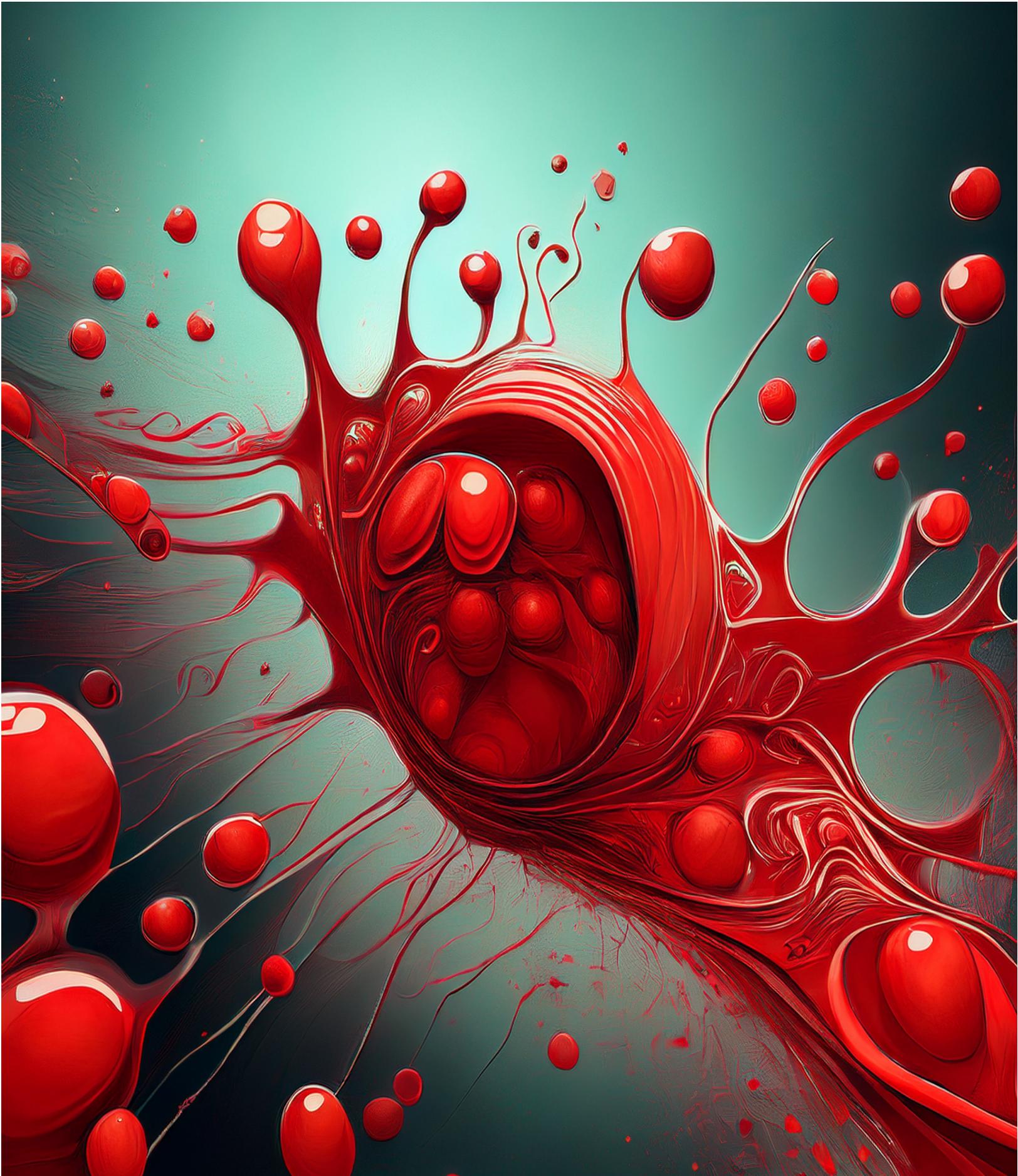


Clotting



PTT/aPTT and INR

PT/aPTT are laboratory tests that measure the **clotting time** (how long it takes blood to clot.)

PT/aPTT are blood tests and **INR** is a **ratio** calculated from the **PT**.

At least a dozen blood proteins, or blood clotting factors, are needed to clot blood and stop bleeding (coagulation).

Prothrombin, or factor II, is one of several clotting factors produced by the liver. Prothrombin time (PT) measures the presence and activity of five different blood clotting factors (factors I, II, V, VII, and X). This test measures the integrity of the extrinsic and common pathways of coagulation. The prothrombin time (PT) measures the clotting time from the activation of factor VII through the formation of the fibrin clot. Adequate amounts of vitamin K are needed to produce prothrombin. Warfarin (Coumadin) is sometimes prescribed as a "blood thinner" because it is an effective vitamin K antagonist (blocks the formation of vitamin K).

The activated partial thromboplastin time (aPTT) measures the function of several other clotting factors, found in the intrinsic and common blood clotting pathways. It measures the clotting time from the activation of factor XII through the formation of the fibrin clot. aPTT prolongations are caused by factor deficiencies (factors VIII, IX, XI, and/or XII), or inhibitors (most commonly, heparin). Heparin prevents clotting by blocking certain factors in the intrinsic pathway.

aPTT and activated partial thromboplastin time (aPTT) are basically the same thing. The aPTT has largely replaced the older aPTT, which was unable to incorporate variables in surface/contact time.

PT is used to monitor treatment with warfarin (Coumadin). Once warfarin is discontinued, it usually takes several days to clear it from the system. The aPTT test allows the provider to check that there is enough heparin in the blood to prevent clotting, but not so much as to cause bleeding. Once heparin is discontinued, its blood-thinning effects usually only last a few hours.

