DVT: Diagnosis and Treatment

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Disclosures

• None

Acute Venous Thromboembolism (VTE)

• Deep Venous Thrombosis (DVT)
• Pulmonary Embolism (PE)
• 100,000 – 300,000 deaths/yr in the US

Questions To Ask

• Where? – Extent
• When? – Is lysis possible?
• Why? – Provoked vs Unprovoked
  – Previous DVT?
  – Inherited Hypercoagulability?
  – Acquired Hypercoagulability?
• Symptoms? – Is lysis indicated?
DVT: Overview

• Lower Extremity Venous anatomy
• Diagnosis
• Prophylaxis and Treatment
• IVC Filter Indications
• Special Circumstances

Lower Extremity Venous Anatomy

• Deep vs Superficial
• Perforating vs Communicating
• Proximal vs Calf
• Valves
  Numerous distally - decrease proximally

Acute Venous Thromboembolism (VTE)

• Proximal Thrombosis
  – Iliac, femoral, popliteal DVT
  – Commonly seen with systemic disease
  – More likely source of PE, mortality and PTS
• Distal Thrombosis
  – Calf veins
  – Commonly seen with transient risk factors
  – Unlikely source of PE, PTS
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VTE Risk Factors
- Hypercoagulability
- Immobility
- Recent Surgery
- LE Trauma
- OCP/HRT
- Obesity
- Smoking
- Malignancy
- CHF
- IBD
- Family History
- Age > 60yo
- Pregnancy/Post-partum
- Inflammatory States

DVT Diagnosis
- 3 Factors
  - Clinical risk assessment (pre-test probability)
  - Blood tests
  - Vascular imaging

DVT Diagnosis
- Clinical risk assessment
  - Clinical History
  - Symptoms
  - Signs

High Risk (≥3)
Intermediate Risk (1-2)
Low Risk (0)
DVT Diagnosis

Clinical Risk Assessment

Low Risk
Intermediate Risk
High Risk

DVT Diagnosis

Clinical Risk Assessment

Low Risk
Intermediate Risk
High Risk

D-dimer
Proximal CUS
No Further Testing
Anti-Coagulation

DVT Diagnosis

Clinical Risk Assessment

Intermediate Risk

D-dimer
Proximal CUS
Whole Leg US
No Further Testing
1 week later
Anti-Coagulation

DVT Diagnosis

Clinical Risk Assessment

High Risk

D-dimer
Proximal CUS
Whole Leg US
No Further Testing
1 week later
Anti-Coagulation

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D-Dimer
- Marker of endogenous fibrinolysis
- Increase
  - VTE
  - Inflammatory conditions
  - Post-operative/Trauma
- Some controversy in use to diagnose VTE
- High Sensitivity/Negative Predictive Value
  - Best in Low-Moderate Pre-test Probability

Duplex US
- Best imaging modality for DVT
  - Non-invasive
  - High Specificity/Positive Predictive Value
  - Proximal Compression
    US vs Whole-Leg US
  - 2 Point Compression
    Point of Care US

Duplex US
- Primary Diagnostic Criteria
  - Venous incompressibility
  - Thrombus visualization
  - Absent/Diminished spontaneous flow
  - Absent of respiratory phasicity
  - Absent color flow

Duplex US
- Adjunctive Criteria
  - Increased venous diameter
  - Immobile venous valves
  - < 50% Diameter increase with Valsalva
CT/MR
- Clinical suspicion PE – CP/SOB etc
- Very proximal clot – CFV/EIV/CIV
- Previous DVT/PE
- Considering intervention

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Surgical Prophylaxis
- 1% of hospitalized patients die of PE
- Without VTE prophylaxis – up to 70% of post-operative patients develop VTE
- Prophylaxis – given pre-operatively
  - Unfractionated heparin 5000 u Q 8-12
    - Results in a 50%-70% risk reduction for VTE
  - LMWH most effective for high risk surgery
    - 40 mg QD

Hypercoagulability
- >60% of pts with spontaneous VTE
  - Congenital vs Acquired vs Systemic
- High-Risk Population:
  - Spontaneous, initial thrombosis < age 50
  - Family history of VTE
  - Recurrent venous thrombosis
  - Thrombosis occurring in unusual vascular beds: portal, hepatic, mesenteric, or cerebral veins
  - History of warfarin-induced skin necrosis
    - Protein C deficiency
Value of Screening: Overused?

- Strongest risk factor for VTE recurrence is prior VTE, especially idiopathic
- Screening information used to identify family members with an inherited thrombophilia
  - Anticoagulant prophylaxis rarely recommended in asymptomatic affected family members
  - May represent privacy/insurability risk
- Acute VTE can affect Screening tests

Goals of VTE Therapy

- Prevent thrombus propagation and PE
  - Proximal DVT without anticoagulation → up to 50% PE
- Prevent recurrent VTE
- Limit late complications
  - Post-thrombotic syndrome
  - Chronic thromboembolic pulmonary hypertension

Therapy

- LMWH, Fondaparinux
  - Facilitates outpatient therapy
  - May be more effective
  - Once daily dosing
- UF Heparin (IV, SQ)
  - Special populations (CKD, ESRD)
- UFH at least 5 days, overlap with warfarin at least 5 days
- DOACs – huge change

