Venous Thromboembolism Diagnosis and Treatment – Adult – Inpatient/Ambulatory/Emergency Department Clinical Practice Guideline

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Pharmacy & Therapeutics Committee (Last Periodic Review: 07/21/2016)
Pharmacy & Therapeutics Committee (Interim Review: 3/16/2017)

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Executive Summary
Guideline Overview
This guideline provides recommendations and guidance for the diagnosis and treatment of venous thromboembolism (VTE) in the inpatient, ambulatory and emergency department/urgent care settings.

Key Practice Recommendations
Treatment of venous thromboembolism (VTE) can be done with a variety of modalities including; anticoagulants, thrombolysis, surgical interventions or a combination of these treatment options. While there are a variety of options available there is limited data that directly compares the outcomes for these therapies. The selection of treatment options should be directed based on severity of clot burden and patient specific factors.

Companion Documents
Hyperlink any companion documents (algorithms, tables, forms, etc.) here.
1. Diagnostic algorithm for DVT
2. Diagnostic algorithm for PE
3. Treatment algorithm for PE
4. Pulmonary embolism severity index scoring table
5. Anticoagulation treatment algorithm
6. Warfarin Management - CPG - Adult - Ambulatory
7. Warfarin Management - CPG - Adult - Inpatient
8. Therapeutic Dosing of Unfractionated Heparin - CPG - Adult

Scope
Disease/Condition(s): VTE which most commonly consists of deep vein thrombosis (DVT) and pulmonary embolism (PE), but may also include other types of thrombosis.

Clinical Specialty: Primary Care Providers, Emergency Department Providers, Urgent Care Providers, Hospitalists, Cardiology, Surgical Specialities, Nursing, and Pharmacy

Intended Users: Physicians, Advanced Practice Providers, Nurses, and Pharmacists.

Objective(s): To assist clinicians in the diagnosis and treatment of venous thromboembolism

Target Population: Adult patients diagnosed with VTE in the ambulatory, inpatient, and/or emergency department/urgent care setting.

Interventions and Practices Considered: This guideline contains recommendations designed to assist clinicians in the diagnosis and treatment of patients with VTE:
- Utilization of probability score for diagnosis
- Diagnosis algorithms for DVT and PE
- Utilizing severity scores for outpatient treatment
- Selection of therapeutic treatment options based on patient specific risk factors

Major Outcomes Considered: Specific outcomes/performance measures considered for this guideline will include:
- Evaluation of treatment setting for VTE (i.e. inpatient, outpatient)
- Evaluation of treatment selection for VTE (i.e. anticoagulation, interventional procedure)
- Number of readmissions or complications post VTE Treatment
**Methodology**

**Methods Used to Collect/Select the Evidence:**
Electronic database searches (e.g., PUBMED) were conducted by the guideline author(s) and workgroup members to collect evidence for review. Expert opinion and clinical experience were also considered during discussions of the evidence.

**Methods Used to Formulate the Recommendations:**
The workgroup members agreed to adopt recommendations developed by external organizations and/or arrived at a consensus through discussion of the literature and expert experience. All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees (as appropriate).

**Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:**
Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see Figure 1 in Appendix A).

**Rating Scheme for the Strength of the Evidence/Recommendations:**
See Appendix A for the rating scheme(s) used within this document.
**Introduction**

Treatment of venous thromboembolism (VTE), which includes pulmonary embolism (PE) and deep vein thrombosis (DVT), can be done with a variety of modalities including; anticoagulants, thrombolysis, surgical interventions or a combination of these treatment options.\(^1\,^2\) While there are a variety of options available for VTE treatment there is limited data that directly compares the outcomes for these therapies. The selection of treatment options should be directed based on severity of clot burden and patient specific factors.\(^1\) This guideline is intended to provide recommendations for diagnosis of VTE, selection of therapy and length of therapy.

**Recommendations**

**Diagnosis of VTE**

1. The diagnosis of VTE should be based on both clinical findings and diagnostic testing.\(^1\,^3\,^4\) *(UW Health GRADE High quality evidence, strong recommendation)* Clinical presentation for both PE and DVT are listed in Table 2.

