factors.

There are 13 principal coagulation factors in all, and each of these has been assigned a Roman numeral, I to XIII.

Coagulation can be initiated through the activation of two separate pathways, designated extrinsic and intrinsic. Both pathways result in the production of factor X.

The activation of this factor marks the beginning of the so-called common pathway of coagulation, which results in the formation of a clot.

The extrinsic pathway is generally the first pathway activated in the coagulation process and is stimulated in response to a protein called tissue factor, which is expressed by cells that are normally found external to blood vessels.

However, when a blood vessel breaks and these cells come into contact with blood, tissue factor activates factor VII, forming factor VIIa, which triggers a cascade of reactions that result in the rapid production of factor X.

In contrast, the intrinsic pathway is activated by injury that occurs within a blood vessel. This pathway begins with the activation of factor XII (Hageman factor), which occurs when blood circulates over injured internal surfaces of vessels.

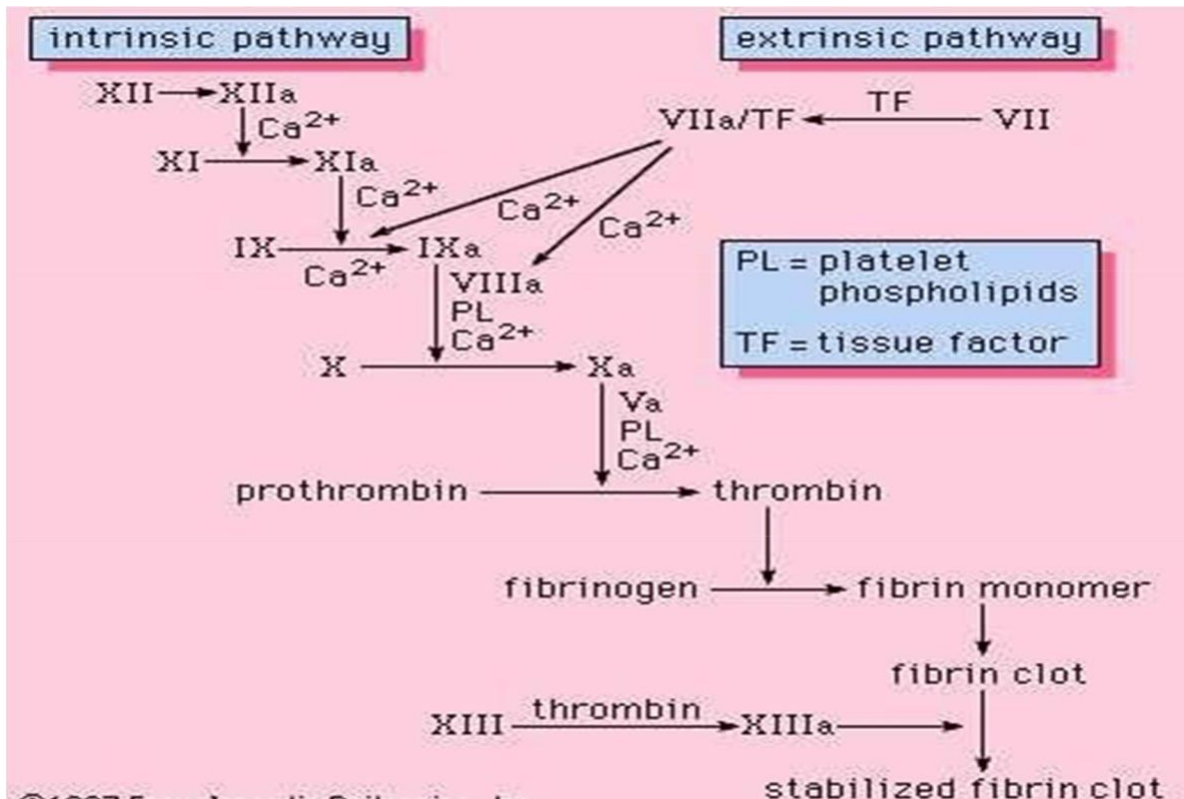


Fig: The blood coagulation cascade is initiated through either the extrinsic or intrinsic pathway.

Components of the intrinsic pathway also may be activated by the extrinsic pathway; for example, in addition to activating factor X, factor VIIa activates factor IX, a necessary component of the intrinsic pathway.

The production of factor X results in the cleavage of prothrombin (factor II) to thrombin (factor IIa).

Thrombin, in turn, catalyzes the conversion of fibrinogen (factor I)—a soluble plasma protein—into long, sticky threads of insoluble fibrin.

The fibrin threads form a mesh that traps platelets, blood cells, and plasma. Within minutes, the fibrin meshwork begins to contract, squeezing out its fluid contents.

This process, called clot retraction, is the final step in coagulation. It yields a resilient, insoluble clot that can withstand the friction of blood flow.

Clotting Factors:

- i. Fibrinogen
- ii. Prothrombin
- iii. Tissue Factor or Thromboplastin
- iv. Calcium ions
- v. Proaccelerin (labile Factor)
- vi. Unassigned
- vii. Proconvertin(Stable factor)
- viii. Antihæmophilic Factor A
- ix. Antihæmophilic Factor B
- x. Stuart-Prower Factor
- xi. Plasma Thromboplastin Antecedent
- xii. Hageman Factor
- xiii. Fibrin Stabilizing Factor / Laki-Lorand Factor