If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.

This handout is for reference only. It may not include content identical to the powerpoint. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.
Deep Venous Thromboembolism and Pulmonary Embolism: Making the Right Decision for Your Patient.

John Heick, PT, PhD, DPT, OCS, NCS, SCS
July 7, 2017

Objectives

1) Identify the pathology leading to Venous Thromboembolism,
2) Differentiate between DVT and PE clinical patterns,
3) Implement clinical decision making in choosing if a patient should remain in bed or move,
4) Discuss clinical practice guidelines that provide guidance in evaluating appropriateness to move or not to move,
5) Discuss case studies to illustrate the clinical decision making process in evaluating appropriateness to move or not to move.
Questions 1 & 2

• What techniques or methods were you taught during your entry-level professional education to evaluate a patient for a DVT or PE?

• What techniques or methods do you routinely use to evaluate a patient that you suspect has a DVT or PE?

Survey says...

• 850 Clinical instructors

• During entry-level education, 80.5% were taught to use Homans sign to identify a patient with a DVT.

• To evaluate a patient with a suspected DVT, 87.3% indicated they routinely used signs and symptoms, 67.9% used Homans sign, and 20.9% used the Wells clinical decision rule.
Techniques Taught to Clinical Instructors During Entry-Level Professional Education to Evaluate a Patient for a Deep Vein Thrombosis (N=850)*

<table>
<thead>
<tr>
<th>Techniques Taught</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homans sign</td>
<td>684 (80.5)</td>
</tr>
<tr>
<td>Observation/appearance</td>
<td>331 (38.9)</td>
</tr>
<tr>
<td>Edema</td>
<td>239 (28.1)</td>
</tr>
<tr>
<td>Component of CDR</td>
<td>238 (28.0)</td>
</tr>
<tr>
<td>Palpation</td>
<td>222 (26.1)</td>
</tr>
<tr>
<td>Temperature</td>
<td>172 (20.2)</td>
</tr>
<tr>
<td>Pain</td>
<td>165 (19.4)</td>
</tr>
<tr>
<td>Ultrasound b</td>
<td>57 (6.7)</td>
</tr>
<tr>
<td>Other</td>
<td>35 (4.1)</td>
</tr>
<tr>
<td>None</td>
<td>19 (2.2)</td>
</tr>
</tbody>
</table>

* Respondents were able to list up to 3 techniques,
This is a qualitative category from responses received.
Abbreviation: CDR, clinical decision rule.

Homans sign video
Pratt’s sign video

Techniques used to evaluate for a DVT:

<table>
<thead>
<tr>
<th>Technique</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and symptoms</td>
<td>742 (87.3)</td>
</tr>
<tr>
<td>Autar</td>
<td>3 (0.4)</td>
</tr>
<tr>
<td>Homans sign</td>
<td>577 (67.9)</td>
</tr>
<tr>
<td>Pratt’s sign</td>
<td>9 (1.1)</td>
</tr>
<tr>
<td>Wells clinical decision rule</td>
<td>178 (20.9)</td>
</tr>
<tr>
<td>I don’t evaluate for DVTs</td>
<td>30 (3.6)</td>
</tr>
</tbody>
</table>
**Signs and symptoms**

- Pain: 642 (75.5)
- Swelling/edema: 569 (66.9)
- Erythema or redness: 325 (38.2)
- Increased temperature: 189 (22.2)
- Palpation: 129 (15.2)
- Other: 96 (11.3)
- None: 89 (10.5)
- Homans: 77 (9.1)
- Components of CDR: 23 (2.7)
- Doppler: 5 (0.6)

**Use of Homans Sign or CDR by Post-entry Level Education (N=801)**

<table>
<thead>
<tr>
<th>Post Entry–Level Education</th>
<th>Homans Sign Probability (95% CI)</th>
<th>CDR (Wells/Autar) Probability (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NoEd (N=491)</td>
<td>0.71 (0.67-0.75)* 19.2 (13.7-27)**</td>
<td>0.11 (0.09-0.14)</td>
</tr>
<tr>
<td>TDPT only (N=84)</td>
<td>0.56 (0.45-0.66)* 2.3 (1.2-4.3)</td>
<td>0.36 (0.26-0.46)</td>
</tr>
<tr>
<td>SRF (N=177)</td>
<td>0.67 (0.60-0.74)* 5.9 (3.7-9.3)</td>
<td>0.26 (0.20-0.33)</td>
</tr>
<tr>
<td>AAD (N=49)</td>
<td>0.69 (0.55-0.81)* 6.3 (2.6-15.2)</td>
<td>0.26 (0.16-0.41)</td>
</tr>
</tbody>
</table>