<table>
<thead>
<tr>
<th>DVT (uni-lateral)</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swelling</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Pain or tenderness</td>
<td>Pleuritic chest pain</td>
</tr>
<tr>
<td>Redness</td>
<td>Accelerated heart rate</td>
</tr>
<tr>
<td>Warmth</td>
<td>Temperature (low grade)</td>
</tr>
</tbody>
</table>

2. In addition to symptoms, clinical probability scores and algorithms can identify patients who need further diagnostic testing to confirm the diagnosis of VTE\(^1\,^3\,^4\) *(UW Health GRADE High quality evidence, strong recommendation)*

2.1 The Wells Prediction Score is one of the most widely used scoring tools for determining probability of DVT (Table 3) or PE (Table 4). Risk factors are given points which are additive\(^3\,^4\).

**Table 3 Wells score for predicting the probability of DVT – adapted\(^3\)**

<table>
<thead>
<tr>
<th>Risk Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent treatment for cancer: (within previous 6 months) or palliative</td>
<td>1</td>
</tr>
<tr>
<td>Calf swelling: (≥ 3 cm compared to asymptomatic calf)</td>
<td>1</td>
</tr>
<tr>
<td>Swollen superficial veins in symptomatic leg: (unilateral)</td>
<td>1</td>
</tr>
<tr>
<td>Pitting edema in symptomatic leg (unilateral)</td>
<td>1</td>
</tr>
<tr>
<td>History of DVT</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swelling</td>
<td>1</td>
</tr>
<tr>
<td>Localized pain/tenderness</td>
<td>1</td>
</tr>
<tr>
<td>Recent surgery in previous 12 weeks or bedridden for ≥ 3 days</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis or recent casting of lower extremities</td>
<td>1</td>
</tr>
<tr>
<td>Alternative diagnosis more probable than DVT: Baker’s cyst, cellulitis, superficial venous thrombosis, post phlebetic syndrome or lymphadenopathy</td>
<td>-2</td>
</tr>
</tbody>
</table>

Score < 1: low probability and unlikely DVT  
Score 1-2: moderate probability  
Score >2: high probability
Table 4 Wells score for predicting the probability of PE – adapted

<table>
<thead>
<tr>
<th>Risk Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs and/or symptoms of DVT</td>
<td>3</td>
</tr>
<tr>
<td>PE most likely diagnosis</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate &gt; 100 BPM</td>
<td>1.5</td>
</tr>
<tr>
<td>Recent surgery (previous 4 weeks) or immobilization (&gt;3 days)</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous history of VTE</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1</td>
</tr>
<tr>
<td>Recent treatment for cancer (within previous 6 months) or palliative</td>
<td>1</td>
</tr>
</tbody>
</table>

Score < 2: low probability
Score 2-6: moderate probability
Score > 6: high probability

2.2 For additional assistance to further rule out PE is the pulmonary embolism rule-out criterion (PERC). PERC is a decision support tool to assist with the decision for further diagnostic testing in patients with low clinical suspicion for PE.5-8 PERC criteria is listed in Table 5. Any answer of “Yes” warrants further diagnostic testing.

Table 5. Pulmonary embolism rule-out criteria (PERC) score – adapted

<table>
<thead>
<tr>
<th>PERC Criteria</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 49 years</td>
<td></td>
</tr>
<tr>
<td>HR &gt; 99 BMP</td>
<td></td>
</tr>
<tr>
<td>Pulse Oximetry &lt; 95% on room air</td>
<td></td>
</tr>
<tr>
<td>Hemoptysis present</td>
<td></td>
</tr>
<tr>
<td>Taking exogenous estrogen</td>
<td></td>
</tr>
<tr>
<td>History of VTE</td>
<td></td>
</tr>
<tr>
<td>Recent surgery or trauma (requiring intubation or hospitalization in previous 4 weeks)</td>
<td></td>
</tr>
<tr>
<td>Unilateral leg swelling</td>
<td></td>
</tr>
</tbody>
</table>

