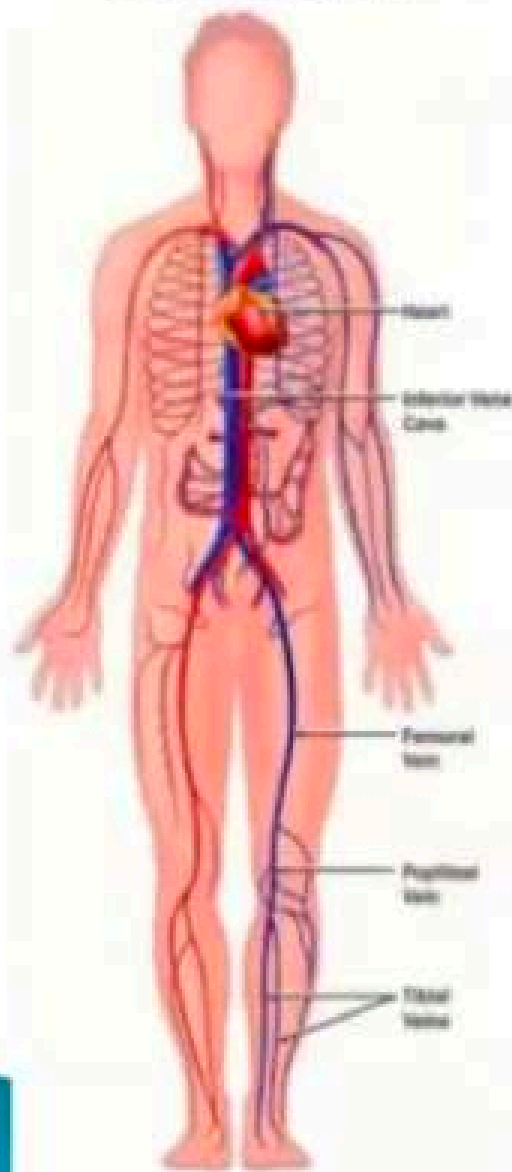


THROMBOEMBOLISM AND ANTI COAGULANTS

WHAT IS THROMBOEMBOLISM?

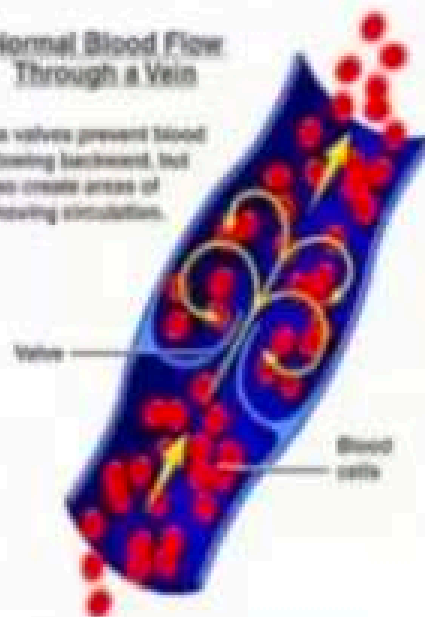
- ▶ **Formation of a clot (thrombus) in a blood vessel that breaks loose and is carried by the blood stream to plug another vessel results in various symptoms according to the area and size of blockage.**

Circulatory System



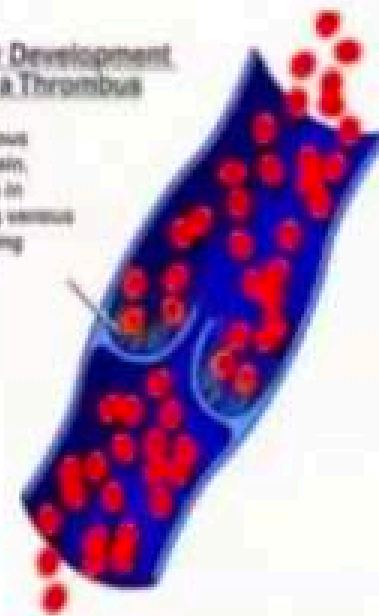
Normal Blood Flow Through a Vein

Vein valves prevent blood from flowing backward, but can also create areas of slow-moving circulation.



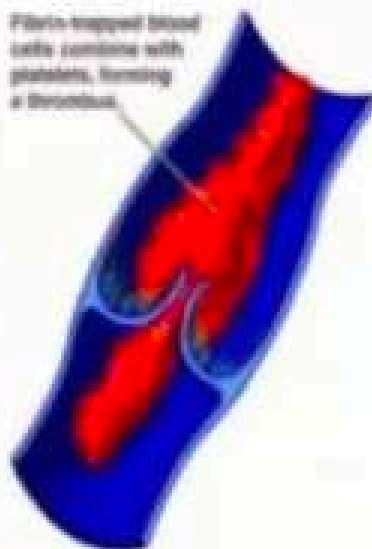
Early Development of a Thrombus

Fibrin, a fibrous clotting protein, accumulates in slow-moving venous blood, trapping blood cells.