The greater the PT/aPTT values, the longer it takes the blood to clot.

HIGH PT/aPTT = risk for BLEEDING.

LOW PT/aPTT = risk for blood clots/ stroke.

The INR stands for International Normalized Ratio. The INR is calculated from the PT and is intended to allow valid comparisons of results regardless of the type of PT reagent used among different laboratories ($INR = \frac{\text{patient PT}}{\text{mean normal PT}}$). The INR is a method of standardizing the PT for coumadin anticoagulation. Before the INR, different labs using different reagents had different controls and widely differing PT value ranges.

An INR of 1 means the blood clots "normally" for that pt. The greater the INR, the longer it takes the blood to clot.

The warfarin (Coumadin) dosage for people being treated to prevent the formation of blood clots is usually adjusted so that the prothrombin time is about 1.5 to 2.5 times the normal value (or INR values 2 to 3). A patient may take warfarin to anticoagulate for atrial fibrillation (target INR around 2.5) or for a mechanical heart valve (target INR 3). An INR of 3 means the blood takes about three times as long to clot compared with the normal value for that pt.

PTT VERSUS APTT

| PTT | APTT |
|--|--|
| PTT is Partial Thromboplastin Time. | APTT is Activated Partial Thromboplastin Time. |
| This test is done to evaluate the time taken for blood clotting in order to diagnose bleeding problems. | This test refers to the test of activated blood coagulation used to assess the clotting factors of the intrinsic pathway. |
| No activator is used in PTT | An activator is added in APTT |
| If PTT exceeds more than 100 seconds, it indicates bleeding disorders. | If APTT value exceeds 70 seconds, it signifies bleeding disorders. |
| PTT investigates intrinsic pathway as well as common pathway | APTT investigates bleeding disorders and heparin therapy |
| PTT test is beneficial to assess the coagulation factors VIII, IX, X, XII, II (prothrombin), and I (fibrinogen). | Prolonged APTT values measure factors like inherited or acquired intrinsic clotting factor deficiency or abnormality (XII, XI, X, IX, VII, V, II, I), huge blood replacement, classic haemophilia or haemophilia A, lupus anticoagulant (antibodies against substances in the lining of cells called phospholipids), or excessive coumadin dosage (warfarin sodium). |
| Partial Thromboplastin Time (PTT) has an increased reference range of 60-70 seconds | Activated partial thromboplastin time (APTT) has a narrow reference range of 30 – 40 seconds. |
| Partial thromboplastin time (PTT) is less sensitive for monitoring heparin therapy | Activated partial thromboplastin time (APTT) is extremely sensitive for monitoring heparin therapy |

Activated Partial Thromboplastin Time

The activated partial thromboplastin time (aPTT) is a common screening test done to evaluate function of the intrinsic clotting system.

- It has largely replaced the older PTT, which was unable to incorporate variables in surface/contact time.
- The aPTT now measures the clotting time of plasma, from the activation of factor XII by a reagent (a negatively charged activator such as silica and a phospholipid) through the formation of a fibrin clot.
- If a patient's aPTT is abnormal, additional tests will be done to determine the exact cause of the coagulation problem.

Reference values for aPTT vary among laboratories, but generally range between 25 and 38 seconds. The aPTT of a newborn will usually be prolonged and may be up to 55 seconds at birth. It decreases to the adult range by 6 months of age. (Note: each lab has its own reference values based upon the equipment and reagents used.)

The aPTT is the most commonly used test to monitor heparin therapy. The therapeutic goal for a patient being anticoagulated with heparin, is an aPTT approximately 1.5 to 2.5 times the mean normal value. Heparin is most often administered as an initial intravenous bolus followed by a continuous intravenous infusion. The aPTT is evaluated every 6 hours during the first day of heparin therapy and 6 hours after any dosage change. If the aPTT is therapeutic, it can be checked once daily while patients are on heparin. (Note: If low molecular weight heparin is given for anticoagulation, a prolonged aPTT does not occur, so another test(s) may be indicated to monitor therapy.)

If the aPTT is increased beyond the therapeutic range, the physician may order the heparin IV flow slowed or briefly discontinued. As the half-life of heparin is quite short, these measures will often allow the aPTT to rapidly return to a therapeutic range. Protamine sulfate may also be given to block the action of heparin. In some serious situations, such as active bleeding, the physician will order a transfusion of whole blood or plasma to increase clotting factors. Surgery may be postponed in a patient who has an increased aPTT, unless it is an emergency procedure.

A prolonged aPTT in non-heparinized patients can occur due to:

- salicylates
- inherited or acquired intrinsic clotting factor deficiency or abnormality (XII, XI, X, IX, VII, V, II, I)
- massive blood replacement
- hemophilia A
- lupus anticoagulant
- excessive coumarin dosage

A decreased aPTT can occur due to:

- digitalis
- tetracyclines
- antihistamines
- nicotine
- elevated factor VIII
- tissue inflammation or trauma

ANTICOAGULANT VERSUS ANTIPLATELET

ANTICOAGULANT

An agent used to prevent the formation of blood clots

Slows down clotting and reduce fibrin formation to prevent the formation and growth of clots

Used for the conditions, which involve stasis, causing the formation of blood clots

Examples: Heparin, warfarin, dabigatran, apixaban, and rivaroxaban

ANTIPLATELET

A platelet-blocking drug, which reduces the tendency of platelets in the blood to clump or clot

Prevents platelets from clumping to prevent the formation and growth of clots

Used for the conditions, which involve endothelial damage and platelets sticking to the injured site

Examples: Aspirin and a P2Y12 inhibitor used in dual antiplatelet therapy (DAPT)