Life-threatening Blood Clots

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Important Notice

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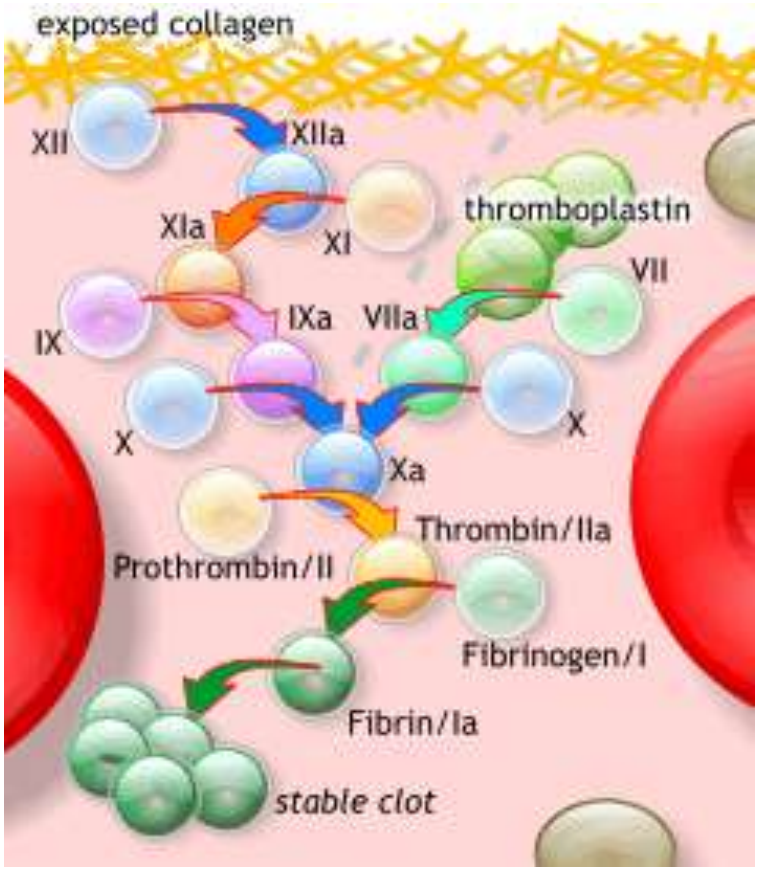
Discussion Goals:

- What are blood clots?
- Where do blood clots occur?
- What are risk factors for blood clots?
- What are the symptoms of blood clots?
- How are blood clots diagnosed?
- How can blood clots be prevented?
- How are blood clots treated?

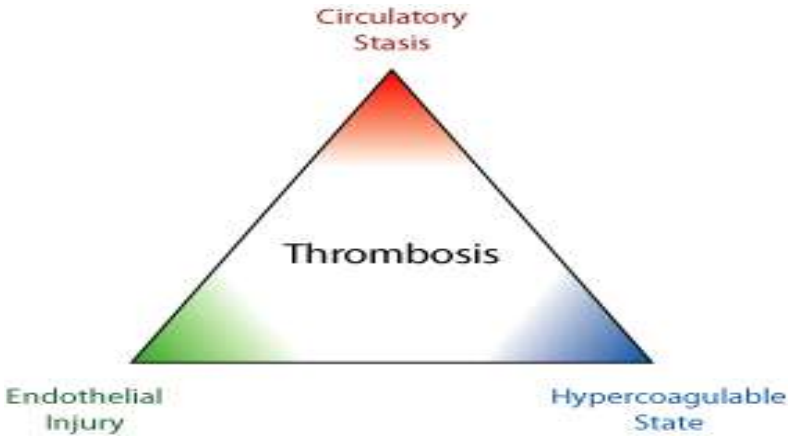
Blood Clotting, What are Blood Clots

- Blood clots are necessary to prevent bleeding and promote healing
- Blood needs to be able to flow freely in the vessels but clot when outside of blood vessels
- How does blood clot?
  - There is a complex interaction between blood vessels, platelets, specific clotting factors and blood flow
  - Platelets are more involved in clotting in arteries and the clotting factors are more involved in veins



