

B. Sc Second year (Honours)

Paper-4

Dr.Mirza Imteyaz Baig

Mechanisms of Blood clotting

Blood coagulation refers to the process of forming a clot to stop bleeding.

To stop bleeding, the body relies on the interaction of three processes:

Primary hemostasis involves the first two processes.

1. **Vasoconstriction.** Vasoconstriction is the body's first response to injury in the vascular wall. When injury occurs, vessel walls constrict, causing reduced blood flow to the site of injury.
2. **Platelet plug.** Platelets aggregate to the site of the injury. They stick together acting as a "plug." Platelets also activate the process which causes a fibrin clot to form, known as secondary hemostasis.

Secondary hemostasis.

3. Platelets alone are not enough to secure the damage in the vessel wall. A clot must form at the site of injury. The formation of a clot depends upon several substances called clotting factors. These factors are designated by roman numerals I through XIII. These factors activate each other in what is known as the clotting cascade. The end result of this cascade is that fibrinogen, a soluble plasma protein, is cleaved into fibrin, a non soluble plasma protein. The fibrin proteins stick together forming a clot.

The clotting cascade occurs through two separate pathways that interact, the intrinsic and the extrinsic pathway.

Extrinsic Pathway

The extrinsic pathway is activated by external trauma that causes blood to escape from the vascular system. This pathway is quicker than the intrinsic pathway. It involves factor VII.

Intrinsic Pathway

The intrinsic pathway is activated by trauma inside the vascular system, and is activated by platelets, exposed endothelium, chemicals, or collagen. This pathway is slower than the extrinsic pathway, but more important. It involves factors XII, XI, IX, VIII.

Common Pathway

Both pathways meet and finish the pathway of clot production in what is known as the common pathway. The common pathway involves factors I, II, V, and X.

How a Blood Clot Is Made

Blood is made up of many different cells—mostly red blood cells, white blood cells and platelets—as well as clotting factors. These and other elements float through blood vessels in a straw like liquid called plasma.

The coagulation cascade is a complex chemical process that uses as many as 10 different proteins (called blood clotting factors or coagulation factors) that are found in plasma. Put simply, the clotting process changes blood from a liquid to a solid at the site of an injury. Here's how the process works:

1. **Injury.** A cut on the skin or an internal injury creates a small tear in a blood vessel wall, which causes blood flow.
2. **Vessel constriction.** To control blood loss, the blood vessel immediately narrows (called constriction), which limits blood flow through the vessel.
3. **Platelet plug.** In response to the injury, tiny cells in the blood called platelets are activated. The platelets stick to one another and to the wound site to form a plug. The protein von Willebrand factor (VWF) helps the platelets stick to each other and to the blood vessel wall.
4. **Fibrin clot.** Next, blood clotting factors trigger production of fibrin, which is a strong, strand like substance that surrounds the platelet plug and forms a fibrin clot, a mesh like net that keeps the plug firm and stable. Over the next several days to weeks, the clot strengthens and then dissolves as the wounded blood vessel wall heals.