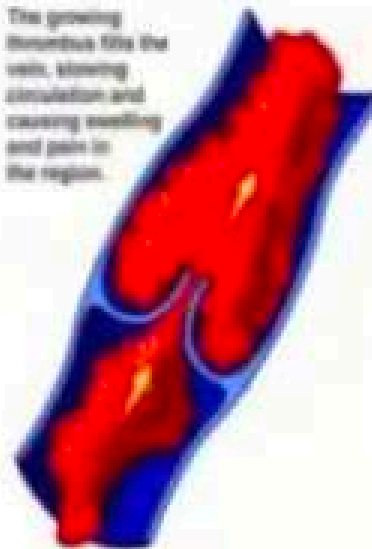
Continued Development of a Thrombus

Fibrin-trapped blood cells combine with platelets, forming a thrombus.



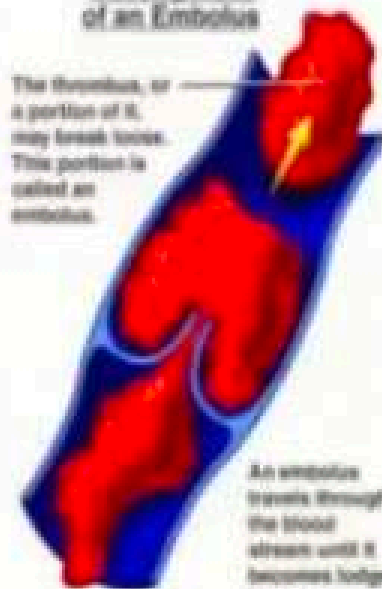
Final Development of a Thrombus

The growing thrombus fills the vein, slowing circulation and causing swelling and pain in the region.




Development of an Embolus

The thrombus, or a portion of it, may break loose. This portion is called an embolus.



An embolus travels through the blood stream until it becomes lodged in a narrower blood vessel.

WHAT IS DVT

- ▶ Deep vein thrombosis is a blood clot that forms inside a vein, usually deep within leg.
 - ▶ As many as 900,000 Americans a year get one, and up to 100,000 die because of it.
 - ▶ The danger is that part of the clot can break off and travel through bloodstream. It could get stuck in lungs and block blood flow, causing organ damage or death.
- 


SYMPTOMS OF DVT:

- ▶ leg swelling below the knee
- ▶ redness
- ▶ pain in the area of the clot.
- ▶ But people won't always have these. About half of people with DVT get no warning signs.


PULMONARY EMBOLISM

- ▶ a clot that moves into lungs and blocks the blood supply.
- ▶ It can cause trouble breathing, low blood pressure, fainting, a faster heart rate, chest pain, and coughing up blood.

CAUSES AND RISK FACTORS:

- › An injury that damages the veins
 - › Overweight
 - › Family history
 - › Catheter placed in the vein
 - › Hormone therapy or taking contraceptive pills
 - › Heavy smoking
 - › Sitting in the same position for long durations without any movements as in case of driving
 - › Prolonged bed rest such as during hospital stay or paralysis
 - › Pregnancy
 - › Hereditary blood clotting disorders
 - › Cancers
 - › Inflammatory bowel disease
 - › Heart failure
 - › Surgeries, especially of the lower limbs
- 

PREGNANCY AND DVT:

- ▶ Women are more likely to develop DVT during pregnancy and in the 4 to 6 weeks after giving birth.
 - ▶ That's when they have higher levels of estrogen, which may make blood clot more easily.
 - ▶ The pressure of their expanding uterus can slow blood flow in the veins as well.
 - ▶ Certain blood disorders can boost their chances of having DVT even more.
- 

HORMONE THERAPY:

- ▶ Like pregnancy, birth control pills and some treatments for postmenopausal symptoms raise the amount of estrogen in a woman's blood. That can increase the odds of getting DVT.

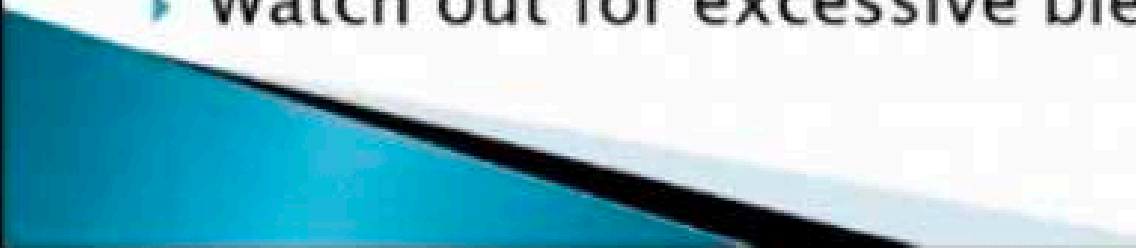
IMMOBILITY:

- ▶ Studies show long-distance travel -- a trip that lasts more than 4 hours -- doubles the chance of developing DVT.

