DVT/PE

Venous Thromboembolism Disease

- A Blood clotting condition
  - DVT – deep vein thrombosis
  - PE – pulmonary embolus

Virchows Triad

- Alteration of normal blood flow
- Injury of epithelium
- Hypercoagulable
  - Deficiencies of Antithrombin III
  - Hyperviscosity – nephrotic syndrome
  - Trauma, Burns, CA, Pregnancy

Venous Thromboembolism

- Includes both DVT & PE
- Estimated Annual incidence 117/100,000
- Incidence rises markedly with age
  - 60 yrs old + > 900/100,000
- Most clinically important PEs originate from proximal DVT of leg & pelvis (popliteal, femoral, iliac veins)

Venous Thromboembolism

- 1/3 of patients who have symptomatic VTE present with PE
- 2/3 present with DVT
- Mortality rate is approximately
  - 6% in patients with DVT
  - 12% in patients with PE

Venous Thromboembolism

- Compared with DVT, PE is more fatal and has a higher rate of recurrence
- PE is usually a consequence of DVT
- 40% of patients with proximal DVT have associated PE – by lung scan
- 70% of patients with PE are found to have DVTs
Risk Factors

- Increasing Age
- Prolonged immobility
- Surgery
  - DVT 42-57% of hip arthroplasty
  - 41-85% of knee arthroplasty
  - PE 0.9-28% hip arthroplasty
  - 1.5-10% of knee arthroplasty

- Trauma
- Malignancy
- Pregnancy
- Estrogen medications
  - OCPs, HRT
- Tamoxifen
- CHF
- Diseases of blood viscosity: polycythemia, sickle cell disease, multiple myeloma
- Thrombophilia

Clinical Presentation of DVT

- In the affected extremity
  - Swelling
  - Pain
  - Warmth
  - Redness
- Can occur asymptptomatically

Clinical Presentation of PE

- Dyspnea – In patients with preexisting dyspnea from CHF or COPD, worsening of dyspnea may be only symptom
  - Chest pain
  - Tachycardia
  - Syncope
  - Cough
- Less frequent symptoms
  - Fever
  - Hemoptysis
  - Cyanosis
  - Hypotension
  - Shock

EKG changes with PE (not sensitive or specific)

- Result from Right heart strain
  - T wave inversion on precordial leads
  - RBBB
  - S. Q. T. Well known but uncommon
- CXR findings with PE (nonspecific)
  - Plate like atelectasis
  - Pleural effusion
  - Elevated diaphragm
### Imaging Modalities for DVT

- **Ultrasound / Doppler Studies**
  - Sensitivity 89-96%
  - Specificity 94-99%

**Limitations of US in DVTs**
- A normal exam in the presence of a high probability patient DOES NOT rule out DVT – will require additional testing.
- Cannot distinguish between old and new clots.
- NOT accurate in detecting DVT in pelvis

- **Contrast Venography** – still gold standard
  - Not used much due to:
    - Pain
    - Phlebitis
    - Hypersensitivity or toxic reaction to dye

### Imaging Modalities for PE

- **Helical (Spiral) CT**
  - CT Angiography – diagnostic test of choice
    - Predictive value – 92-96%

**Limitations**

- **Ventilation-Perfusion Scan**
  - Reports a probability spectrum
  - Normal, low, intermediate, high
  - Normal excludes Dx, High establishes Dx

- **Pulmonary Angiography**
  - Requires greater amounts of contrast than CT angiography
  - Therefore increased risk of kidney injury
  - Contraindicated in:
    - Severe Pulmonary HTN
    - CHF
  - Indicated when suspicion remains high even when less invasive studies results are negative.