Virchow's Triad

- Hypercoagulability
- Endothelial dysfunction/injury
- Circulatory stasis



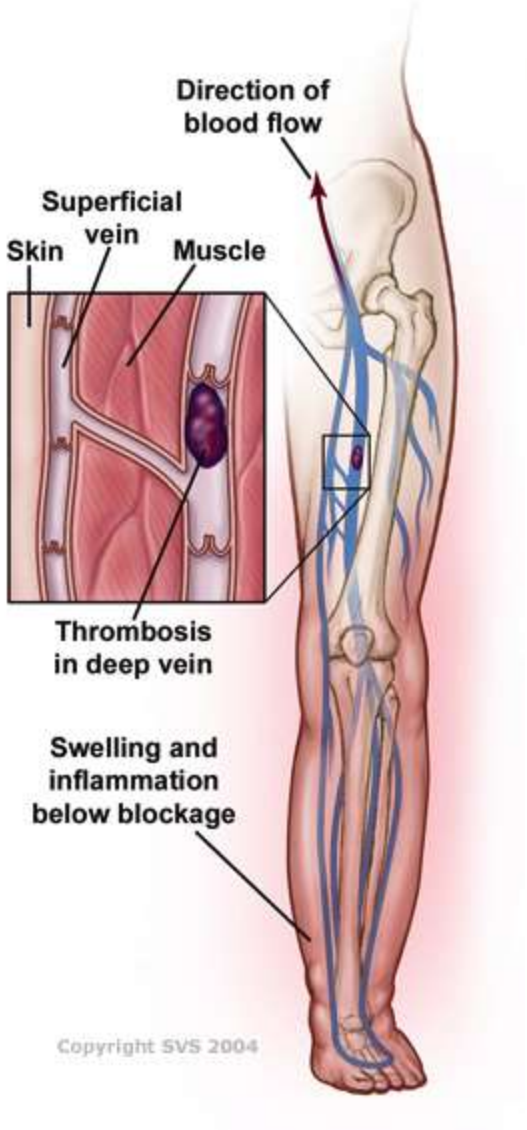
- Rudolf Virchow
  - 1821-1902

When Good Clotting goes Bad

- DVT (Deep Venous Thrombosis)
- PE (Pulmonary Embolus)
- Thrombus formation from Atrial Fibrillation
- Arterial thrombi

DVT – Deep Venous Thrombosis

- DVT:
  - Blood clots that form in the large, deep veins, typically in the leg
- Superficial Phlebitis
  - Blood clots that form in superficial veins
  - Not a risk for PE



DVT

- Symptoms
  - Leg pain and tenderness
  - Swelling of the leg
  - Redness of the leg
  - Warmth of the leg

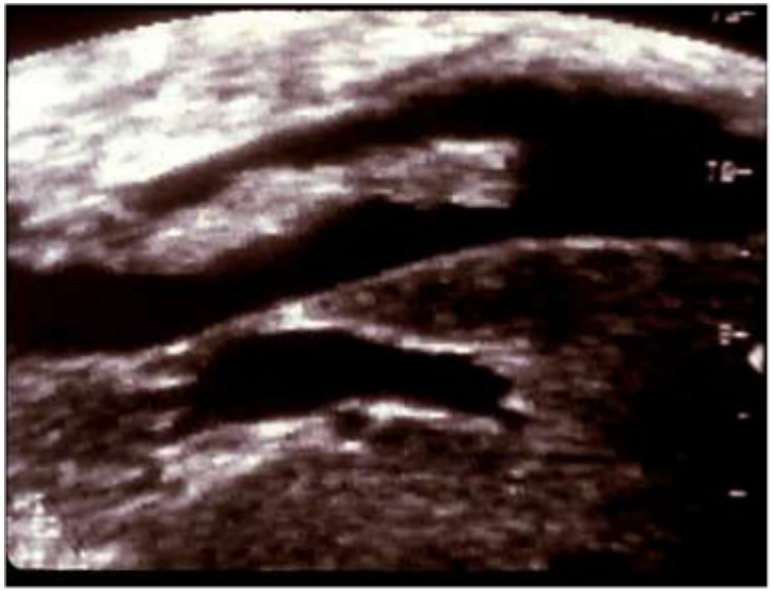
DVT

- Risk factors
  - Tobacco use
  - Recent fracture
  - Pregnancy and taking Estrogen
  - Obesity
  - Recent surgery/immobility
  - Cancer
  - Thrombophilia (acquired or inherited)