* * Probability of the use of Homans sign significantly greater (*P<.01*) than the probability of use of a CDR (Wells or Autar). **NoEd group is less likely (*P<0.1*) than the other three groups to use a CDR.
Identify pathology leading to VTE

Pathology of VTE

- VTE: 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. Stein 2010
VTE

– Can occur in any vein, MOST common in the legs

– Long saphenous vein thrombosis extends into deep veins (DVT)

– DVT localized in the calf veins are often small & less commonly associated with a PE

Initiation of a Thrombosis

• Venous stasis due to:
  – Immobility
  – Venous obstruction
  – Increased venous pressure
  – Venous dilation
  – Increased blood viscosity
Initiation of a DVT

• Platelet aggregation
  – Damaged vessel wall exposes the subendothelium
  – Inflammatory response leads to thrombogenesis with adhesion, activation & aggregation of platelets and thus coagulation.
  – Can occur with direct venous damage
    • hip or knee surgery, or varicose vein stripping, severe burns, or lower-limb trauma.
  – Can occur in chronic inflammatory states.

DVT

• Proximal DVTs involve the popliteal, femoral, or iliac venous system.
• ~20% to 30% of untreated 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.
• VTE→DVT→PE
  – Important causes of morbidity and mortality in hospitalized patients.
  – VTE also occurs spontaneously in healthy, ambulatory outpatients.
PDVT

- PDVT is the more dangerous form of DVT because it is more likely to cause life-threatening PE and may result in a greater risk of postthrombotic syndrome.

What may contribute to VTE?

- Factor V mutation is a single base mutation in the factor V gene that eliminates 1 of 3 activated protein C cleavage sites. Sode et al, 2013
- Factor V mutation is associated with a 2- to 10-fold increased risk for VTE.
- Patients with an AB blood type & factor V mutation are more prone to VTE
  - blood type accounts for a 20% increased rate of VTE
  - and factor V mutation accounts for a 10% increased rate of VTE Sode et al, 2013
Questions 3 & 4

- What type of lower extremity thrombus is associated with a pulmonary embolus?

- Have you treated a patient with an Upper extremity DVT or perhaps a patient with a UE DVT that caused a PE?

What about upper extremity DVTs?

- Accounts for 4-10% of all cases of DVT Kraaijapoel et al 2017

- UE DVT incidence has ↑’d due to the use of peripherally inserted central catheters (PICC lines) or central venous catheters (CVC).

- UE DVT affects the subclavian vein, axillary vein, or both most often with less common sites being the internal jugular and brachial veins.
Possible Predictors of Upper Extremity DVT*

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Absent</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous material (catheter or access device in subclavian or jugular vein; pacemaker)</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>Localized pain</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>Unilateral pitting edema</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>Other diagnosis at least as plausible (negative association)</td>
<td>0</td>
<td>-1.0</td>
</tr>
</tbody>
</table>

**Key:** Total score of
-1.0 or 0: low probability of UE DVT
1: intermediate probability
2-3: high probability


---

**PE**

- ~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.
Consider the conducting airways of the bronchial tree.

VTE → Pulmonary Embolism

VTE Incidence

- From 1989-2006, hospital DVT increased 3.1 times from 35 to 107/100,000 population. Stein 2010
- From 1992-2006, PE in hospitalized patients increased 2.5 times from 33 to 83/100,000 population. Stein 2010
- The incidence of initial VTE rises exponentially with age, increasing from <1 case per 1000 person-years in persons aged <50 years to 6–8 per 1000 person-years in persons aged >80 years. Tritschler & Aujesky, 2017
- Overall, >60% of all VTE events occur in persons aged ≥ 65 years. Tritschler & Aujesky, 2017
Inpatient vs outpatient

- In many cases, PDVT does not appear until after a patient has been discharged from the hospital and is being managed as an outpatient.

- If outpatients with PDVT can be identified earlier rather than later, the risk for severe morbidity and mortality potentially can be lessened.

After D/C from the Hospital

- Venographic studies suggest that ~ 1 of 5 (20%) patients undergoing elective orthopedic surgery who receive standard antithrombotic prophylaxis will have asymptomatic DVT found by venography at the time of hospital discharge.