### Treatment

- **Initiation “Bridge”**
  - Heparin – 5000 units bolus (then 1000 units/hr)
    - Monitor platelets
  - OR
    - Enoxaparin (Lovenox) 1 mg/kg s.c. Q 12 hours OR
      - 1 ½ mg/kg s.c. Q 24 hours
    - Dalteparin (Fragmin) 200 units/kg/dg s.c. bid
    - Begin Warfarin

- **Warfarin is a Vitamin K antagonist**
  - Therefore prevents activation of factor II, VII, IX, X

- The anticoagulant effects of Warfarin are delayed for several days after dosing changes – especially initiation of therapy – because of variable half-lives of previously formed circulating clotting factors.
- Can have paradoxical hypercoagulable state caused by Warfarin’s effect on proteins C+S.
Initiation of Warfarin

- In most patients, Warfarin should be initiated as a maintenance dosage 5mg daily.
- Initiate at lower dosage with liver disease, poor nutritional status and heart failure.
- Outpatient – initiation
  - Inpatient dosage of 10mg for first 2 days then the anticipated maintenance dose about 5mg daily.

Initiation of Warfarin – INR measurement

- Measure INR for baseline
- Next INR can be obtained after 2 or 3 doses of Warfarin.
- Then frequency of INR decreases to twice / week until therapeutic range obtained.
- Then, weekly, every other week and finally monthly
- Increased monitoring if INR becomes subtherapeutic.

Heparin vs Warfarin

<table>
<thead>
<tr>
<th>Heparin</th>
<th>Warfarin</th>
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<tbody>
<tr>
<td>Inactivates thrombin (11a) +Xa</td>
<td>Vit K</td>
</tr>
<tr>
<td>LMWH</td>
<td>Factor II, VII, IX, X</td>
</tr>
<tr>
<td>Enoxaparin (Lovenox)</td>
<td>Dabigatran (Pradexa)</td>
</tr>
<tr>
<td>Dalteparin (Fragmin)</td>
<td>Fixed dose 150mg bid</td>
</tr>
<tr>
<td>Fondaparinux (Arixtra)</td>
<td>No testing</td>
</tr>
<tr>
<td></td>
<td>Does not require bridging with Heparin</td>
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<tr>
<td></td>
<td>No antidote if bleeding</td>
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</tbody>
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Post Thrombotic Syndrome

- Definition:
  - The development of chronic venous obstructive symptoms secondary to deep venous thrombosis- Caused by injury to the venous valvular system
- Symptoms:
  - Pain
  - Venous dilation – varicose veins
  - Edema / swelling of the leg
  - Skin Changes
  - Venous ulcers

Post Thrombotic Syndrome

- Epidemiology
  - Risk factors
    - High BMI
    - Increased with age
    - Female
  - NO increased risk with Thrombophilia
  - (Antithrombin, Protein C+S deficiency, Lupus, Anticoagulant, Factor V Leiden

- Cumulative incidence of chronic skin changes
  - At 1 yr post DVT – 2.6%
  - At 5 yrs post DVT – 9.3%
Post Thrombotic Syndrome

- **Treatment**
  - The strong association of Recurrent DVT suggests that prevention of recurrent DVT is the most important for DVT.
  - In one study — compared
    - Patients with subtherapeutic INR (<20) for more than 50% of readings in 1st 3 months
    - Patients with INR greater than or equal to 2.0 more than 50% of 1st 3 months of treatment
    - The odds ratio for risk — thrombotic syndrome was 2.71 (95% - CI 1.44 – 5.10) over 5 year follow up

Post Thrombotic Syndrome

- **Treatment**
  - AAFP recommends use of compression stockings within one month of proximal DVT
  - Continue for minimum of 1 year
  - Knee high graduated stockings exerting 30-40 mmHg pressure at the ankle

Post Thrombotic Syndrome

- **Treatment**
  - Compression Therapy — Metanalysis of 5 trials
    - Use resulted in 54% relative risk reduction in development of PTS.
    - The lowest risk of development of PTS is associated with earlier use of compression stockings.

Post Thrombotic Syndrome

- **Surgical Intervention**
  - primarily for occluded iliac vein disease
  - Percutaneous angioplasty with or without stenting
  - Venous bypass surgery
  - Endophlebectomy

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