VTE Algorithm: Diagnosis and Treatment
Disclosures

• None
Objectives

• 1. Diagnosis and Treatment algorithm for Acute Pulmonary Embolism

• 2. Diagnosis and Treatment algorithm for Acute DVT
WHAT WOULD YOU DO?
45 year old female comes to the ER with chest pain and shortness of breath.
She has had a prior DVT for which she received coumadin for a year.
She stopped her blood thinner 3 months ago.
Elective ankle surgery 2 weeks ago.
HR 115
BP 90/60
O2 sat 94% on Non Re-breather
WWYD?

- Echo shows dilated right ventricle
- BNP 1200
- Troponin 1.2
WWYD?

• What now?
• Who makes the decision?
• How do they make the decision?
• Will the best treatment plan be offered to this patient?
Our System

• Admitted to hospitalist
  – Pulmonary Critical Care Consult
    • Consider systemic TPA
      – 2/3 of TPA withheld in appropriate patients due to concerns of bleeding risk
    • Therapeutic anticoagulation
  – CT Surgery Consult
    • Is there a role for embolectomy
  – Vascular Surgery Consult
    • Is there a role for catheter directed TPA
    • What is the source of the Clot
Our System

• 6 notes in the computer
• No centralized discussion amongst doctors to determine the best treatment for this patient
• Is this the optimal solution for our patient?
Other Systems

THIS IS CHAOS

InHospital

Referring Hospital

Heparin/IV tPA?

Catheter?

Surgery?

ED/Floor Team
+/- Pulmonary
+/- Hematology

Vascular Medicine/Cardiology
+/- IR

Thoracic Surgery
HOW DOES THE RIGHT MODEL WORK?
73 year old male with chest pain and shortness of breath

- Admission testing included
  - CT scan
  - Pro BNP
  - Echo
  - Troponin
  - BMP
  - CBC
  - PT/INR
• Echo demonstrated large RV
  – Paradoxic motion of septum
  – Estimated PA pressures of 55
• Pro BNP 256
• CTA Chest:
Multidisciplinary Discussion

• Risks and benefits of TPA at 73 years old
• Thrombus burden and classification of his PE
  – 100 mg TPA systemic
  – 50 mg TPA systemic
  – Low dose catheter directed TPA
  – Open embolectomy
  – Systemic anticoagulation and supportive care
How was this case handled

- Pt was started on therapeutic heparin
- Catheter directed therapy to the bilateral PE
  - Low Dose TPA given his age of >70.
- LE Duplex and IVC duplex showed a L femoral and iliac DVT
  - No symptoms so no surgical therapy
POD #1

- TPA administered at 1mg/hr/catheter
- Low dose heparin in each sheath
- Swan PA pressures monitored until resolution of PA hypertension
- Fibrinogen, PTT, CBC and hemodynamics monitored for signs/symptoms of bleeding
Post Op Care

• Discharge planning
  – Plan for 12 months of anticoagulation
  – Compression stockings 30-40mmHg for two years
  – 72 hour echo to look for resolution of right heart strain
  – 3 month follow up appt. to assess for resolution of right heart strain and symptoms of post thrombotic syndrome
So How Do We Get There?

• Step one
  – Prompt Identification of Disease

• Step two
  – Risk Stratification

• Step three
  – Develop a Patient and Disease Specific Plan
Disease Identification

• Combine risk models with good clinical judgment
### Wells Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active cancer (ongoing treatment or within last 6 months, or palliative)</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis or recent plaster immobilisation of lower extremities</td>
<td>1</td>
</tr>
<tr>
<td>Recently bedridden &gt;3 days and/or major surgery within 4 weeks</td>
<td>1</td>
</tr>
<tr>
<td>Local tenderness</td>
<td>1</td>
</tr>
<tr>
<td>Thigh and calf swollen</td>
<td>1</td>
</tr>
<tr>
<td>Calf swelling 3 cm &gt; asymptomatic side (measured 10 cm below tibial tuberosity)</td>
<td>1</td>
</tr>
<tr>
<td>Pitting oedema in symptomatic leg only</td>
<td>1</td>
</tr>
<tr>
<td>Dilated superficial veins (non-varicose) in symptomatic leg only</td>
<td>1</td>
</tr>
<tr>
<td>Alternative diagnosis as or more likely than DVT</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Probability of VTE increases from 3 to 75 % as wells score increases**
# PE Modified Wells Criteria

