Management of Venous Thromboembolism

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** NO conflicts of interest to report
Acute Pulmonary Embolism
“I’m coming, Elizabeth!!!”
Objectives

• Triage treatment of VTE depending on risk of the patient
• Outline common anticoagulation options for acute VTE, including length of treatment
• Outline the role of thrombolytics, ultrasound and IVC filter in acute VTE
• Risk stratify patients with VTE in regards to inpatient or home care
• Brief touch on the new oral anticoagulation agents
Pulmonary Embolism(s)

- Acute Pulmonary Embolism
  - Thrombus
  - Air
  - Fat

- Chronic Pulmonary Embolism
Risks

- Chronic heart disease
- Autoimmune disease
- Stroke
- Surgery in last 3 months
- Paresis/Paralysis
- Prior blood clot
- Malignancy
- Immobility
- Chronic heart disease
- Autoimmune disease
- Stroke
- Surgery in last 3 months
- Paresis/Paralysis
- Prior blood clot
- Malignancy
- Immobility
Case 1

- 50 year old man s/p a right calcaneal tendon repair 1 week ago, presents with acute shortness of breath when bending down to put a new DVD in the DVD player

- Not a smoker, no family history of blood clots

- History of DM, high LDL
What is the next best step?

• A) Get a CT chest with “PE protocol”
• B) Get a VQ scan
• C) Start anticoagulation
• D) Get blood work
• E) Tell the ED to call pulmonary, then continue writing your blog on why the Harry Potter kids could totally beat up the Twilight kids

Creatinine- 2.5
The VQ scan will take 5 hours to get done and read. The next best step is:

• A) Wait for the VQ scan
• B) Give IV fluids and get chest CT PE protocol
• C) Get a chest CT scan without contrast
• D) Give anticoagulation
• E) Order an ultrasound while waiting for the VQ scan
Empiric Anticoagulation


“The Guidelines from Chest”
High risk

Diagnostic work up LONGER than 4 hours?

- Yes: ANTICOAGULATE
- No: WAIT until work up finished

Mod risk

Diagnostic work up LONGER than 24 hours?

- Yes: ANTICOAGULATE
- No: WAIT until work up finished

Low risk

Diagnostic work up LONGER than 4 hours?

- Yes: ANTICOAGULATE
- No: WAIT until work up finished
## Wells Criteria

<table>
<thead>
<tr>
<th>Clinical symptoms of DVT</th>
<th>Score</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other diagnosis less likely than pulmonary embolism</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Heart rate &gt; 100</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Immobilization (≥ 3 days) or surgery in previous 4 weeks</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Previous DVT/PE</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Malignancy</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

### Pretest probability

<table>
<thead>
<tr>
<th>Pretest probability</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>&gt; 6.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.0 to 6.0</td>
</tr>
<tr>
<td>Low</td>
<td>&lt; 2.0</td>
</tr>
</tbody>
</table>

### Simplified Wells

<table>
<thead>
<tr>
<th>Simplified Wells</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE likely</td>
<td>≥ 4.0</td>
</tr>
<tr>
<td>PE unlikely</td>
<td>≤ 4.0</td>
</tr>
</tbody>
</table>

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The VQ scan will take 5 hours to get done and read. The next best step is:

• A) Wait for the VQ scan
• B) Give IV fluids and get chest CT PE protocol
• C) Get a chest CT scan without contrast
• D) Give anticoagulation
• E) Order an ultrasound while waiting for the VQ scan
Heparin- why the hurry?
Should you ultrasound his legs?

- A) No, he has a cast, so can’t get one anyway
- B) No, this won’t change my treatment
- C) No, this increases risk of recurrent PE
- D) Yes, this may give me an indication for anticoagulation without waiting for VQ
- E) Yes, because I own stock in ultrasound
Case 2

• 50 year old man s/p a right calcaneal tendon repair 1 week ago, presents with acute shortness of breath when bending down to put a new DVD in the DVD player

• Not a smoker, no family history of blood clots

• History of DM, high LDL
Anticoagulation
Case 1- HR 90, creat 2.5

Case 2- HR 110, creat 0.8

LMWH*

UFH°

Fondaparinux

*LMWH- Low molecular weight heparin
°UFH- Unfractionated heparin
Case 1 - HR 90, creat 2.5

LMWH*

UFH°

Case 2 - HR 110, creat 0.8

Fondaparinux

*LMWH- Low molecular weight heparin
°UFH- Unfractionated heparin
Choices...

UFH
- Reversed with protamine
- Can use in renal insuff
- Easily turned off
- Better if pt unstable
- Use in obese patients

LMWH
- Lower mortality 6.1% → 4.5%
- Less major bleeding 5.4% → 3.7%
- Less recurrent VTE 2% → 1.2%
- Less low Plt issues

Fondaparinux
Predictable Pharmacokinetics
QD or BID dosing
Fixed dosing
Length of therapy?