DVT

- Diagnosis
  - Patient history
  - Physical exam
  - Lab tests
    - D-dimer
    - Clotting studies
  - Imaging studies
    - Lower extremity ultrasound
    - Others (CT, Venograpy, MRI)

DVT: Ultrasound



Long Axis View

Short Axis View

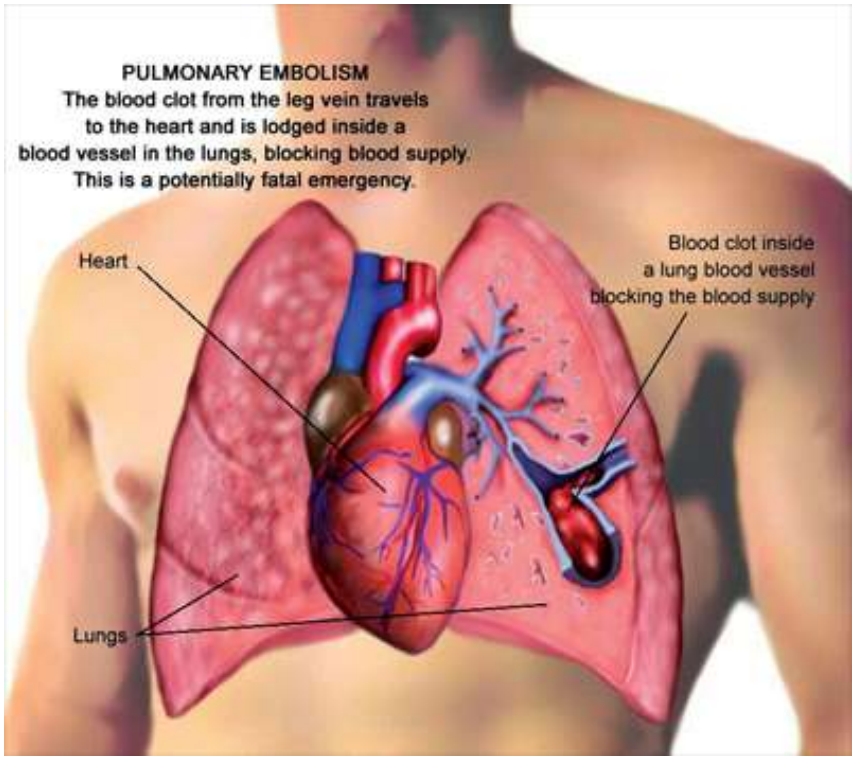
Figure 2. Venous ultrasound image showing a deep venous thrombosis (clot) that has partially broken away from the wall and is floating in the blood stream

DVT: Treatment

- Compression
- Elevation
- Anticoagulation – blood thinning
  - Why:
    - To prevent extension of the clot, and travel to the lung
  - Medications:
    - Lovenox or heparin - Prevents more clot from forming
    - Coumadin - Prevents further clots from forming.
  - How long:
    - Uncomplicated - 3-6 months
    - Complicated - Lifetime

PE: Pulmonary Embolus

- Pulmonary embolus – Blockage of the arteries to the lungs by a blood clot
- The majority of pulmonary emboli come from DVTs



Pulmonary Embolus

- Symptoms
  - Pleuritic chest pain
  - Shortness of breath
  - Lightheadedness
  - Hemoptysis
  - Tachycardia
  - Symptoms of a DVT

