01 VTE: Venous Thromboembolism

Definition: VTE Clot formation within the **venous** circulation

Can manifest into DVT deep vein thrombosis🡪 commonly large Leg vein

Can manifest into PE (15-20% of DVT) Pulmonary embolism 🡪 usually ends up in lungs (or brain)

Factors:

1. Age: over 60 years
2. Major surgery orthopedic procedures of the lower extremities, increase by 50%
3. Trauma
4. Immobility of limb paralysis
5. Estrogen
   1. How? Increase serum clotting factor and induce protein C resistance
6. Protein C resistance is an anticoagulant
   1. How? Protein C cannot break down factor V (proaccelerin)
   2. Cancer have suppressed
      1. Protein C
      2. Protein S
      3. Antithrombin
7. Prothrombin G20210A mutation
   1. How does it work? Increase basal level of functionally normal prothrombin
8. MI, stroke
9. Spinal cord injury

Epidemiology (stats)

1. Affects 1 million people in US
   1. 200,000 deaths yearly
2. African Americans have the highest risk
   1. Then Europeans
   2. Asian have the lowest risk

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| Clinical Presentations: DVT (Deep vein thrombosis) | Clinical Presentations: PE (Pulmonary embolism) |
| 50% are asymptomatic | DVT (80%) |
| Pain/Tenderness | Tachypnea (rapid breathing) Dyspnea(SOB) |
| Edema | Pleuritic chest pain (pleuritic cavity) |
| Skin discoloration (darkening) | Tachycardia |
| Increase leg size | Cough |
| Homan’s Sign: not 100% (pain when ankle is moved) | Hemoptysis (coughing up blood) |
| Palpable cord (hardening of veins) | Rales (lung crackles) |

How to find VTE

1. What is the Gold standard? Radiographic contrast
   1. Pros? Most accurate, used for research b/c it has stronger evidence
   2. Cons? Hypotension, cardiac arrhythmias and renal toxicity b/c inject dye
2. Most common practice? Ultrasonography (compress leg), computed tomography scans
   1. Monitor DVT:
      1. Duplex
      2. Doppler Ultrasound using vein compression (Thrombo does no compress)
   2. Monitor PE
      1. CT Spiral computed tomography
         1. Pros? Checks PE and MI
      2. V/Q scan not used much
      3. Plasma D-Dimer
         1. Pros? If test is negative 🡪 patient does not have DVT

General Treatment treat the same if patient has DVT Vs PE

1. Use anticoagulants for vein
2. Use antiplatelet for artery
3. All patients admitted to the hospital with VTE should receive prophylaxis such as UFH, LMWH or fondaparinux
4. Anticoagulation therapy should be continued for a minimum of 3 months

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| **Coagulants** |  |  |
| **Inactive Factor: Synonym** | **Active Factor: Synonym** | **Half-Life** |
| I: Fibrinogen | Ia: Fibrin | 3-4 days |
| II: Prothrombin | IIa: Thrombin | 100 hours long half life  Downstream = harder to fix |
| V: proaccelerin | Va |  |
| VII: Stable Factor | VIIa | 3-6 hours short half life  Upstream = fix easily |
| IX: Platelet Cofactor II | IXa | 15-24 hours |
| X: Stuart-Prower | Xa | 40 hours |
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| **Pathologic Clot formations** | **Clots that are not suppose to happen** | **Treat** |
| Clot burden | Size of clot |  |
| Thrombus | A pathological clot that forms inside a vein/artery which will cause blockage 🡪 ischemia, restriction in blood supply. A thrombus will form and will propagate (clot continues to grow) |  |
| Arterial Thrombus  “White Clot” | Platelet rich, usually due to rupture of atherosclerotic plaque leading to endothelial damage. Artery pumps a lot of blood, so platelets are the only ones that can stick on. | Anti-Platelets |
| Venous Thrombus  “Red Clot” | Fibrin and erythrocyte rich, usually due to venous stasis causing accumulation of active clotting factors or endothelial damage due to trauma or surgery | Anti-Coagulants |
| Embolus | Thrombus that breaks off |

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| **Natural Anti-Coagulants** | Mechanism |
| AT (Anti-thrombin) | Inhibit factors IIa (thrombin) and IXa Heparin increases activity |
| Protein C and Protein S | Inhibit factors Va and VIIIa |
| TFPI: tissue factor pathway inhibitor | Inhibits factor VIIIa |
| Plasmin | Only enzyme that ‘breaks down’ fibrin. (fibrinolysis) |

Virchow’s Triad: Three factors that contribute to thrombosis

**Hypercoagulable state:**

1. Malignancy (cancer)
2. Pregnancy (why?) clot to survive giving birth
   1. Estrogen therapy
3. Inflammatory bowel disease
4. Nephrotic Syndrome
5. Sepsis (?) illness in which the bloodstream is overwhelmed by bacteria
6. Protein C or S deficiency
   1. Resistance to Activated Protein C
7. Sickle cell anemia

**Vascular Wall Injury**

1. Trauma or surgery such as hip, abdomen or pelvis
2. Chemical irritation
   1. (ex?) IV potassium chloride or Vancomycin
3. Acute MI
4. Catheters any foreign object in vessel, body starts to clot

**Circulatory Stasis**

1. Immobility or paralysis
   1. Ex? Spinal cord injury, stroke
2. Venous obstruction form tumor or fat
3. LVD left ventricular dysfunction
   1. Ex? Cardiomyopathy, CHF, MI
4. Atrial Fib