Current Practice and Screening for Deep Vein Thrombosis and Pulmonary Embolism: Keeping Up With the Evidence.

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 Disclosure

• We have nothing to disclose as no relevant financial relationship exists.
Learning Objectives

– After this session, you will be able to:
• 1. Identify the pathology leading to formation of a DVT and PE.
• 2. Discuss the morbidity and mortality related to DVT.
• 3. Compare and contrast signs and symptoms related to differential diagnosis of a DVT to a PE.
• 4. Analyze the models of assessment for identifying a DVT.
• 5. Introduce clinical algorithms for PE to guide clinicians for intervention decisions.
• 6. Critically evaluate the use of Homan’s sign.
• 7. Discuss current practice related to interventions of a patient with a DVT and PE.
• 8. Advocate for the use of clinical decision rules and clinical practice guidelines in evaluating and providing interventions for patients with a DVT or PE.
Questions to Ponder
Session Outline

• Identify pathology of DVT & PE
• Analyze model of assessment for identifying a DVT
• Critically evaluate the use of Homans sign
• Introduce clinical algorithms for PE to guide clinicians
• Case studies
• Implementing guidelines
• Discussion
Introduction to Pathology of VTE

• VTE refers to all forms of thrombosis in the venous circulation and manifests in 2 ways: deep vein thrombosis (DVT) and pulmonary embolism (PE).

• DVTs affect ~ 2 million Americans per year, is the 3rd most common cardiovascular disease after CAD and stroke, and PE are responsible for 10% of hospital deaths. Anand et al 1998; Autar, 1996
VTE

- Can occur in any vein, most common in the legs
- If superficial, then usually varicosities, benign & self-limiting
- Long saphenous vein thrombosis extends into deep veins (DVT)
- DVT localized in the calf veins are often small & less commonly associated with a PE
- Associated with significant morbidity
Initiation of a Thrombosis

- Venous stasis
  - Immobility
  - Venous obstruction
  - Increased venous pressure
  - Venous dilation
  - Increased blood viscosity
DVT

• Proximal DVTs involve the popliteal, femoral, or iliac venous system.

• Approximately 20% of untreated silent calf vein thrombi and 20% to 30% of untreated symptomatic calf vein thrombi extend into the popliteal vein.

• When the DVT extends and is untreated, it is associated with a 40% to 50% risk of clinically detectable PE. Anderson FA

• VTE$\rightarrow$DVT$\rightarrow$PE
  – Important causes of morbidity and mortality in hospitalized patients.
  – VTE also occurs spontaneously in healthy, ambulatory outpatients.
PDVT

• Proximal deep vein thrombosis (PDVT) is the more dangerous form of lower-extremity DVT because it is more likely to cause life-threatening PE and may result in a greater risk of postthrombotic syndrome. Riddle & Wells 2004

• Calf DVT, although less serious than PDVT, must be considered because the thrombus extends proximally in approximately 30% of cases. Riddle & Wells 2004
• ~ 10% of all patients with acute PE die during the first 1 to 3 months after diagnosis.

• Overall, 1% of all patients admitted to hospitals die of acute PE, and 10% of all hospital deaths are related to a PE.
DVT incidence trends

• From 1989-2006, hospital DVT increased 3.1 times from 35 to 107/100,000 population. Stein 2010

• From 1992-2006, the incidence of PE in hospitalized patients increased 2.5 times from 33 to 83/100,000 population. Stein 2010
  – The incidence of a secondary diagnosis of PE increased at a lower rate.

• Stein concluded that “Efforts to prevent DVT in high-risk hospitalized patients appear to be inadequate. Therapy of DVT, however, appears to be effective.”
DVT trends: Stein 2010

- The proportion of hospitalized patients with DVT has decreased as a result of early discharge home.
- The incidence of PE increases exponentially with age, but no age group is immune.
- Asians and Native Americans have a lower incidence of PE than whites or African Americans.
- Epidemiologic data and new information on risk factors provide insight into making an informed clinical assessment and evaluation for antithrombotic prophylaxis.
Risk factors for DVT

- Previous venous thrombosis or embolism
- Age, over 55-60 years
- Active cancer or cancer treatment
- Severe infection
- Oral contraceptives, hormonal replacement therapy
- Pregnancy or given birth within the previous six weeks
- Immobility (bed rest, flight travel, fractures)
- Surgery, anesthesia
- Critical care admission, central venous catheters
- Inherited thrombophilia
- Obesity
- One or more significant medical comorbidities (for example: heart disease; metabolic, endocrine or respiratory pathologies; acute infectious diseases; inflammatory conditions, peripheral arterial insufficiency)
Clinical manifestations of a PE

- S&S of VTE are caused by obstruction to venous outflow, inflammation of the vessel wall or perivascular tissues, or embolization of thrombus into the pulmonary circulation.
- Most clinically significant and fatal PE probably arise from thrombi in the proximal veins of the legs.
- Asymptomatic PE is detected by perfusion lung scanning in approximately 50% of patients with documented proximal vein thrombosis.
Clinical manifestations of a PE

• Although PE also may complicate calf vein thrombosis, these emboli tend to be smaller in size, and PE occurs less commonly than in patients with proximal vein thrombosis.