Pulmonary Embolus

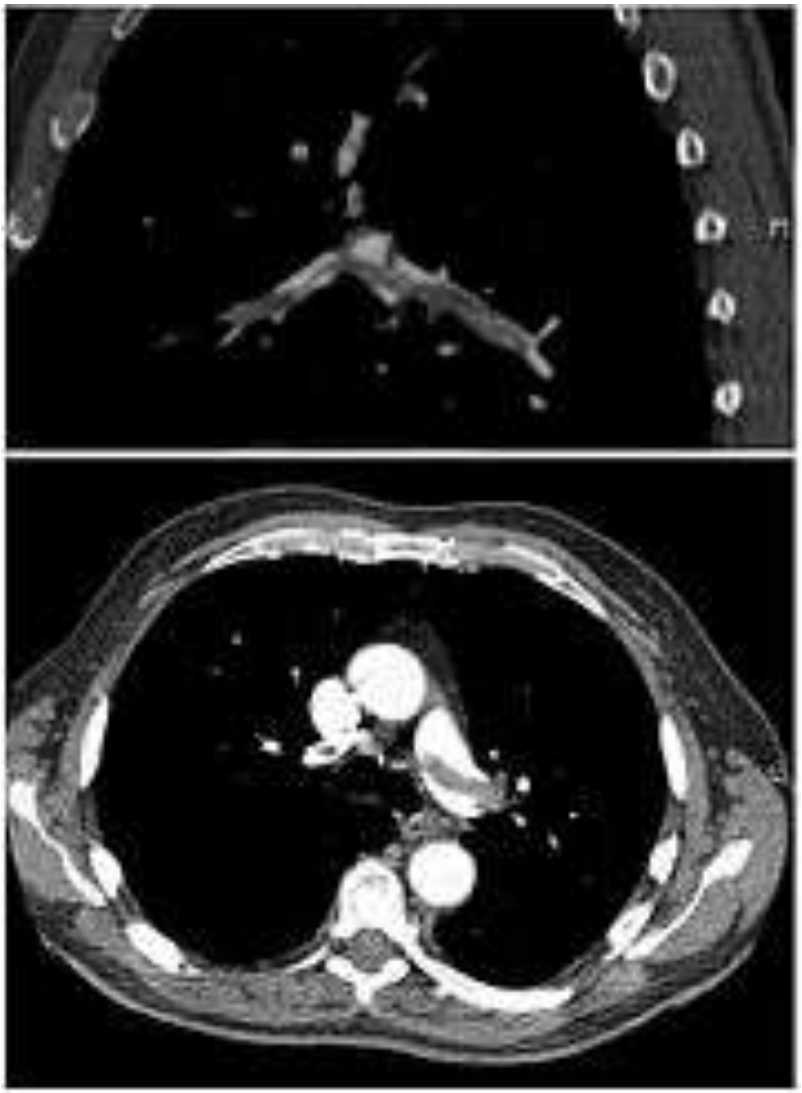
- Risk factors
  - Tobacco use
  - Recent fracture
  - Pregnancy and taking Estrogen
  - Obesity
  - Recent surgery/immobility
  - Cancer
  - Thrombophilia (acquired or inherited)

Pulmonary Embolus

- Diagnosis
  - Patient history
  - Physical exam
  - Lab tests
    - D-dimer
    - Clotting studies
  - Imaging studies
    - CT angiogram
    - VQ scan
    - Other (MRI, arteriography)