- 3 months after hospital discharge, symptomatic nonfatal VTE occurs in ~ 1 of 42 (2.4%) patients, and fatal PE occurs in approximately 1 of 1250 (0.08%) patients.
Outpatients with PE

- Erkens evaluated the safety of outpatient management of acute PE by examining patients diagnosed between January 1, 2007 and December 31, 2008.

- 260 (55.0%) were treated as outpatients and 213 (45.0%) were admitted to the hospital. The majority of the patients were admitted because of severe co-morbidities (45.5%) or hypoxia (22.1%).

Outpatients with PE

- No outpatient died of fatal PE during the 3 month follow-up period. The overall mortality was 5.0% (95% CI: 2.7 to 8.4%).
  - The rates of recurrent VTE in outpatients were 0.4% (95% CI: 0.0 to 2.1%) and 3.8% (95% CI: 1.9 to 7.0%) within 14 days and 3 months, respectively. Four (1.5%) outpatients were admitted to the hospital within 14 days.

- Conclusion: the majority of patients with acute PE can be managed as outpatients with a low risk of mortality, recurrent VTE and major bleeding episodes.
Differentiate between DVT and PE clinical patterns

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)

Hillegas et al, 2015
S&S of LE DVT

- Pitting edema
- Tenderness & pain in the LE
- Erythema
- Warmth
- Swelling of the LE
- Prominent superficial veins
Why VTE?

- **A proximal** lower-extremity DVT (above the knee)
  - associated with 50% risk of PE if not treated
  - risk of PE is 20% to 25% if calf vein thrombi.
- One in 5 with acute PE die almost immediately; 40% will die within three months.
- VTE has secondary conditions including:
  - Post PE syndrome
  - Chronic Thromboembolic Pulmonary Hypertension (CTEPH).
- Survivors of PE often develop significant cardiopulmonary morbidity: CTEPH most often

Why VTE?

- Both hospitalized and non-hospitalized patients may be affected by VTE.
  - Half of new VTE cases are hospital-acquired or occur within 90 days of a hospital stay or surgical procedure.
  - VTE accounts for 5% to 10% of all deaths during hospitalization.
  - Acute medical illness is associated with an 8X increased risk of VTE
    - accounts for about one-fourth of all VTE events in the community
  - Immobilization for 3 or more days is one of a number of risk factors for VTE in hospitalized medical patients
  - Immobilization secondary to long-distance air travel is also a risk factor
Why a VTE Guideline?

- Both hospitalized and non-hospitalized patients may be affected by VTE

- Cancer alone: 4.1-fold risk of thrombosis
- Chemotherapy increases the risk 6.5-fold.
- Age >50 incidence increases to 5-6 per 1000,
- > risk in men than women in older adults
- Survivors of first VTE: 10% to 30% develop another VTE within 5 years.

PE Clinical manifestations

- **Dyspnea** is the most frequently reported symptom.
  - Pulse oximetry!

- Chest pain is common.

- Syncope is usually associated with a massive PE and caused by a reduction in cardiac output. Results in hypotension and impairment of cerebral blood flow.
Question 5 & 6

• What is the most likely sign or symptom for a patient with a DVT?

• What is the most likely sign or symptom for a patient with a PE?

Implement clinical decision making in choosing if a patient should remain in bed or move.
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.

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.
Screening for VTE

Algorithm 1: Screening for Risk of Venous Thromboembolism

Is the patient at high risk for VTE? (Table 1 and 6)

- YES
  - Interventions to decrease risk (Table 7)
    1. Encourage mobility and physical activity
    2. Use of mechanical compression
    3. Consult with physician about medication
    4. Provide education on VTE prevention (Table 9)

- NO
  - Encourage mobility and physical activity

Clinical algorithm for PE
Suspect PE

Clinically unstable?

NO

Consider Massive PE

YES

Estimate clinical Pretest Probability Using CDR

< 4

YES CT angiogram

NO PERC positive?

> 6

Begin Anticoagulation

5-6

NO

PERC positive?

YES

CT angiogram

PE unlikely

NO D-dimer?

PE unlikely

YES D-dimer?

Reassess likelihood of PE

PE confirmed
Question 7

• If the D-dimer is negative in a patient with a suspected PE after CT imaging, what is the next step in deciding if the patient does have a PE?