## Table 1. Wells Prediction Rule for Diagnosing Pulmonary Embolism: Clinical Evaluation Table for Predicting Pretest Probability of Pulmonary Embolism

<table>
<thead>
<tr>
<th>Clinical Characteristic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous pulmonary embolism or deep vein thrombosis</td>
<td>+ 1.5</td>
</tr>
<tr>
<td>Heart rate &gt;100 beats per minute</td>
<td>+ 1.5</td>
</tr>
<tr>
<td>Recent surgery or immobilization (within the last 30 d)</td>
<td>+ 1.5</td>
</tr>
<tr>
<td>Clinical signs of deep vein thrombosis</td>
<td>+ 3</td>
</tr>
<tr>
<td>Alternative diagnosis less likely than pulmonary embolism</td>
<td>+ 3</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>+ 1</td>
</tr>
<tr>
<td>Cancer (treated within the last 6 mo)</td>
<td>+ 1</td>
</tr>
</tbody>
</table>

### Clinical Probability of Pulmonary Embolism

<table>
<thead>
<tr>
<th>Probability</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0-1</td>
</tr>
<tr>
<td>Intermediate</td>
<td>2-6</td>
</tr>
<tr>
<td>High</td>
<td>≥7</td>
</tr>
</tbody>
</table>

Transition to Home (Included in both DVT & PE Order Set):

1. Sentara to Home Consult (auto-checked)
2. Care Coordination Consult (auto-checked)
3. Transition to Oral Medication:
   - NOAC
   - Lovenox bridge to Coumadin

Immediate Discharge?

Diagnosis of VTE

Activate PE treatment order set
(* includes assessment of need for PE Response Team)

Diagnosis of VTE

Activate DVT treatment order set
(* includes assessment of need for DVT Response Team)

End

Oral Medication:
- NOAC
- Lovenox bridge to Coumadin

ICM to make appointment with PCP within 7 days and/or with anticoagulation clinic

Response Team not yet rolled out
Activate DVT and PE Orderset

Massive Pulmonary Embolism (Shock/Hemodynamic Collapse)

If impending arrest or need for vasopressor agents due to suspected right ventricular failure:

Definition of Massive PE:
- Persistent hypotension SBP < 90 or
- Hypotension that requires vasopressor support or
- Respiratory failure requiring intubation or noninvasive ventilation or
- Cardiac Arrest due to Pulmonary Embolism

1. Dial 1-2 and notify operator of need for Pulmonary Embolism Response Team Alert.
2. After discussion with PE Response Team, order systemic thrombolyis if no contraindications.
3. Consider CT surgery consultation for open embolectomy.
Risk Stratification

• Pulmonary Embolism
  – Massive
  – Submassive
  – Asymptomatic

• DVT
  – Limb Treatening Phlegmasia
  – Proximal Disease (Iliac and IVC)
  – Distal Disease (Calf, Popliteal and Femoral Veins)
RV/LV ratio > 0.9 is an independent predictor of mortality¹⁻⁴
Patients with persistent RV dysfunction at discharge:

- 8 times more likely to have recurrent PE
- 4 times higher in mortality rate

than patients with RV dysfunction regressed at discharge\textsuperscript{6}
## Risk Stratification

### MASSIVE PE Panel

- **CBC WITH DIFFERENTIAL**
  - **STAT, ONE TIME** First occurrence Today at 0020, Lab Performed

- **PT-INR**
  - **STAT, ONE TIME** First occurrence Today at 0020, Lab Performed

- **APTT**
  - **STAT, ONE TIME** First occurrence Today at 0020, Lab Performed

- **NT PROBNP**
  - **STAT, ONE TIME** First occurrence Today at 0020, Lab Performed

- **TROPOININ**
  - **STAT, ONE TIME** First occurrence Today at 0020, Lab Performed

- **Echo Cardiogram Complete**
  - **STAT, ONE TIME** First occurrence Today at 0020
  - Indication for Exam: Pulmonary embolism, acute, to guide therapy
  - Portable Exam @ Bedside? Yes
  - Echocardiographic contrast agent will be used per protocol for patients with inadequate visualization: Yes
  - Is discharge contingent on echo: No
  - PE evaluation study to be done during business hours 7AM to 7 PM. If after hours, please ensure Echo is completed by 9 AM the following morning.