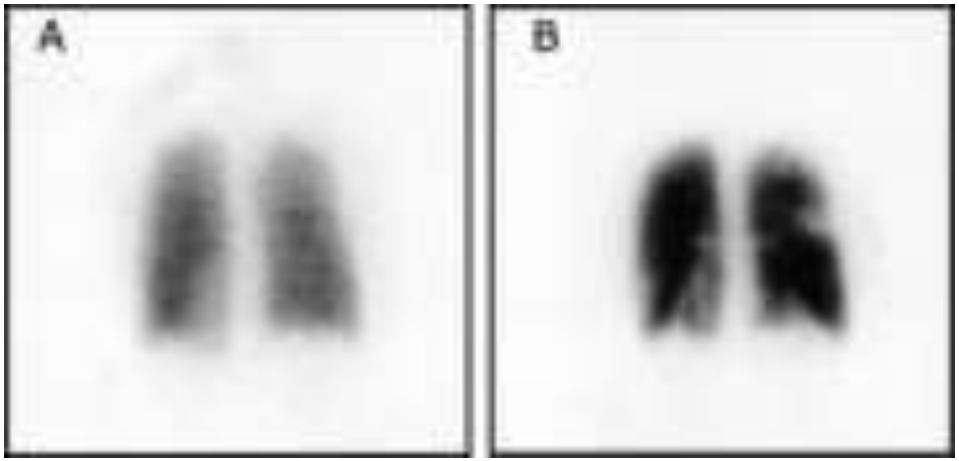
Pulmonary Embolus

- CT angiogram
  - Computerized axial tomography – serial x-rays reconstructed to form cross sectional images
  - Dye is injected to allow to visualize the blood flow through the pulmonary arteries
  - Lack of bright blood indicates clotting



Pulmonary Embolus

- VQ scan



- Ventilation to perfusion scan
  - Radioisotopes are both inhaled and then injected
  - A mismatch of ventilation to perfusion is considered abnormal

Pulmonary Embolus: Treatment

- Anticoagulation – blood thinning
  - Why:
    - To prevent extension of the clot and allow oxygenation
  - Medications:
    - Lovenox or heparin - prevents more clot from forming
    - Coumadin - prevents further clots from forming.
  - Vena cava filters
  - How long:
    - Uncomplicated - 3-6 months
    - Complicated - Lifetime

Hypercoagulability

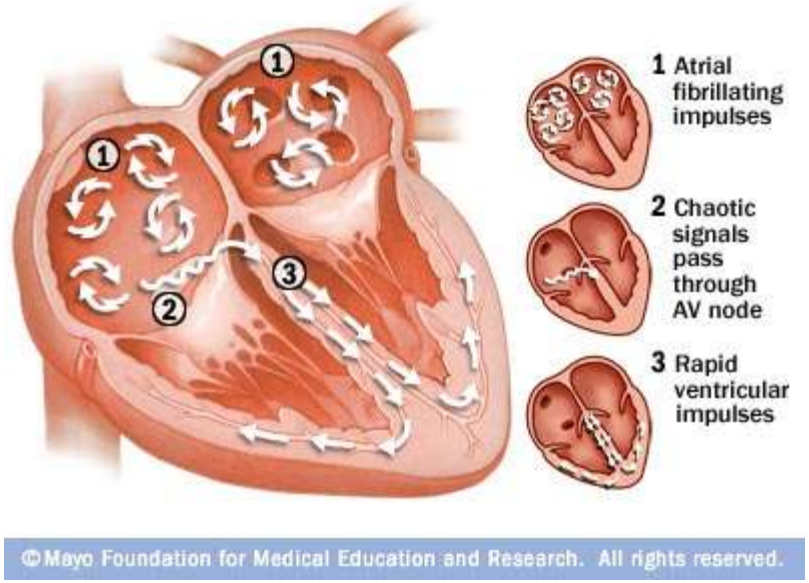
- Who should be tested?
  - Family history of blood clots
  - Second unprovoked blood clot
- What tests are done?
  - Protime, PTT, Fibrinogen, Thrombin Time, Protein C, Protein S, Antithrombin III, Lupus, FV Leiden, Prothrombin 20210, Homocysteine
  - Evaluation for cancer?
- Why is it important?
  - People with hypercoagulable states should be on lifelong coumadin to prevent recurrence
  - Some of these genetic mutations run in families

Prevention of DVT and PE

- If hospitalized, immobilized or a recent high risk surgery anticoagulants, compression stockings or SCDs may be ordered by your physician
- Inform your physician about personal or family history of blood clots
- While traveling
  - Stand up and walk every two hours
  - Flex feet and ankles, avoid crossing your legs and changes positions regularly
  - Avoid smoking
  - Wear loose fitting clothing
  - Avoid dehydration
  - Avoid sedating medications
  - Consider wearing knee high compression stockings

