General Physiology Lect.12

Prevention of Clotting in the Normal Vascular System

The intravascular anticoagulants

1. **<u>Endothelial surface factor:</u>**

    a. **The smoothness of endothelium, which prevents contact activation of the intrinsic clotting system.**
    b. **Layer of glycocalyx, a mucopolysaccharides adsorbed to the inner surface of the endothelium, which repels the clotting factor and platelets.**
    c. **A protein bound with endothelial membrane, thrombin which bind thrombomodulin, this dulin-thrombin not only slows the clotting process, but also activates a plasma protein, protein C, that acts as an anticoagulant by inactivating activated factors V and VIII.**

2. **<u>Antithrombin factor:</u> the most important anticoagulants in the blood itself that remove thrombin from blood, the most powerful**

    1. **The fibrin fibers that themselves are formed during the process of clotting and**
    2. **an alpha- globulin called antithrombin III or antithrombin – heparin co factor, about 85-90% of thrombin formed adsorbed to the fibrin fibers as they develop. The thrombin that does not adsorb to fibrin fibers, soon combines with antithrombin III, which**

block the effect of the thrombin on the fibrinogen and inactivates it within 12-20 minutes.

3. **<u>Heparin:</u> is a conjugated polysaccharide, formed by the basophilic mast cells located in the pericapillary connective tissue throughout the body. It prevents blood coagulation by combining with antithrombin-heparin co factor which makes this factor combine with thrombin. The antithrombin heparin complex removes several other activated coagulation factors in addition to thrombin from circulating blood, the others include factors XII, XI, IX and X.**

Prevention of Blood Coagulation outside the Body:

1. **Heparin: it prevents the blood coagulation when added to the sample of blood outside the body as well as in the body.**

2. **Calcium-deionizing agent used for preventing coagulation is sodium, ammonium, or potassium citrate. The citrate ion combines with Ca in the blood to cause an un-ionized Ca compound, and lack of Ca prevents coagulation.**

3. **Collecting of the blood in siliconized containers, which prevents contact activation of platelets and factor XII,**

which are effects that initiate the intrinsic clotting mechanism.

4. **Coumarine derivates: these are used internally to prolong the coagulation time from the normal range of about 2-3 minutes to 10 minutes. Vitamin K is essential for the formation of prothrombin by the liver, these substances when given they interfere with action of Vit. K and this cause a decrease in the formation of prothrombin by the liver and this causes prolongation of coagulation time, and this prevents the occur of blood clots.**

Blood Disease

1. **Decreased prothrombin, factor VII, IX and X caused by Vitamin K.**

Hepatitis , cirrhosis (replacement of liver cells by fibrous tissue), acute yellow atrophy and the presence of a stone in the common bile duct (in which bile does not reach the duodenum) and this effect on the absorption of vit. K . all these factors cause a severe tendency to bleed.
These liver diseases often cause decreased production of prothrombin and the other factor both because of poor vitamin K absorption and because of the diseased liver cells.

2. ***Hemophilia:*** **it is a hereditary disease which affects the male only, the female is not affected by the disease, because at least one of her two X chromosomes will have the**

appropriate genes. If one of her X chromosomes is deficient, she will be a hemophilia carrier.

There are three types of Hemophilia:

1. **Classical hemophilia (hemophilia A):**

This is caused by the deficiency of factor VIII.

2. **Hemophilia B: this caused by deficiency of factor IX.**
3. **Hemophilia C: this caused by the deficiency of factor XI.**

The treatment by giving the patient deficient factor.

3. **<u>Thrombocytopenia:</u> this means the presence of a very low quantity of platelets in the circulating system, this caused by drugs, chemicals and sometimes due to unknown reason, in this case it's called idiopathic thrombocytopenia.**

The treatment by giving the patient blood containing fresh blood platelets. (ordinary, bleeding does not occur until the number of platelets in the blood below 50,000 µl rather than normal 150,000-300,000 levels as low as 10,000 µl are frequently lethal.