A) 1 month
B) 3 months
C) 6 months
D) Indefinitely
...It depends on the risk!
With longer therapy:

- Increased bleeding risk
- Decreased recurrent events
Risk of recurrent VTE

- Provoked PE - surgical
- Provoked PE - non-surgical
- Unprovoked PE
- Patients with recurrent events

Chest guidelines 2012
First episode of PE with reversible risk factor.

- *Ex: Trauma, surgery, immobilization*
- Meta-analysis of 5 trials
  - 2185 patients
  - Compared 4-6 weeks to 3-6 months

<table>
<thead>
<tr>
<th></th>
<th>4-6 weeks tx</th>
<th>3-6 months tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent VTE</td>
<td>11.6%</td>
<td>6.4%</td>
</tr>
</tbody>
</table>
| Major bleeding   | 0.6%         | 1.2%          | **Not significant**

Recommendation: 3 months
First episode of PE, unprovoked

• Warfarin for 3 months, then reassess for bleed risk:

  - High bleed risk
  - Mod bleed risk
  - Low bleed risk

  → 3 months, then STOP

  → Indefinite anticoag
## Risk factors for bleeding

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 65</td>
<td>Previous bleeding</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>Antiplatelet Therapy</td>
</tr>
<tr>
<td>Poor anticoagulant control</td>
<td>Recent surgery</td>
</tr>
<tr>
<td>Frequent falls</td>
<td>Reduced functional capacity</td>
</tr>
<tr>
<td>Previous stroke</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Anemia</td>
<td>Cancer</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>Liver Failure</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td></td>
</tr>
</tbody>
</table>
2\textsuperscript{nd} or more PE, unprovoked

- Warfarin for 3 months, then reassess for bleed risk:
  - High bleed risk: 3 months, then STOP
  - Mod bleed risk: Indefinite anticoag
  - Low bleed risk: Indefinite anticoag
VTE and Cancer

- Higher recurrent PE risk
- ALSO higher bleed risk
- Favor LMWH for acute therapy
- Favor continuing LMWH for 3-6 months

Northcountytoastmasters.org
Transition to vitamin K antagonist

Intrinsic pathway

XII → XIIa
   ↓
  XI → Xla
     ↓
    IX → IXa
      ↓
     X → Xa
       ↓
      Prothrombin (II)
        ↓
       Thrombin (IIa)
         ↓
        Fibrinogen
          ↓
         tPA
           ↓
        Plasminogen
          ↓
         Plasmin

Extrinsic pathway

Tissue Injury
  ↓
Tissue factor
  ↓
VII - TF
  ↓
VII
   ↓
  warfarin
  ↓
  Xa inhibitors
  ↓
  heparin
  ↓
  Anti III
  ↓
  Xa inhibitors
  ↓
  IIa inhibitors
  ↓
  Fibrin
  ↓
  XIIIa
  ↓
  Fibrin Clot
  ↓
  Fibrin degradation products
Transition to vitamin K antagonist

$\text{INR} \geq 2$
Case 3

- 50 year old man s/p a right calcaneal tendon repair 1 week ago, presents with acute shortness of breath when bending down to put a new DVD in the DVD player
- Not a smoker, no family history of blood clots
- History of DM, high LDL
Train wreck!!
Train wreck!!
Train wreck!!
Train wreck!!
Stabilize
RV overload
RV overload- “D” sign
Anticoagulation
Oops!!
Thrombolytics: things to know

- **Indication:**
  - 1) Persistent hypotension or shock

- **Potential indications:**
  - Severe hypoxemia
  - Large perfusion defect on VQ scan
  - Extensive embolic burden on CT
  - RV dysfunction
  - Free-floating RA or RV thrombus
  - Patent foramen ovale
  - Cardiopulmonary resuscitation
Thrombolytics: things to know

• Thrombolytics have NEVER shown mortality benefit.
• Heparin should be STOPPED after thrombolytics, check PTT Q4 hours until PTT less than twice normal
• Half life of thrombolytics are SHORT, but action is NOT (up to 24 hours with tPA)
Issues

• Did our patient’s sudden SOB equate to failing anticoagulation?
• Therefore, should we have placed an IVC filter?
• Why didn’t we do an U/S?
IVC filter
IVC filter

• Absolute contraindication to therapeutic anticoagulation
• Failure of anticoagulation when there is an acute proximal venous thrombosis
• Other considerations (controversial)
  – You feel patient won’t survive another VTE
  – Patient with PE has poor cardiopulmonary reserve
  – VTE in a patient with high risk of bleeding
Standard anticoag + IVC filter

- 1%
- 21%

Standard anticoag alone

- 5%
- 12%

400 patients With PE

Recurrent PE At 12 days

DVT At 2 years
Standard anticoag + IVC filter

- Symptomatic PE At 8 years: 36%
- Recurrent PE At 8 years: 35%
- DVT At 8 years: 35%
- Symptomatic PE At 8 years: 6%

Standard anticoag alone

- Symptomatic PE At 8 years: 35%
- Recurrent PE At 8 years: 35%
- DVT At 8 years: 27%
- Symptomatic PE At 8 years: 15%

Mortality and postthrombotic syndrome similar in both
IVC filters

- No trials that have shown a decrease in mortality or recurrence of PE.
- Filters are removable
- > 90% can be retrieved
- BUT ONLY 10.3% end up actually getting the filters removed.
So did this patient FAIL anticoagulation?

