**Prothrombin time (PT)**

 This test measures the formation of a blood clot in vitro, as it estimates the time required for clot formation after exposure to tissue factors.

 That is measured efficiency and concentration coagulations factor include 7, 10, 5, 2 and 1, in extrinsic clotting pathway.

 **Why we make this analysis?**

1-bleeding disorder that lasts for a long time, 2-coagulation abnormalities 3-bleeding with urine, 4-liver problems, 5-before surgery, 6-Vitamin K deficiency, 7-monitoring patients receiving anticoagulant therapy

**Procedure:**

1-Taking a blood sample by sodium citrate tube.

2-Sample preparation using centrifugation 3000 rpm for 15 minutes or 1500 rpm for 30 minutes to obtain plasma free of platelets.

3-Addition 50 μl of plasma to the test tube

4-Addition 50 µl of reagent 1 to plasma

5-Incubate this mixture at 37 °C in a water bath for 3 minutes

6-Then addition 50 μl of reagent 2 to the previous mixture

7-Using watch stop to determine time required for clotting

Reagent 1= activation partial thromboplastin time aptt + sodium oxide

Reagent 2= CaCl2

**Normal value:**

11-14 seconds

**Partial thromboplastin time (PTT)**

 It is also known as the activated partial thromboplastin time (aPTT or APTT), a historical name for this measure is the kaolin-cephalin clotting time (KCCT), which making to test the efficiency of coagulation factors include 8, 9, 11 and 12 in intrinsic clotting pathway.

 **When PTT elevated that refer to:**

1-patient take heparin, or sample contaminant with heparin

2-patient take coagulations therapy (urokinase or streptokinase)

3-coagulation factors deficiency

4-liver disease

5-sepsis

6-antibody against coagulation factors.

**Procedure:**

1-separtion plasma sample by using sodium citrate tube.

2-gently mixing of 100 µl from reagent 1 and 100 µl of plasma sample, in the water bath at 37 °C for 3 minutes.

3- then addition 100 µl from reagent 2 and determine time of clotting by watch stop.

Reagent 1= phospholipid + clot activator.

Reagent 2= CaCl2

**Normal values:**

1 - 4 days (31.5 ----- 54.3 seconds).

5 - 30 days (25.4 -----59.8 seconds).

30 - 90 days (32 ----- 55.2 seconds).

90 - 180 days (28.1 ----- 42.9 seconds).

More than 180 days (26.1 ----- 40.3 seconds).

PT and PTT important to determine 95% of coagulations problems.

**International normalization ratio (INR)**

 It is a laboratory measurement of how long it takes blood to form a clot. It is used to determine the effects of oral anticoagulants on the clotting system. In an attempt to overcome the variability between laboratories, prothrombin times were initially expressed as a ratio of the prothrombin time of a control value.

INR=$\frac{PT sample}{PT control} ×isi$

ISI= international sensitization index.

 The ISI is a numerical value representing the responsiveness of any given commercial system relative to the international standard. It takes into account the variability in results obtained using different commercial systems in calculating the result. In this way, results from different laboratories and countries can be compared more readily.

**Why do we monitor the INR?**

 We regularly monitor the INR of people using warfarin in order to balance the risk of excessive bleeding (when the INR is too high, meaning that the blood is too thin) against the risk of clotting or thrombosis (when the INR is too low or the blood is too thick). INR values over 4.5 increase the risk of major haemorrhage (bleeding), and an INR less than 2 increases the risk of thromboembolism (formation of blood clots within the blood vessels) and associated conditions such as heart attack and stroke.

Reference:

Hoffbrand AV, Steensma DP. Hoffbrand's essential haematology. John Wiley and Sons; 2019 Dec 31

