

Diseases Associated with Clotting Problems

To understand the possible disorders associated with the blood clotting (coagulation) system, consider the goal of the system: to prevent excess bleeding. If the clotting system can not adequately form clots (thrombi), then the result is a bleeding disorder (hemophilia); if the clotting system forms clots too easily, then the result is formation of excess clots (thrombophilia). A general overview of the clotting process is depicted on the final page of this handout.

Platelet Disorders:

Platelet disorders occur when there are too few platelets, too many platelets or a normal number of platelets that do not function in the normal manner. Having too few platelets or platelets that do not function well (for example, aspirin use) can lead to a bleeding tendency (hemophilia). Likewise, too many platelets can predispose to a tendency to clot excessively (thrombophilia).

Platelet function can be altered in many different situations; many medications to treat diseases such as strokes and heart attacks were specifically designed to alter the ability of platelets to form clots. There are also a number of diseases that can alter how well a platelet can function.

Coagulation Cascade Disorders:

The second portion of the clotting system, the coagulation cascade, also has the potential to cause both an inability to form clots (hemophilia) or an excessive ability to form clots (thrombophilia). Hemophilic states result when there are decreased levels of the clotting factors (depicted in the above diagram). There are two primary disorders, hemophilia A and hemophilia B. Hemophilia A results from low levels of factor VIII and hemophilia B results from low levels of factor IX. Low levels of virtually any of the factors in the above diagram (with the exception of factor XII) will result in an inability to form blood clots; this will result in some degree of excess bleeding.

To understand the problems associated with excess clotting, consider the goal of the primary functions of blood in the body. Blood contains numerous cells and proteins and those components all have vital roles in the human body. However, the primary function of blood is to deliver oxygen throughout the body, which is accomplished by red blood cells. Blood receives its oxygen supply from the lungs and is then transported from the heart in blood vessels called arteries to the rest of the body. Once the blood has delivered its oxygen, it is returned to the heart in blood vessels called veins.

Arterial Thrombotic Disease:

Clots (thrombi) that form in arteries can limit and/or completely block the supply of blood (and thus oxygen) to a portion of the body. Lack of oxygen to a tissue is referred to as ischemia. Prolonged ischemia can lead to tissue death, referred to as infarction. This process can occur anywhere in the body. For example, a heart attack (myocardial infarction) occurs when the blood flow that provides oxygen to the heart is blocked. A stroke (cerebrovascular accident) occurs when the blood flow that provides oxygen to the

brain is blocked. In both cases, there are numerous risk factors that can predict a susceptibility to these disorders. Many of these are not modifiable such as age and sex. There are other risk factors that can be changed: smoking, obesity, inactive (sedentary) lifestyle, uncontrolled high blood pressure (hypertension) and uncontrolled high cholesterol (hyperlipidemia).

Venous Thrombotic Disease:

