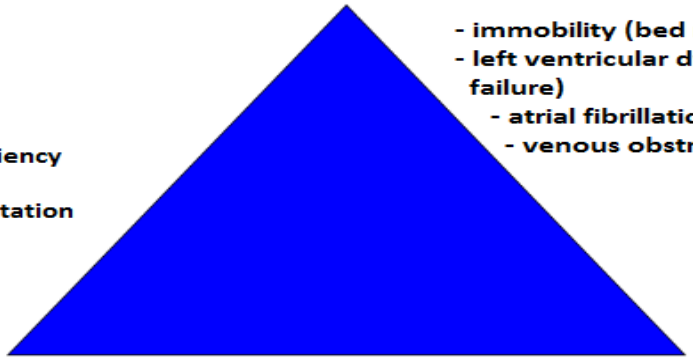
**Virchow's Triad**



**Venous Stasis**
abnormality of blood flow

- immobility (bed rest, paralysis, travel)
- left ventricular dysfunction (heart failure)
- atrial fibrillation
- venous obstruction: tumor, obesity, pregnancy

**Hypercoagulability**
abnormality in clotting components

- protein S or C deficiency
- ATIII deficiency
- Factor V Leiden mutation
- increased estrogen
- pregnancy

**Endothelial Injury**
abnormality of surfaces in contact with blood

- vascular injury/trauma; artherosclerosis
- major surgery (orthopedic)
- valvular heart disease, heart valve replacement
- central venous catheters
- previous DVT/PE

**S/S**

- DVT: usually unilateral, pain, edema, change in color, heat, numbness, tingling, change in size (pooling of blood)
- PE: SOB, pain, dizziness, cough, increased RR and HR

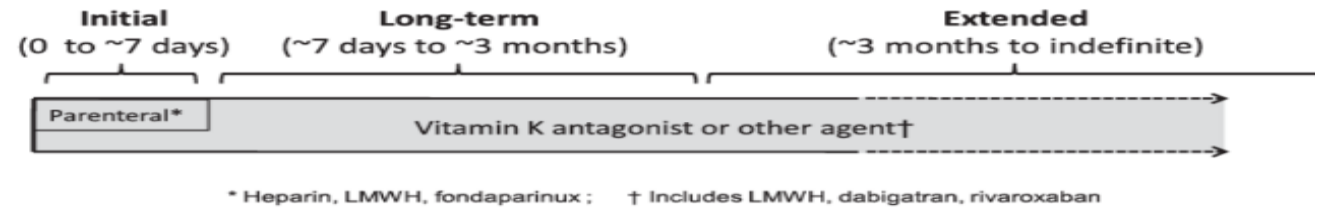
**Drug-related causes of VTE**

- Estrogens/progestins (oral contraceptives)
- Hormone replacement therapy
- Selective Estrogen Receptor Modulators (SERMS)

**Goals of therapy**

- Prevent thrombus extension
- Prevent thrombus progression to pulmonary embolism
- Prevent recurrence of VTE
- Prevent acute morbidity and mortality of an acute event

**Phases of anticoagulation**




* Heparin, LMWH, fondaparinux ; † Includes LMWH, dabigatran, rivaroxaban

**Initial therapy: Warfarin option**

- Start ONE of the following & continue x 5 days (min) & INR > 2 x 48 h
  - IV UFH
  - SC LMWH
  - SC fondaparinux
  - SC UFH (weight-based)
- Start warfarin ON SAME DAY

**Monitoring**

- Baseline INR then daily until stabilized (INR 2-3)
- Baseline CBC then while on UFH/LMWH/FONDA

**UFH vs. LMWH**

- LMWH more convenient
  - Less laboratory monitoring
  - Single daily SC administration
  - Outpatient administration
- LMWH more cost-effective
- LMWH less adverse effects
  - Heparin-induced thrombocytopenia
  - Osteoporosis (use short-term)
- UFH preferred in patients with very poor renal function (CrCl < 30)

**Elevated INR** TR = therapeutic range

| | |
|---|---|
| • TR < INR < 5<br>• No sig. bleeding | • Lower or omit dose<br>  ○ If only minimally above TR, no dose reduction may be required<br>• Monitor frequently<br>• Resume at lower dose when INR therapeutic |
| • 5 ≤ INR < 9<br>• No sig. bleeding | • Omit next one or two doses<br>• Monitor frequently<br>• Resume at appropriately adjusted dose when INR in TR |
| | ALTERNATIVE, particularly if increased risk of bleeding<br>• Omit dose<br>• Give Vit K (1 – 2.5 mg PO) |
| | IF RAPID REVERSAL REQUIRED (urgent surgery)<br>• Vit K (≤ 5 mg po) – expected to reduce INR in 24 h<br>  ○ If INR still high, additional Vit K (1 – 2 mg PO) can be given |
| • INR ≥ 9<br>• No sig. bleeding | • Hold warfarin therapy and give higher dose Vit K (2.5 – 5 mg po) – expected to reduce INR in 24-48 h<br>• Monitor more frequently and use additional Vit K if necessary<br>• Resume therapy at appropriately adjusted dose when INR is in TR |
| • Serious bleeding at any elevation of INR | • Hold warfarin therapy and give Vit K (10 mg by slow infusion), supplemented with FFP, PCC or rVIIa<br>• Vitamin K can be repeated q12h |
| • Life-threatening bleeding | • Hold warfarin therapy and give FFP, PCC, or rVIIa, supplemented with vitamin K (10 mg by slow infusion)<br>• Repeat if necessary (depending on INR) |

**Duration of therapy**

- Unprovoked (idiopathic)
  - Proximal DVT/PE (1st episode or recurrence) – extended
  - Isolated distal DVT (first episode) – 3 months
  - Isolated distal DVT (recurrence) – extended
- Provoked (non-idiopathic)
  - Reversible cause – 3 months
  - Irreversible cause – treat as unprovoked

**Cancer**

- Primary prevention: no role unless hospitalized for acute illness
- Treatment:
  1. LMWH for at least 6 months
  2. Warfarin or LMWH indefinitely thereafter until malignancy resolved

**Patient counseling**

- Monitor for bleeding
- Diet – maintain consistent intake of green leafy veggies
- INR monitoring
- Inform if missed doses

**VTE in pregnancy**

- Warfarin = teratogenic = AVOIDED
- UFH and LMWH preferred

**Treatment recommendation**

- LMWH, regularly adjust to pt wt
- DC 24 h prior to induction of labor or C-section
- Anticoagulate x 6 wks post-delivery

- NOTE: warfarin, UFH, LMWH safe in nursing mothers

**Monitoring**

- INR monitoring
- Bruising/bleeds that don't stop; blood in stool; nose bleeds; bleeding from gums; blood in urine
- Lethargy if becoming anemia
- Leg DVT: if chest pain/SOB = concern for PE