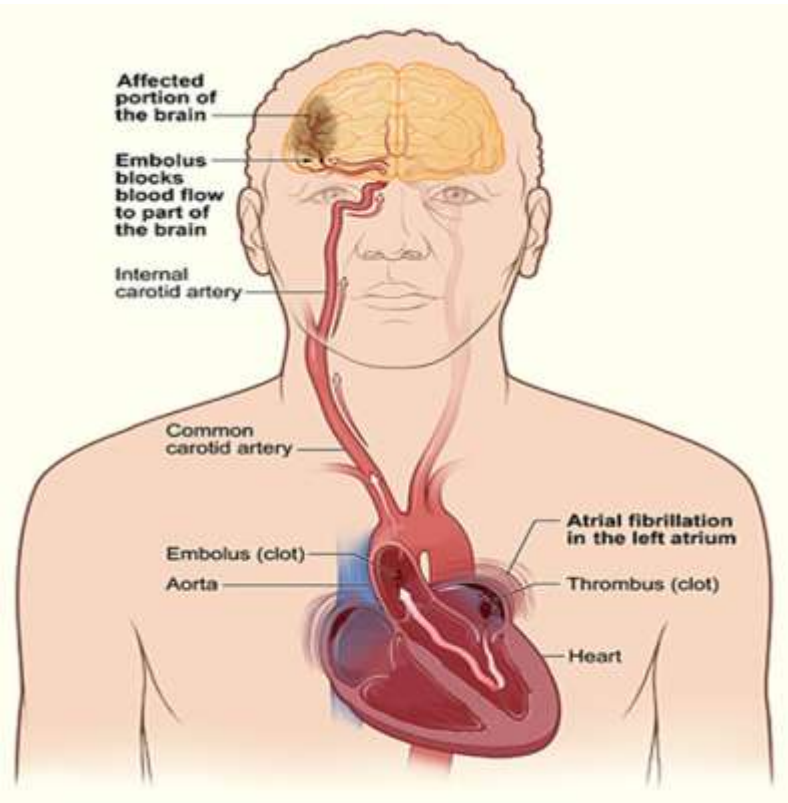
Thrombus formation from Atrial Fibrillation

- Atrial fibrillation
  - Most common cardiac arrhythmia
  - Incidence: almost 10% of people over age 80
  - Irregular conduction of electrical impulses from the atria to ventricles
- Symptoms
  - Palpitations
  - Shortness of breath
  - Fluttering in the chest
  - Dizziness
  - Weakness



Thrombus formation from Atrial Fibrillation

- Irregular heart beat leads to stasis of blood in the atria
- Thrombi can embolize to other parts of the body
  - Brain (stroke)
  - Eye
  - Spine
  - Arms or legs
  - Other internal organs



