

## **Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), and Thrombin Time (TT) – Significance, Indications, Procedures, and Normal Ranges**

### **Prothrombin Time (PT)**

#### **Significance:**

- PT measures the efficiency of the extrinsic and common coagulation pathways (Factors I, II, V, VII, and X).
- It is used to monitor warfarin (coumadin) therapy.
- It helps diagnose bleeding disorders, liver disease, and vitamin K deficiency.

#### **Indications:**

- Evaluation of coagulation disorders.
- Monitoring warfarin therapy.
- Assessment of liver function (since clotting factors are synthesized in the liver).
- Investigation of vitamin K deficiency.
- Preoperative screening for clotting abnormalities.

#### **Procedure:**

1. Sample Collection:
  - a. Venous blood is collected in a tube containing sodium citrate (anticoagulant).
2. Centrifugation:
  - a. The plasma is separated from the blood cells.
3. Test Process:
  - a. Tissue factor (thromboplastin) and calcium are added to the plasma.
  - b. The time taken for clot formation is recorded as PT.
4. Results Interpretation:
  - a. The PT is often converted to International Normalized Ratio (INR) for standardization.

#### **Normal Range:**

- PT: 10 – 13 seconds (varies by laboratory).
- INR: 0.8 – 1.2 (normal), 2.0 – 3.0 (therapeutic range for anticoagulant therapy).

## Activated Partial Thromboplastin Time ( aPTT)

### Significance:

- aPTT measures the intrinsic and common pathways (Factors I, II, V, VIII, IX, X, XI, XII).
- It is used to monitor heparin therapy.
- Helps diagnose hemophilia, von Willebrand disease, and lupus anticoagulant syndrome.

### Indications:

- Evaluation of unexplained bleeding.
- Monitoring heparin therapy.
- Detecting intrinsic pathway defects (e.g., Hemophilia A & B.)
- Screening for lupus anticoagulant or antiphospholipid syndrome.
- Preoperative screening if there is a history of bleeding tendency.

### Procedure:

1. Sample Collection:
  - a. Venous blood is collected in a sodium citrate tube.
2. Centrifugation:
  - a. Plasma is separated.
3. Test Process:
  - a. Partial thromboplastin reagent and calcium chloride are added to plasma.
  - b. The time for clot formation is recorded as aPTT.

### Normal Range:

- aPTT: 25 – 35 seconds.
- Therapeutic range (for heparin therapy): 1.5 – 2.5 times the normal value (50 – 70 sec.)

## **Thrombin Time (TT)**

### **Significance:**

- TT measures the final step of coagulation – conversion of fibrinogen to fibrin by thrombin.
- It detects abnormalities in fibrinogen function or the presence of thrombin inhibitors (e.g., heparin, fibrin degradation products).

### **Indications:**

- Evaluation of hypofibrinogenemia (low fibrinogen).
- Detection of heparin contamination.
- Diagnosis of disseminated intravascular coagulation (DIC).
- Investigation of liver disease and fibrinolysis disorders.

### **Procedure:**

1. Sample Collection:
  - a. Venous blood is collected in a sodium citrate tube.
2. Centrifugation:
  - a. Plasma is separated.
3. Test Process:
  - a. Bovine thrombin is added to plasma.
  - b. The time for fibrin clot formation is recorded.

**Normal Range :**TT: 14 – 18 seconds.

### **Conclusion:**

- **PT/INR is useful for extrinsic pathway defects and warfarin monitoring.**
- **aPTT is useful for intrinsic pathway defects and heparin monitoring.**
- **TT assesses fibrinogen function and detects thrombin inhibitors.**

Test	Pathway assessed	Monitors therapy	Main indications
PT/INR	Extrinsic & Common	Warfarin (Coumadin)	Liver disease, vitamin K deficiency, bleeding disorders
aPTT	Intrinsic & Common	Heparin	Hemophilia, lupus anticoagulant, clotting factor deficiencies
TT	Final step to Heparin presence (Fibrinogen to Fibrin)		Hypofibrinogenemia, DIC, fibrinolysis disorders

### International Normalized Ratio (INR)

#### Definition:

The International Normalized Ratio (INR) is a standardized measurement of Prothrombin Time (PT) used to assess the extrinsic coagulation pathway and monitor warfarin (coumadin) therapy. INR helps ensure consistency in PT results across different laboratories by adjusting for variations in reagents.

#### Significance of INR

- Standardizes PT results across different laboratories.
- Used to monitor warfarin (oral anticoagulant) therapy.
- Assesses bleeding risk in patients on anticoagulants.
- Helps diagnose liver disease, vitamin K deficiency, and coagulation disorders.

•ISI (International Sensitivity Index) = A value assigned to thromboplastin reagents by manufacturers to standardize results.

#### Indications for INR Testing:

1. Monitoring warfarin therapy to prevent excessive bleeding or clot formation.
2. Diagnosing liver disease, as clotting factors are synthesized in the liver.
3. Assessing vitamin K deficiency, which affects clotting factor production.
4. Preoperative screening in patients with known clotting disorders.
5. Evaluating unexplained bleeding or clotting tendencies.