Outpatient Treatment

- Appropriate
  - Ambulatory, stable patient
  - Low to moderate risk of bleeding
  - No severe renal insufficiency
  - System in place for the following:
    - Administration of LMWH and warfarin with monitoring
    - Surveillance/treatment of recurrent VTE/bleeding complications
  - DOACs now
Outpatient Treatment

- Not Appropriate
  - Massive/very symptomatic DVT
  - Symptomatic PE
  - High risk of bleeding with anticoagulant therapy
  - Comorbid conditions or other factors warranting in-hospital care

Long-Term Use

- Standard of care: Conversion to warfarin with INR goal 2.0 – 3.0
- DOACs increasing use
- Malignancy: LMWH
  - Decreased bleeding complications
  - Decreased recurrent VTE
  - Possible survival advantage

Duration of Anticoagulation

- Provoked (DVT or PE) → 3 months
- Malignancy (DVT or PE) → Lifelong
  - Or until clear evidence of eradication of malignancy
- Unprovoked with thrombophilia → Lifelong
- Unprovoked without thrombophilia
  - Distal clot → 3 months
  - Proximal or PE → Lifelong
  - 2nd event → Lifelong

Direct Oral Anticoagulant (DOAC)

<table>
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<tr>
<th>Condition</th>
<th>Dabigatran (Pradaxa)</th>
<th>Rivaroxaban (Xarelto)</th>
<th>Apixaban (Eliquis)</th>
<th>Edoxaban (Savaysa, Lixiana)</th>
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<tbody>
<tr>
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<td>DirectThrombin inhibitor</td>
<td>Factor Xa inhibitor</td>
<td>Factor Xa inhibitor</td>
<td>Factor Xa inhibitor</td>
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<tr>
<td>Stroke Prevention in Atrial Fibrillation</td>
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<td>Knee/ Hip Arthroplasty</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>

*Dabigatran and Edoxaban are approved for acute VTE treatment only after an initial 5-day course of treatment with a parenteral anticoagulant.*
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IVC Filter

- Clear indications
  - Acute DVT with contraindication to anticoagulation
  - Acute DVT with bleeding on anticoagulation
  - Acute DVT/Propagation of DVT on anticoagulation

IVC Filter

- Unclear indications
  - Prophylaxis in immobile patients
  - Peri-operative prophylaxis
  - Proximal DVT

IVC Filter

- With Filter, Anticoagulate as SOON as possible for DVT
- Presence of filter is not an indication for anticoagulation by itself
- Temporary IVC Filter
  - RETRIEVE THEM!!!
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DVT: Special Circumstances

- Pregnancy
- Upper Extremity
- Calf Vein

VTE in Pregnancy

- Pregnancy/Post-partum
  - Hormonal venous relaxation
  - Valvular incompetence
  - Increased blood volume
  - Increased abdominal/pelvic pressure
- 0.025-0.1% of pregnancies
- DVT 3x more common than PE
- PE may be leading cause of maternal death
  - Up to 20% of mortality

Anticoagulation in Pregnancy

- Warfarin contraindicated
  - Crosses placenta
    - Can cause fetal bleeding
    - Teratogenic
- Unfractionated Heparin
  - Difficult to administer
- LMWH
  - Easy to maintain therapeutic levels
  - May cause less bone density loss than heparin
Upper Extremity DVT
- Thoracic Outlet
- Catheter-associated
- Incidence of PE not well-known
  - Thought to be significantly less than LE DVT
  - LE DVT 30-50% PE (Proximal LE DVT)
  - UE DVT 2-33% PE

Upper Extremity DVT
- Catheter-associated
  - UE DVT increasing with increasing catheter use
  - If functioning and needed
    - Leave in place
    - Anticoagulate until catheter no longer needed
  - Axillary, Subclavian, Internal Jugular Veins
    - DVT should be treated as any other provoked DVT
      - 3 months anticoagulation

Calf Vein Thrombosis (CVT)
- Distal Veins: Axial and Muscular
- Proximal vs Distal LE DVT
  - Distinction based on outcomes (PE, PTS)
- Increasing use of whole-leg US
  - PT and Peroneal Veins
    - Isolated AT Vein DVT uncommon
  - US: Less sensitivity/specificity (vs Proximal)

Isolated Calf Vein Thrombosis
- Treatment controversial
- ACCP Guidelines
  - 2001:
    - Symptomatic: anticoagulation 6-12 weeks
    - If anticoagulation not administered: serial US
  - 2008
    - First isolated, unprovoked CVT: anticoagulation 3 months
  - 2012
    - Without severe symptoms or RF: serial US \(\pm\) Propagation
    - With severe symptoms or RF: anticoagulation 3 months
### Summary

- US is the best modality to detect DVT
- Negative D-Dimer should only be used to rule out DVT in low-intermediate pretest probability of DVT
- CTV/MRV: Proximal thrombus, Chest symptoms
- Provoked VTE should be treated for 3 months
- Unprovoked VTE should be treated with lifelong therapy in most patients

### Summary

- Malignancy: Treatment until malignancy eradicated → LMWH is best therapy
- IVC Filters should be used judiciously
- DVT in Pregnancy treated with LMWH
- Proximal UE DVT treated for 3 months
- DVT associated with catheters should be treated; catheter can be left in place and used
- Isolated CVT treated for 3 months vs serial US