Atrial Fibrillation Treatment

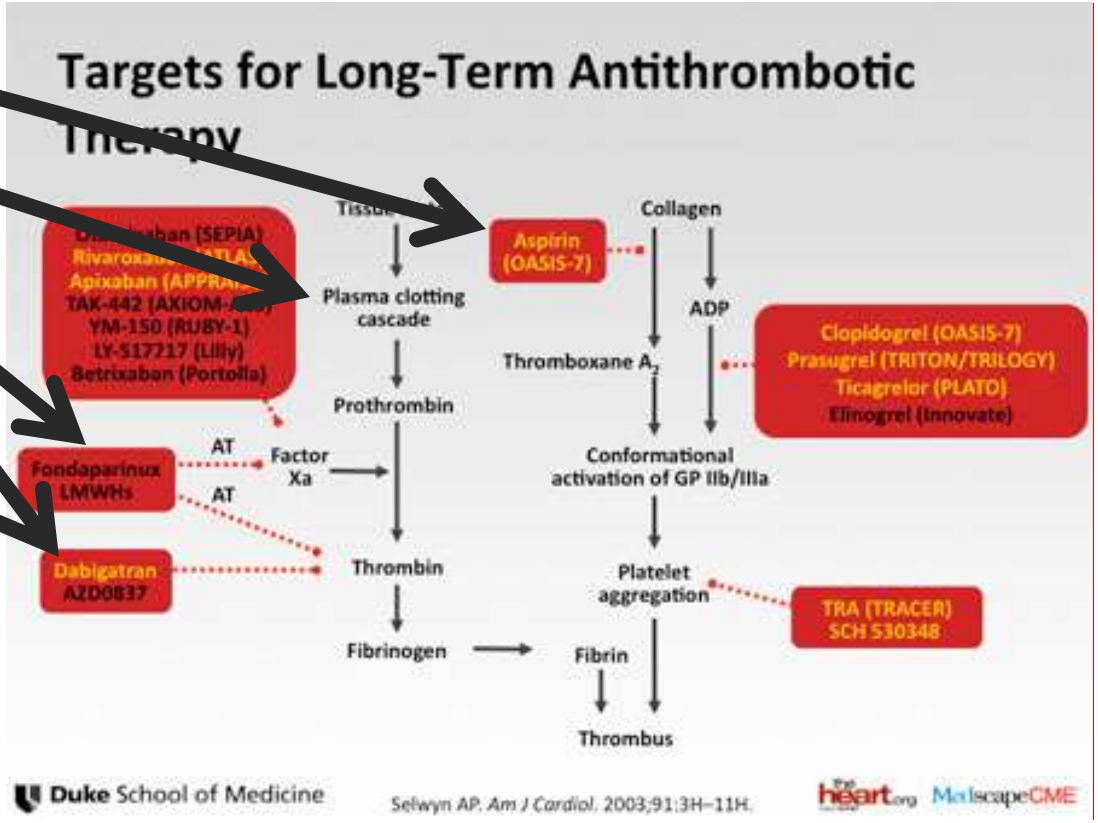
- Electrocardioversion
  - If new onset or the patient is unstable
- Rate control vs rhythm control
  - Rate control reduces symptoms
  - Rate control is generally cheaper and better tolerated
  - There is no difference in occurrence of stroke
- Anticoagulation
  - Aspirin
  - Coumadin
  - Dabigatran

Arterial Thrombi

- Blood clots that form in the Arteries
- Usually occur due to endovascular injury (Cholesterol plaques)
- Examples
  - Heart attacks
  - Stroke
  - Peripheral arterial disease
  - Bowel ischemia
  - Organ infarction

Medications

- Aspirin
- Coumadin
- Lovenox
- Dabigatran



Medications

- Aspirin
  - Mechanism: Inhibits thromoboxane which binds platelets together
  - Uses:
    - Prevention of cardiac disease and stroke
    - Used to prevent thrombus formation in low risk patients with atrial fibrillation
    - Not effective in the prevention of DVT or PE
    - Other – pain, headache etc

Medications

- Enoxaparin (Lovenox) and Heparin
  - Mechanism – Activates antithrombin II which inhibits factors Xa and IIa which cause clotting
  - Uses
    - Prevention of DVT
    - Treatment of DVT or PE – continuous or while staring coumadin
    - Treatment of acute heart attack

Medications

- Coumadin (warfarin)
  - Mechanism
    - Inhibits vitamin K dependent formation of clotting factors II, VII, IX, X
  - Uses
    - Prevention of stroke with atrial fibrillation – in high risk patients
    - Prevention of recurrence of DVT and PE
    - Anticoagulation with artificial heart valves
  - Monitoring
    - There is a narrow therapeutic window
    - INR is used to monitor degree of anticoagulation
    - INR must be regularly monitored (Goal 2-3)
    - Dosing is variable based on age, diet and liver function

Medications

- Dabigatran (Pradaxa)
  - Mechanism of action
    - Direct thrombin inhibition
  - Uses
    - Prevention of stroke with atrial fibrillation – in high risk patients
  - Monitoring
    - None

Any questions?