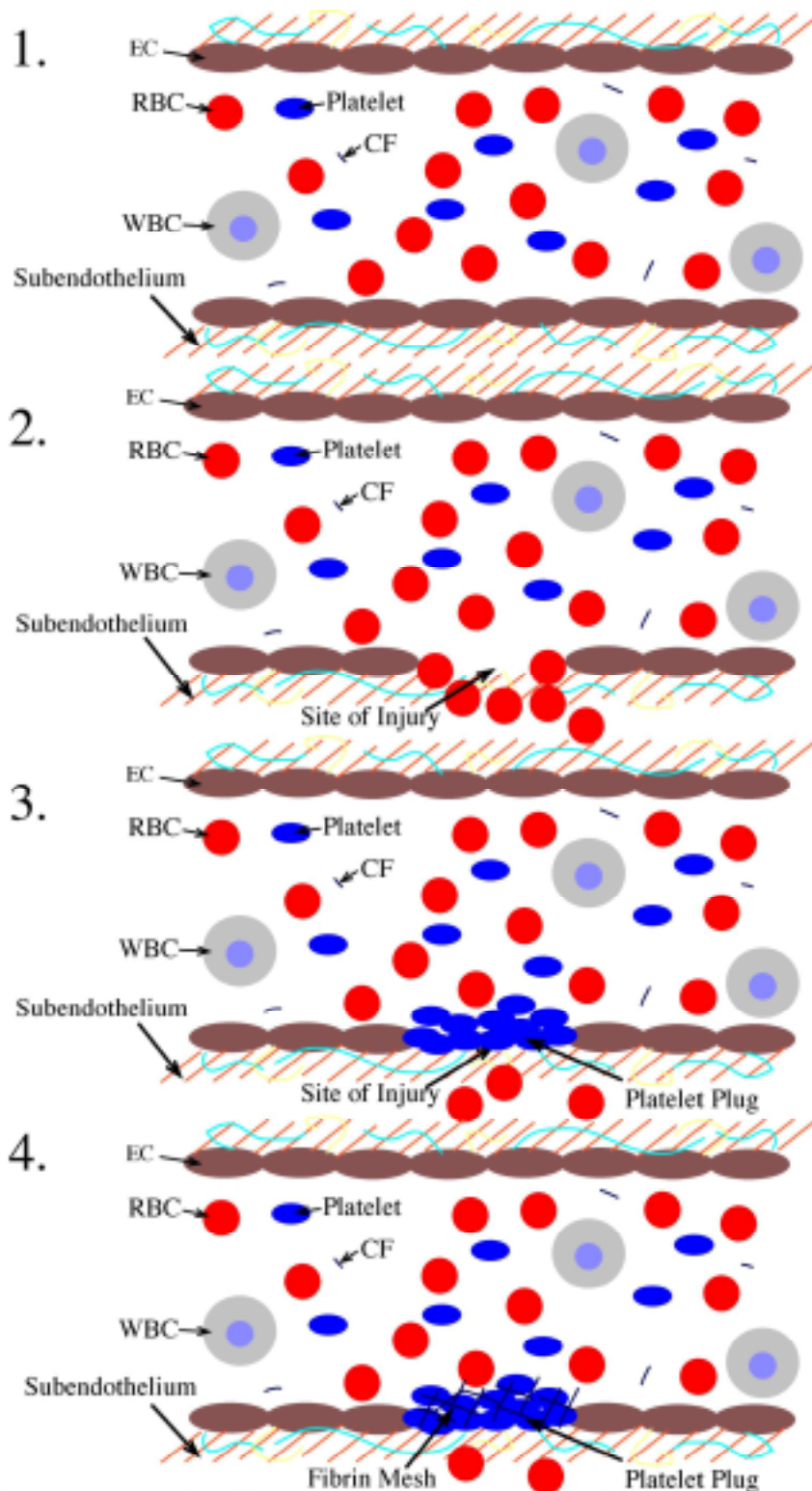
Clots that form in veins can block the flow of blood back to the heart. Again, these clots can form in veins throughout the body, but one of the most common places is in the deep veins of the legs. When a clot forms in one of these veins (called a deep vein thrombosis or DVT), it can cause redness, swelling, warmth and pain. Portions of this clot can break off from the main clot, becoming an embolus (an embolus is any foreign object traveling in the blood stream). The embolus travels in the blood stream and can travel through the heart and into the lung, giving rise to a clot in the lung (pulmonary embolus). A pulmonary embolus blocks blood flow to the lungs, preventing adequate oxygenation of the blood. As with strokes and heart attacks, pulmonary emboli can be small and asymptomatic or large and life-threatening.

Every year, approximately 250,000 patients develop a deep venous thrombosis (DVT's). Of these patients, between 30-50% develop a pulmonary embolus some of which can be fatal.

Secondary Disease States Affecting Clotting Processes:

There are a number of diseases that can alter the clotting process; although these are not the main focus of this website, it is important to briefly mention a few as these can interact with other disorders, thus increasing the possibility of forming a clot. Many types of cancer, auto-immune diseases (for example lupus), post-operative states (especially following knee and hip surgery) and any condition which results in prolonged immobilization.

Thrombophilic states can increase the likelihood of clotting problems, as is discussed on the WebPages specific to the disorders. However, even without any known thrombophilic state or risk factor, one can develop arterial and/or venous thrombi. There are numerous factors and disorders that can predispose one to forming clots and it has been only recently that physicians and scientists have begun to understand such disorders. It is quite likely that further disorders remain to be discovered which may provide further insight into how and why unwanted clots form and ultimately how they can be treated and/or prevented.



The Formation of a Clot. Panel 1 depicts a normal artery or vein in the body composed of an endothelial cell (EC) wall with a subendothelial layer of collagen and other substances. Some of the normal components of the blood are depicted including red blood cells (RBC), white blood cells (WBC), platelets and clotting factors (CF). Panel 2 shows a break in the EC wall, resulting in bleeding from the site. Panel 3 shows platelets coming together (aggregation) to form a platelet plug. Panel 4 shows the final step, where the coagulation cascade forms a fibrin network to secure the clot in place.

Further Information:

For further information, please visit the University of Illinois – Urbana/Champaign and Carle Cancer Center webpages on coagulation disorders at:

www-admin.med.uiuc.edu/hematology.

This information is provided as a resource to patients and health care providers. The information contained above represents common diagnostic and treatment modalities, but individual circumstances may require additional or different tests or medications. All medical decisions should be made with the advice and consultation of a physician or other health care provider.