- **CT CTA CHEST PULMONARY... if not previously ordered**
  - STAT, ONCE, Starting 4/27/18

- **PVL IVC (INCLUDES IVC/ILIAC VEINS)**
  - STAT, ONCE, Starting 4/27/18, Suspected PE

- **PVL VENOUS EXAM LE BILATERAL R/O DVT**
  - STAT, ONCE First occurrence Today at 0020
  - Indication for Exam: SUSPECTED PE
  - Is discharge contingent on imaging order? NO

- **PVL VENOUS EXAM UE BILATERAL R/O DVT... if Lower extremity study is negative**
  - STAT, ONCE, Starting 4/27/18, If LE Study is negative
Greater thrombus removal gives lower PTS rate


Study to evaluate correlation between residual thrombus and post-thrombotic syndrome (PTS)

- 71 consecutive IFDVT patients treated with CDT
- Blinded comparison of pre- and post-treatment phlebograms and evaluation of CEAP/Villalta scores
Greater thrombus removal gives lower PTS rate

First study to demonstrate:

- **Direct** and **significant** correlation of between PTS scores and thrombus clearance

- Conclusion: when thrombus clearance is complete, PTS can be avoided
Treatment Algorithm Massive PE

- Heparin ONLY - Pulmonary embolism heparin infusion. standard weight-based heparin (80 units/kg bolus + 18 units/kg/hr drip) dosing per pharmacy. For patients with contraindication to alteplase.
  Standard weight-based heparin (80 unit/kg bolus + 18 unit/kg/hr drip). May be used for DVT, PE, AFIB, acute ischemic extremity. Indication:[Select One:28985]
- Warfarin and PT-INR panel
- tPA 100mg bolus dose panel
- tPA 50mg bolus dose panel

Transition to Home

ICM Consult automatically generated to schedule PCP appointment within 7 days at discharge and anticoagulation services appointment, if necessary.
- ICM Consult Process
- Sentara to Home - Pharmacy Consult
  Routine, RX TO DC First occurrence Today at 0020
  Need help with an additional medication? Yes
  Need help with an additional medication? Yes
- List additional requests or questions:
Asymptomatic PE and DVT

- Enoxaparin (LOVENOX) injection
  1 mg/kg, Subcutaneous, 2 TIMES DAILY
- Weight based heparin dosing per pharmacy once height and weight obtained (includes PTTs)
  Standard (80 unit/kg bolus + 18 units/kg/hr drip) heparin dosing for DVT/PE/Atrial Fibrillation. Please indicate if you do not wish a heparin bolus to be given at initiation of drip:
- Heparin to Warfarin (COUMADIN) bridge - Pharmacy to dose (Includes PT/INR)
- Apixaban (ELIQUIS) DVT/PE Treatment Panel
- Rivaroxaban (XARELTO) DVT/PE Treatment Panel
tPA Education

- A need for administration of tPA in a patient with acute PE occurred.
- Nursing treatment algorithm for administration of TPA
- Decrease time to infusion therapy and decrease bleeding risks
ICM Anticoag Follow Up System List

A new system list has been created for patients who need follow-up due to a **Deep Vein Thrombosis (DVT) or Pulmonary Embolism (PE)**. To access the list, select the System Lists folder, select the ICM Anticoag Follow Up Pilot system list, and then select your hospital.