Question 8

• If the PE rule out criteria or PERC is positive in a patient with a suspected PE, what is the next step in deciding if the patient does have a PE?
Clinical Pretest Probability - Initial Wells DVT CDR

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)

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

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Frequency</th>
</tr>
</thead>
<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>High risk &gt; 4</td>
<td></td>
</tr>
</tbody>
</table>

Other DVT Assessment Tools

- **Kahn**
  - Found not to be effective in hospitalized patients

- **Oudega**
  - Primary Care

- **St. Andre**
  - Hospitalized patients

- **Ambulatory**
  - Outpatient
Use of CDRs for VTE

- 394 physicians surveyed, 22% claimed to never use a CDR in patients suspected to have a DVT.
- Deviating from any of the CDR’s comes at the cost of the efficiency and safety of the management of patients with suspected VTE.
- Adhering to a CPR is associated with both a significant decrease in the number of applied diagnostic tests as well as in the 3-month VTE incidence and perhaps even mortality.

iDVT & Wells CDR

- 4 items taken from Wells associated with a high risk of DVT:
  - Immobilization (minimal 3 days and/or major surgery <4 weeks)
  - Difference in the calve circumferences of at least 3 cm compared to the asymptomatic leg
  - VTE in the past
  - active malignant Tumor (treatment ongoing or within previous 6 months or palliative)
iDVT & Wells

• The DVT prevalence was 36%.
• The area under the ROC curve was 0.70 (95%CI 0.66–0.74) and 0.65 (95%CI 0.61–0.70) for the Wells rule and I-DVT (difference 0.049, 95%CI –0.01–0.11; p = 0.13).
• Conclusion: The simple I-DVT score and Wells rule have comparable diagnostic accuracy. Dronkers et al, 2017

Interventions to ↓ VTE

• Lower extremity exercises such as ankle pumps
• Ambulation ASAP
• Hydration
• Correct use of compression stockings (14-15 mmHg) unless contraindicated
• Refer for pharmacological prophylaxis

Hillegass et al, 2015
Education for patients

- Risk factors for DVT
- Possible consequences for DVT
- Interventions to decrease risk
- S&S of DVT & importance of seeking help
- Importance of follow-up monitoring
- Importance of compliance
- Medication side effects, adverse reactions & dietary restrictions

Hillegass et al, 2015

Question 9

- Name 2 interventions to decrease the likelihood of VTE formation.
Discuss clinical practice guidelines that provide guidance in evaluating appropriateness to move or not to move.

Algorithm 3: Mobilizing Patients with Known Lower Extremity Deep Vein Thrombus

- Are they anticoagulated?
  - Yes
    - LMWH
    - Fondaparinux
    - UFH
    - NOAC
  - No
    - LMWH
    - UFH
    - NOAC

LMWH = Low-Molecular Weight Heparin
UFH = Unfractionated Heparin
NOAC = Novel Oral Anticoagulants
INR = International Normalized Ratio
IVC = Inferior Vena Cava

1 If started on Coumadin, LMWH usually also started. Use LMWH guidelines for mobilization decision in these situations

Hillegass et al, 2015
When to Mobilize after Diagnosis of VTE?

• Old assumption: early mobilization could cause the DVT to dislodge,
• Strict bed rest was prescribed with early ambulation being considered a contraindication when a LE DVT was documented.
• Meta-analysis and systematic review:
  – no greater risk of PE in anti-coagulated patients who are mobilized early versus those who remain on bed rest.
• Early mobilization in patients with LE DVT who are anti-coagulated prevents adverse effects of bed rest
• Early mobilization reduces risk of extension of DVT proximally as well as the more long term effects of PTS.

Major Findings of the CPG

• Physical therapists should play a large role in identifying patients who are high risk of a VTE.
  – Prevention is key
• Recognize signs and symptoms of a LE DVT and determine likelihood of DVT
• Mobilize as soon as possible
• Complications post DVT can continue for years or even a lifetime.
  – Prevention is key
VTE & PT

• Across various practice settings, physical therapists encounter patients who are at risk for VTE, may have an undiagnosed DVT, or have recently been diagnosed with a DVT. The physical therapist's responsibility to every patient is four-fold:
  – 1. Prevention of VTE
  – 2. Screening for DVT
  – 3. Contributing to the healthcare team in making prudent decisions regarding safe mobility for these patients
  – 4. Prevention of long term consequences of DVT