• Asymptomatic VTE is found in 70% of patients who present with confirmed PE. These thrombi usually are large and involve the proximal veins.
Clinical manifestations continued

• In approximately 70% of patients referred for clinically suspected venous thrombosis, the diagnosis will be excluded by objective tests.

• Of the 30% who have VTE, approximately 85% will have proximal DVTs and the remainder will have thrombosis confined to the calf.
Signs & Symptoms

• The classic signs and symptoms of DVT are localized pain, tenderness, swelling, and discoloration.

• Other symptoms may include lower extremity edema, fever, extremity warmth, and pain.
  – Symptoms can serve only as a trigger for further diagnostic inquiry; they cannot, by themselves, rule a DVT in or out.

• Like symptoms, physical examination findings are not sensitive or specific; in more than 50% of the instances in which there was a verified DVT, there was a normal physical examination.
Signs & Symptoms

• Most clinicians attempt to identify outpatients suspected of having PDVT by considering the patients’ signs and symptoms and associated risk factors. For example, patients with symptomatic PDVT tend to complain of lower extremity pain, calf tenderness, and lower extremity swelling.

• However, approximately 75% of all patients who are suspected of having PDVT are found not to have PDVT when formal diagnostic testing is completed.
Other conditions to consider

- Malignant disease
- Morbid obesity
- Previous history of VTE
- Stroke
- Irritable bowel syndrome
- Congestive heart failure
- Pregnancy
- Advanced age
- Hereditary conditions
  - Include deficiencies in protein C and protein S and familial thrombophilia.
Differential Dx of DVT

• Common conditions that mimic a VTE:
  • Muscle hematoma
  • Muscle or tendon tear
  • Muscle cramp
  • Superficial thrombophlebitis
  • Postphlebitic syndrome
  • Cellulitis
  • Sciatica
  • External venous compression
Conditions that may mimic symptoms associated w/ pDVT

- **Musculoskeletal**: trauma, hematoma, myositis, tendinitis, Baker’s cyst, synovitis, osteoarthritis, osteomyelitis, tumors, fractures
- **Neurological**: sciatica, lower-limb paralysis
- **Venous**: phlebitis, postthrombotic syndrome, compressed veins
- **Arterial**: acute arterial occlusions, a-v fistula
- **Generalized**: edema, cardiogenic, nephrogenic, dysproteinemic
- **Cutaneous**: dermatitis, cellulitis, lipoedema, panniculitis
- **Localized**: edema, pregnancy, oral contraceptive intake, limb immobilization
Current practice evolving

• Current practice is to refer all patients presenting with complaints suspected of a DVT, to specialized diagnostic services for objective testing.

➢ Studies have revealed that 80–90% of these referred patients do not have a DVT.

• Rapid point-of-care D-dimer assays combined with a specific CDR makes it possible to realize a diagnostic work-up in a primary care setting.
• Given that PDVT is a serious disorder with potentially life-threatening consequences, tests used by physical therapists to identify patients with PDVT should have a very high sensitivity (proportion of patients with the disorder who have a positive test) so that negative tests would indicate that the clinician can confidently rule out the disorder.
Sensitivity & Specificity

- False negative tests would be potentially catastrophic in this case because the patient would actually have a PDVT even though the test result was negative.

- The therapist would potentially falsely conclude that referral to a physician is unnecessary.
Homans sign
In Our Current & “Classic” Texts
Homans’ Sign Evaluated (Urbano, 2001 - review)

• Homans’ sign present in 33% pts with thrombosis, also present in 21% without

• Estimates of accuracy of Homans’
  – positive in 8% to 56% of proven DVT cases, positive in 50% of symptomatic pts without proven DVT
  – More common in pts clinically suspected of DVT with negative venogram than in clinically suspected with positive venogram

• “This has led nearly all authors to declare that Homans’ sign in unreliable, insensitive, and nonspecific in the diagnosis of DVT.”

Wells CDR

• “The diagnosis of DVT relies heavily on the use of objective tests because signs and symptoms are not thought to be specific.”