The list only includes DVT and PE patients who need post discharge follow-up anticoagulation care. The **Follow Up Documented** column will display an icon if any appointments have been entered using the Post DC Follow Up navigator. You can see the details of any existing appointments by selecting the **Discharge Appointments** report in Patient List.
The ICM Anticoag Follow Up System List should be worked by sorting by Expected Discharge Date (EDD) and ensuring all patients getting discharged within 48-72 hours meet the below expectations. If any of the key criteria are missing, such as EDD or discharge plan, this should be escalated to the care team and reviewed at MDRs.

If a patient stays on this list past their expected discharge date, that patient should be reviewed to ensure that they will not miss their scheduled follow-up PCP or anticoagulation appointments due to a later discharge date.

**Expectations for each patient on the ICM Anticoag Follow Up System List are as follows:**

1. Patients that are planning to be discharged should have a post-discharge PCP appointment scheduled within 7 days of discharge. A PCP will need to be identified that can see the patient within 7 days if they do not currently have one.

2. **Patients on Coumadin** need their INR checked within 72 hours. Anticoagulation clinics are an option that can be utilized. Work with the patient’s provider to determine the best option for the patient and schedule an appointment for within 72 hours of discharge, if needed. If an anticoagulation clinic is to be used, ensure the provider has completed the referral in Epic before calling (844) 544-6004 to schedule the appointment. Once the appointment is scheduled, ask the anticoagulation services clinic scheduler to remove the patient from their follow-up list to avoid duplication of efforts.

3. Patients should use Sentara to Home, if available, so they have their anticoagulation medication in their hands before they leave the hospital. Be mindful of discharges scheduled for when Sentara to Home is not opened.

4. For patients being discharged to another facility, coordinate with the discharge provider to ensure the patient is discharged on an anticoagulant. If the patient is on Coumadin, also ensure that the patient leaves with an order to get their INR checked within 72 hours.

The scheduling of the patient’s appointments should be done in collaboration with the patient and/or the patient’s identified caregiver to ensure that the date/time selected is one that the patient is able to make. Efforts should also be made to ensure that the patient has transportation to the appointment. PCP and contact information in Epic should be verified and updated if necessary.
From the person making the appointment:

If patient on Coumadin:

“Hello, my name is __________. I am your Integrated Care Manager. We want to help prepare you for a smooth transition out of the hospital and to your next level of care. It looks like you will probably leave the hospital in about 2-3 days. One of the most important things you need to do when you leave the hospital is get your blood tested within 72 hours to make sure your blood thinner medication is working as desired. I see here that your primary care physician is Dr. __________. Is that correct? I would like to give his/her office a call to see if they can give you that test and follow-up on your anticoagulation care.”

If patient NOT on Coumadin:

“Hello, my name is __________. I am your Integrated Care Manager. We want to help prepare you for a smooth transition out of the hospital and to your next level of care. It looks like you will probably leave the hospital in about 2-3 days. One of the most important things you need to do when you leave the hospital is ensure you follow-up with your primary care physician within the first week. I see here that your primary care physician is Dr. __________. Is that correct? I would like to give his/her office a call so we can set up your follow-up appointment.”

Phone call initiated at bedside with patient/caregiver.

“Hi, this is __________ one of the integrated care managers at Sentara __________ Hospital. I am calling to make an appointment for __________. He/She needs a post hospitalization anticoagulation follow-up appointment within the next 3 days (if on Coumadin) / 7 days (if not on Coumadin).”

“Mr/Ms __________ would you be able to go and do you have transportation to an appointment on _____ at _____? Oh you do, great! I am going to get that scheduled for you now.”

“Okay, Mr/Ms __________ I have scheduled your appointment for _____ at _____ for the __________ appointment will be documented on your discharge instructions for you.”

“I spoke with your primary care physician’s office and they requested you go to a different location for that 72-hour post-discharge blood test. Dr. __________ suggested you make an appointment with __________. Does that location work for you? I would like to give them a call so we can set up that follow-up.”
PE Response Team

- InHospital
- Referring Hospital

Severe PE Identified

PERT Team Activated

Immediate Conference with:
- Pulmonary Medicine
- Vascular Surgery
- Admitting Physician

Disposition and Treatment Plan
We've found some clogs in your lungs...

Health Update for the Little Old Lady Who Lives in a Shoe