COMPLICATIONS OF DVT:

- ▶ Pulmonary embolism
- ▶ Dizziness
- ▶ Sweating
- ▶ Chest pain, which worsen with cough or deep breathing
- ▶ Rapid breathing and heart beat
- ▶ Coughing up blood
- ▶ Skin sores which can lead to infections and/or gangrene

PREVENTION:

- ▶ Take medications as prescribed and in right doses
 - ▶ Keep a check on blood pressure
 - ▶ Quit smoking
 - ▶ Maintain a healthy height to weight ratio
 - ▶ Avoid sitting continuously for long duration
 - ▶ Move the legs for a while when sitting for long duration
 - ▶ Learn to identify warning symptoms of DVT
 - ▶ Visit a doctor regularly
 - ▶ Discuss any side effects of medications with the doctor
 - ▶ Watch out for excessive bleeding
- 

D DIMERS:

This looks for levels of D-dimer, a substance that's in your blood when you have a clot. If the test is normal, meaning your levels aren't high and there's no clot, you might not need any more tests.

DOPPLER ULTRASOUND:

- ▶ This painless imaging test doesn't have radiation the way an X-ray does.
- ▶ It uses sound waves to create a picture of legs.
- ▶ The doctor spreads warm gel on skin, then rubs a wand over the area where they think the clot is.
- ▶ The wand sends sound waves into body.
- ▶ The echoes go to a computer, which makes pictures of your blood vessels and sometimes the blood clots.
- ▶ A radiologist or someone who's specially trained has to look at the images to explain what's going on.

Ventilation perfusion (V/Q) scan:

- ▶ Doctors use this imaging test to check lungs for air flow (ventilation, or V) and blood flow (perfusion, or Q).

Spiral computed tomography:

- ▶ This is a special version of a CT scan in which the scanner rotates to create a cross-section view of your lungs.


Pulmonary angiogram:

- ▶ If other imaging tests aren't clear, doctors will use this test. Unlike the others, this test is invasive -- a catheter into a vein and guide it to the veins and arteries around heart.
- ▶ a dye that shows up on an X-ray. This helps see if there's a clot in lungs

Echocardiogram:

- ▶ This ultrasound of the heart can help to see areas that aren't working the way they should. This test doesn't diagnose PE, but it can show strain on the right side of heart that results from PE.

ANTICOAGULANTS:

- ▶ **Anticoagulants** are drugs that treat blood clots, and help prevent blood clot formation in the veins and arteries and used for thromboembolism
 - ▶ Commonly called blood thinners.
- 


Types of Anticoagulants

- ▶ coumarins and indandiones
- ▶ factor Xa inhibitors
- ▶ heparins
- ▶ thrombin inhibitors

coumarins and indandiones

- ▶ Warfarin, the only drug listed in this category, is a coumarin.
- ▶ It is an oral anticoagulant that inhibits Vitamin K epoxide reductase, an enzyme that recycles oxidized vitamin K. Vitamin K is an activator of coagulating factors II, VII, IX and X, so by decreasing the availability of Vitamin K synthesis of these factors are decreased.

WARFARIN:

- ▶ Warfarin is an extremely effective anticoagulant
 - ▶ but there are a few drawbacks.
 - ▶ It can interact with certain foods and can it cause serious interactions with many commonly used medicines.
 - ▶ Regular blood monitoring (international normalized ratio-INR) is done to check for effectiveness and safety.
- 

factor Xa inhibitors

- ▶ selectively and reversibly blocking the activity of clotting factor Xa, preventing clot formation.
- ▶ Factor Xa inhibitors have predictable anticoagulant effects and do not require routine monitoring, unlike some other anticoagulants.

RIVAROXABAN:

- ▶ Initial dose: 15 mg orally twice a day for first 21 days of therapy
Maintenance dose: 20 mg orally once a day for the remaining duration of treatment.

APIXABAN:

- ▶ Initial dose: 10 mg orally 2 times a day for 7 days
Maintenance dose: 5 mg orally 2 times a day

heparins

- ▶ Heparin is an **injectable anticoagulant** that activates antithrombin III, which inhibits thrombin and factor Xa, factors necessary in the final stages of blood clotting cascade.
- ▶ There are two types of heparins:
 - high molecular weight heparins
 - low molecular weight heparins.

Properties of Heparins and warfarin.

Property	Heparins	Warfarin
Structure	Large acidic polysaccharide polymers	Small lipid-soluble molecule
Route of administration	Parenteral	Oral
Site of action	Blood	Liver
Onset of action	Rapid (minutes)	Slow (days); limited by half-lives of preexisting normal factors
Mechanism of action	Activates antithrombin III, which proteolyzes coagulation factors including thrombin and factor Va	Impairs post-translational modification of factors II, VII, IX and X

thrombin inhibitors

Thrombin inhibitors are anticoagulants that bind to and inhibit the activity of thrombin therefore prevent blood clot formation.

- ▶ Thrombin inhibitors inactivate free thrombin and also the thrombin that is bound to fibrin.

Types of thrombin inhibitors:

- ▶ Argatroban
- ▶ Bivalirudin
- ▶ Dabigatran etexilate mesylate
- ▶ Lepirudin
- ▶ Praxbind