• “It has been our impression that clinical features can be used to classify symptomatic patients with suspected DVT as having a high or low probability for DVT before diagnostic testing.”
Clinical Pretest Probability - Wells DVT Score

Active cancer (on treatment for last 6 months or palliative) 1
Paralysis, paresis or plaster immobilization of lower extremity 1
Immobilization previous 4 days or major surgery within 4 weeks 1
Entire leg swollen 1
Calf swollen by more than 3 cm 1
Pitting edema 1
Collateral superficial veins (non-varicose) 1
Probable alternative diagnosis -2

High DVT Risk = 3+
Moderate DVT Risk = 1-2
Low DVT Risk = < 1

(If both legs are symptomatic, score the more severe leg)
## CURRENT Wells CDR (2-level)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Cancer (ongoing treatment, w/in 6 months or palliative)</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis paresis or recent plaster immobilization of LE’s</td>
<td>1</td>
</tr>
<tr>
<td>Recently bedrest 3 days or &gt; or major surgery w/in 12 weeks requiring general or regional anaesthesia</td>
<td>1</td>
</tr>
<tr>
<td>Localized tenderness along deep venous distribution</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swollen</td>
<td>1</td>
</tr>
<tr>
<td>Calf edema @ least 3 cm larger than asymptomatic side</td>
<td>1</td>
</tr>
<tr>
<td>Pitting edema confined to symptomatic side</td>
<td>1</td>
</tr>
<tr>
<td>Collateral superficial veins (non-varicose)</td>
<td>1</td>
</tr>
<tr>
<td>Previously documented DVT</td>
<td>1</td>
</tr>
<tr>
<td>Alternative diagnosis at least as likely as DVT</td>
<td>-2</td>
</tr>
<tr>
<td><strong>Clinical probability simplified score</strong></td>
<td>-</td>
</tr>
<tr>
<td>DVT ‘likely’</td>
<td>2 points or more</td>
</tr>
<tr>
<td>DVT ‘unlikely’</td>
<td>Less than 2 points</td>
</tr>
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</table>
## Padua CDR for Hospitalized Patients

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
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<tbody>
<tr>
<td>Active Cancer*</td>
<td>3</td>
</tr>
<tr>
<td>Previous VTE (excludes superficial vein thrombosis)</td>
<td>3</td>
</tr>
<tr>
<td>Reduced mobility**</td>
<td>3</td>
</tr>
<tr>
<td>Already known thrombophilic condition</td>
<td>3</td>
</tr>
<tr>
<td>Recent (&lt;1 month) trauma/surgery</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 70 years old</td>
<td>1</td>
</tr>
<tr>
<td>Heart and/or respiratory failure</td>
<td>1</td>
</tr>
<tr>
<td>Acute MI or CVA</td>
<td>1</td>
</tr>
<tr>
<td>Obesity (BMI &gt; 30 kg/m)</td>
<td>1</td>
</tr>
<tr>
<td>Ongoing hormonal treatment</td>
<td>1</td>
</tr>
<tr>
<td><strong>High risk &gt; 4</strong></td>
<td></td>
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</tbody>
</table>

*Patients with local or distant metastases and/or in whom chemotherapy or radiotherapy had been performed in the previous 6 months.

**Bedrest with bathroom privileges for at least 3 days
# Wells Rule for PE

<table>
<thead>
<tr>
<th>Clinical signs &amp; symptoms of DVT</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Alternative diagnosis less likely than PE</td>
<td>3.0</td>
</tr>
<tr>
<td>Heart rate &gt; 100</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization &gt; 3 days or surgery in past 4 weeks</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous PE or DVT</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Cancer (tx in last 6 months)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical probability of PE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Intermediate</td>
<td>2 to 6</td>
</tr>
<tr>
<td>High</td>
<td>➤ 6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternate scoring</th>
<th></th>
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<tbody>
<tr>
<td>Unlikely</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>Likely</td>
<td>&gt; 4</td>
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# Revised Geneva Rule for PE

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Age &gt; 65</strong></td>
<td>1</td>
</tr>
<tr>
<td>Previous PE or DVT</td>
<td>3</td>
</tr>
<tr>
<td>Surgery or fx of LE’s in past month</td>
<td>2</td>
</tr>
<tr>
<td>Cancer (active or cured &lt; 1 year)</td>
<td>2</td>
</tr>
<tr>
<td>Unilateral LE pain</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate</td>
<td></td>
</tr>
<tr>
<td>75 to 94 bpm</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 95 bpm</td>
<td>5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>2</td>
</tr>
<tr>
<td>Pain on deep venous palpation of LE &amp; unilateral edema</td>
<td>4</td>
</tr>
</tbody>
</table>

**Clinical probability of PE**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>Intermediate</td>
<td>4 to 10</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 10</td>
</tr>
</tbody>
</table>
Clinical algorithm for PE
Suspect PE

Clinically unstable?

YES
Consider Massive PE

NO

Estimate clinical Pretest Probability Using CDR

< 4
PERC positive?

NO

YES

< 4

< 4

NO

YES

5-6
CT angiogram

> 6
Begin Anticoagulation
Reassess likelihood of PE

PERC positive?

- NO
  - PE unlikely
- YES
  - CT angiogram
    - NO
      - D-dimer?
        - NO
          - PE unlikely
        - YES
          - D-dimer
            - NO
              - Reassess likelihood of PE
            - YES
              - PE confirmed
Case studies
Implementing guidelines
Discussion

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References

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