COW CURIOSITY FAIL
Case 4

• 56 year old man with nearly 5 weeks of left sided pleuritic chest pain. He has no shortness of breath, no chest pain, no fevers. Normal vital signs.

• He was seen in the ED multiple times, each time with a normal EKG, and normal labs, normal CXR, and sent home with Nexium.

• His primary care physician calls for a direct admission after a CT chest showed a small sub-segmental PE.
Questions

• Does this patient need admission?
• Does he need a hypercoagulable work up?
• How long does he need anticoagulation?
• What anticoagulants should be given for discharge?
# Pulmonary Embolism Severity Index (PESI)

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (number of years)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
</tr>
<tr>
<td>Cancer hx</td>
<td>30</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>10</td>
</tr>
<tr>
<td>Chronic Lung Disease</td>
<td>10</td>
</tr>
<tr>
<td>Pulse $\geq 100/bpm$</td>
<td>20</td>
</tr>
<tr>
<td>Systolic BP $&lt; 100$ mmHg</td>
<td>30</td>
</tr>
<tr>
<td>Respiratory Rate $\geq 30$ bpm</td>
<td>20</td>
</tr>
<tr>
<td>Temp $&lt; 36 \degree$ Celcius</td>
<td>20</td>
</tr>
<tr>
<td>Altered Mental Status</td>
<td>60</td>
</tr>
<tr>
<td>Arterial Oxygen Saturation $&lt; 90%$</td>
<td>20</td>
</tr>
</tbody>
</table>
## PESI scoring

<table>
<thead>
<tr>
<th>Class</th>
<th>Score</th>
<th>Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>&lt; 66</td>
<td>LOW risk</td>
</tr>
<tr>
<td></td>
<td>66 to 85</td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>86 to 105</td>
<td></td>
</tr>
<tr>
<td></td>
<td>106 to 125</td>
<td>HIGH risk</td>
</tr>
<tr>
<td></td>
<td>&gt; 125</td>
<td></td>
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</tbody>
</table>
## Simplified PESI (‘sPESI’)

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 80 years</td>
<td>1</td>
</tr>
<tr>
<td>History of cancer</td>
<td>1</td>
</tr>
<tr>
<td>Chronic cardiopulmonary process</td>
<td>1</td>
</tr>
<tr>
<td>Pulse ≥ 110/min</td>
<td>1</td>
</tr>
<tr>
<td>Systolic BP &lt; 100</td>
<td>1</td>
</tr>
<tr>
<td>Arterial oxygen sat &lt; 90%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Low risk</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>High risk</strong></td>
<td>≥ 1</td>
</tr>
</tbody>
</table>
First episode of PE, unprovoked

- Warfarin for 3 months, then reassess for bleed risk:
  - High bleed risk
  - Mod bleed risk
  - Low bleed risk

  → 3 months, then STOP

  → Indefinite anticoag
Thrombophilia work up

• Controversial
• Can consider if strong family history
• Therapy does not generally change with this work up.
• Thus, generally not recommended, but can discuss on a case by case basis.
Disposition?

• 1) Patient can go home? YES
• 2) Hypercoag work up? NO
• 3) Length of anticoagulation?
  – 3 months, then re-eval-→ qualifies for life anticoagulation.
• 4) Anticoagulation for home:
  – Lovenox and coumadin (5 day plus INR > 2 goal)
  – Oral anticoagulants not recommended at this time
Objectives

• Triage treatment of VTE depending on risk of the patient
• Review common anticoagulation options for acute VTE, including length of treatment
• Review the role of thrombolytics, ultrasound and IVC filter in acute VTE
• Learn how to risk stratify patients with VTE in regards to inpatient or home care
• Brief touch on the new oral anticoagulation agents
Thank you
Catheter guided embolectomy

- Rheolytic Embolectomy
- Rotational Embolectomy
- Thrombus Fragmentation
- Ultrasound + Low Dose Thrombolytic
- Suction Embolectomy
Prognosis

• Elevated Troponin
• Elevated Lactic Acid
• Elevated BNP
• Low Sodium (<135)
• Evidence of Right Ventricle Strain**
5 year mortality from PE

Cause of Death

Non-Cardiovascular- Malignancy, Sepsis
Cardiovascular- CVA, MI, CHF