CPG action statements for VTE

• 1. PT’s should advocate for a culture of mobility & physical activity unless medical contraindications for mobility exist. Evidence quality I, strength: strong.
• 2. During the initial patient interview & examination, PT’s should determine if the patient is at high risk. Evidence quality I, strength: strong.
• 3. PT’s should provide preventive measures for patients who are identified as high risk for LE DVT. These measures should include education regarding S&S, activity, hydration, mechanical compression, and referral for medication. Evidence quality I, strength: strong.
CPG action statements for VTE

• 4. PT’s should recommend mechanical compression when individuals are at high risk for LE DVT. Evidence quality I, strength: strong.
• 5. PT’s should establish the likelihood of an LE DVT when the patient has pain, tenderness, swelling, warmth, or discoloration in the LE. Evidence quality I, strength: strong.
• 6. PT’s should recommend further medical testing after the completion of the Wells criteria for LE DVT prior to mobilization. Evidence quality I, strength: strong.
• 7. When a patient has a recently diagnosed LE DVT, PT’s should verify whether the patient is taking an anticoagulant medication, what type of anticoagulant medication and when the anticoagulant medication was initiated. Evidence quality V, strength: D-theoretical/foundational

CPG action statements for VTE

• 8. When a patient has a recently diagnosed LE DVT, PT’s should initiate mobilization when therapeutic threshold levels of anticoagulants have been reached. Evidence quality I, strength: strong.
• 9. PT’s should recommend mechanical compression when a patient has a LE DVT. Evidence quality II, strength: moderate.
• 10. PT’s should recommend that patients be mobilized, once hemodynamically stable, following IVC filter placement. Evidence quality V, strength best practice.
CPG action statements for VTE

• 11. When a patient with a documented LE DVT below the knee is not treated with anticoagulation and does not have an IVC filter and is prescribed out of bed mobility by the physician, the PT should consult with the medical team regarding mobilizing vs. keeping the patient on bed rest. Evidence quality V, strength: best practice.
• 12. PT’s should screen for fall risk whenever a patient is taking an anticoagulant medication. Evidence quality I, strength: strong.
• 13. PT’s should recommend mechanical compression when a patient has S&S suggestive of PTS. Evidence quality I, strength: strong.
• 14. PT’s should monitor patient who may develop long-term consequences of LE DVT & provide management strategies that prevent them from occurring to improve the human experience and increase quality of life. Evidence quality V, strength: best practice.

Wells Rule for PE

<table>
<thead>
<tr>
<th>Clinical signs &amp; symptoms of DVT</th>
<th>3.0</th>
</tr>
</thead>
<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>Immobile &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>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Intermediate</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

Alternate scoring

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

<table>
<thead>
<tr>
<th>Age &gt; 65</th>
<th>1</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>Clinical probability of PE</td>
<td></td>
</tr>
<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>

Discuss case studies to illustrate the clinical decision making process in evaluating appropriateness to move or not to move.
Case study

• 52 y/o woman who c/o 1 week history of right calf pain. She underwent a L5 discectomy for LBP & R LE pain 2 months ago. She did not take anticoagulants after the surgery. Pt reports R calf pain for a few days that is different than her previous R LE pain. She has been gradually walking longer distances & does not remember hurting her calf. Her leg is mildly swollen w/pitting edema in the calf. Homans sign is negative and she has tenderness in her calf region.
• She is otherwise healthy and has never had a DVT.

CURRENT Wells CDR (2-level)

<table>
<thead>
<tr>
<th>Active Cancer (ongoing treatment, w/in 6 months or palliative)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<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 anesthesia</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>
</tbody>
</table>

Clinical probability simplified score

<table>
<thead>
<tr>
<th>DVT ‘likely’</th>
<th>2 points or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT ‘unlikely’</td>
<td>Less than 2 points</td>
</tr>
</tbody>
</table>
Case study

- 69 y/o retired man d/c’d from hospital for a surgically repaired supracondylar fracture of the humerus 1 month earlier. He did not take anticoagulants after the surgery. Currently, in addition to his shoulder pain, he c/o moderate L calf pain & swelling during the past week. He is ambulatory & has no history of DVT, leg trauma, or unusual physical activity. He denies chest pain, SOB or dizziness, although he does have CHF controlled by meds. The L calf measures 2 cm larger than the R & there is slight swelling in the thigh. No evidence of pitting edema was found. Homans sign –

CURRENT Wells CDR (2-level)

| Active Cancer (ongoing treatment, w/in 6 months or palliative) | 1 |
| Paralysis paresis or recent plaster immobilization of LE’s | 1 |
| Recently bedrest 3 days or > or major surgery w/in 12 weeks requiring general or regional anesthesia | 1 |
| Localized tenderness along deep venous distribution | 1 |
| Entire leg swollen | 1 |
| Calf edema @ least 3 cm larger than asymptomatic side | 1 |
| Pitting edema confined to symptomatic side | 1 |
| Collateral superficial veins (non-varicose) | 1 |
| Previously documented DVT | 1 |
| Alternative diagnosis at least as likely as DVT | - 2 |

Clinical probability simplified score

DVT ‘likely’ 2 points or more
DVT ‘unlikely’ Less than 2 points
Question 10

• What Wells DVT score would you give this 69 y/o patient?

Case study

• 63 y/o male walked in for elective Right knee arthroplasty Nov. 12th, walked out Nov. 13th, “feeling fine”
• In hospital: compression devices & TED hose (continued TED x 2 weeks)
• FWW 3-4 days then “very active walking” on his own; 2-3/10 pain in knee only; elevate LE & pain relieved
• Dec 3rd notices difficulty catching his breathe w/activity. HR is 108 arriving for PT, increases w/exercise.
• ASA 325 bid x 10 days then 1 day/week x 1 week.
### CURRENT Wells CDR (2-level)

<table>
<thead>
<tr>
<th>Condition</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 anesthesia</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>Clinical probability simplified score</td>
<td></td>
</tr>
</tbody>
</table>

#### DVT ‘likely’
- 2 points or more

#### DVT ‘unlikely’
- Less than 2 points

### Wells Rule for PE

<table>
<thead>
<tr>
<th>Clinical signs &amp; symptoms of DVT</th>
<th>Score</th>
</tr>
</thead>
<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>Immobile &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>

#### Clinical probability of PE

- Low: < 2
- Intermediate: 2 to 6
- High: > 6

#### Alternate scoring

- Unlikely: < 4
- Likely: > 4
Case study

• Makes appt w/PCP for Dec 8th

• PA orders nebulizer tx; consults PCP. PCP sends for imaging

• “Multiple bilateral PE” on CT. US reveals right LE DVT extending into popliteal vein

• Admitted 3 days

---

Case study

• No pain
• No erythema
• Post-operative edema of peripatellar region

• Possible hematologic disorder
### CURRENT Wells CDR (2-level)

<table>
<thead>
<tr>
<th>Condition</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 anesthesia</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>
</tbody>
</table>

**Clinical probability simplified score**

- **DVT ‘likely’**: 2 points or more
- **DVT ‘unlikely’**: Less than 2 points

### Wells Rule for PE

<table>
<thead>
<tr>
<th>Clinical signs &amp; symptoms of DVT</th>
<th>3.0</th>
</tr>
</thead>
<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>Immobile &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>

**Clinical probability of PE**

- **Low**: < 2
- **Intermediate**: 2 to 6
- **High**: ≥ 6

**Alternate scoring**

- **Unlikely**: < 4
- **Likely**: > 4
Question 11

• For this patient case, what Wells criteria for DVT score would you give him?

Question 12

• For this patient case, what Wells PE score would you give him?
Patient example
A 68-year-old man was referred to your clinic following a cemented right hip arthroplasty 3 weeks before your exam. He reports pain in his right calf and thigh since being discharged from the hospital and that these symptoms limit his ability to ambulate. He also reports difficulty getting in and out of bed. You find that he has a swollen right lower extremity and that he complains of pain when you palpate his right posterior calf and knee. You suspect that he may have a DVT, but you also consider that it is likely that the lower-extremity symptoms are attributable to the recent surgical procedure. Do you contact the patient’s physician?

Question 13

• For this patient case, what Wells criteria for DVT score would you give him?
**CURRENT Wells CDR (2-level)**

<table>
<thead>
<tr>
<th>Active Cancer (ongoing treatment, w/in 6 months or palliative)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<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 anesthesia</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>
</tbody>
</table>

**Clinical probability simplified score**

- **DVT ‘likely’**
  - 2 points or more

- **DVT ‘unlikely’**
  - Less than 2 points

---

**Implementing guidelines**

- “Knowledge translation is defined as the exchange, synthesis and ethically sound application of knowledge—within a complex system of interactions among researchers and users—to accelerate the capture of the benefits of research . . . Through improved health, more effective services and products, and a strengthened health care system.”

Discussion  

References


References