If “yes” to any of the above question than further diagnostic testing required

2.3 PERC has been studied for its ability to identify low risk VTE patients. Identifying low risk VTE patients using both clinical gestalt and a PERC negative score have demonstrated a false negative rate of 1-2.4%.5-8

3. Diagnostic algorithms for DVT and PE assist with standardizing the diagnostic approach using a combination of clinical presentation, probability scoring and laboratory testing1. (UW Health Moderate quality evidence, strong recommendation)

3.1 For patients over 50 years old with a low/moderate probability of PE, an age-adjusted D-dimer cutoff may be used to rule out PE instead of the usual 500 µg/L cutoff.9-15 (UW Health Moderate quality evidence, weak/conditional recommendation)

- Adjusted D-dimer cutoff (µg/L) = Age (years) × 10
- This approach was found to appropriately rule out PE in more patients, particularly in those over 75 years old and including those with cancer.9-12,15
- False negative rate of 0-1.16%
3.2 Figure 2 outlines the diagnostic algorithm for DVT and Figure 3 outlines the diagnostic algorithm for PE.

Figure 2. Diagnostic algorithm for DVT

- Patient presents with suspected LE DVT
- Assess clinical risk/probability for LE DVT
- Calculate Wells Clinical Risk Score
- Clinical risk score interpretation:
  - 3 points: High probability (75%)
  - 1-2 points: Moderate probability (17%)
  - < 1 point: Low probability (3%)
- Low Clinical Probability
  - D-Dimer Positive
    - DVT Excluded
    - Perform DUS
  - D-Dimer Negative
    - DVT Diagnosed
- Moderate* or High Clinical Probability
  - D-Dimer Negative
    - DUS Negative
    - DVT Excluded
    - Perform DUS
  - DUS Positive
    - DVT Diagnosed

*Moderate Clinical Probability*: if DUS not readily available, a D-Dimer can be used to help rule out a DVT. If D-Dimer negative then DVT excluded. If D-Dimer positive then send for DUS.
Figure 3. Diagnostic algorithm for PE

Patient presents with suspected PE

Assess clinical risk/probability for PE

Calculate Well’s Clinical Risk Score

Clinical risk score interpretation
7-2 points: High probability (78%)
2-6 points: Moderate probability (28%)
≤ 1 point: Low probability (3%)

Low Clinical Probability

Moderate Clinical Probability

High Clinical Probability

PERC Criteria

D-Dimer *

Perform CT

PE Excluded

CT Normal or Non-Diagnostic

Repeat US in 1-2 weeks

Bilateral US of leg

PE Diagnosed

* D-Dimer: If patient is <50 (years) with D-Dimer >500 µg/L, perform CT. If patient is ≥50 (years), an age-adjusted D-Dimer cutoff is appropriate to use. If D-Dimer is < age-adjusted D-Dimer cutoff, PE Excluded. If D-Dimer is > age-adjusted D-Dimer cutoff, perform CT.

Age-adjusted D-Dimer Cutoff = Age (years) x 10
Treatment of VTE

When diagnosis of VTE has been confirmed treatment must be selected. There are many options available in addition to anticoagulation treatment including; surgical intervention, thrombolytic intervention or mechanical intervention. Considerations for each option should be weighed based on the severity of the clot, presentation of the patient and patient specific risk factors to select the best treatment for the patient.

4. Treatment algorithms can assist with identifying optimal strategies for treating VTE.1,2 (UW Health Moderate quality of evidence, weak/conditional recommendation) Figure 4 outlines the treatment algorithm for PE

Treatment Settings

The majority of patients with DVT and low risk PE can be successfully treated in the outpatient setting. Outpatient management of acute DVT has not been associated with increased mortality, recurrent VTE or increases in major bleeding events and generally has been accepted as a standard of care.1,2 Outpatient management of PE, while not as well documented, has started gaining favor in the medical community. Two randomized trials and several observational studies have suggested that management of acute PE, in low risk patients, in the ambulatory setting did not increase mortality, recurrent VTE or major bleeding events.17-21.

5. Eligibility criteria for outpatient VTE management2,17-23 (UW Health Moderate quality evidence, strong recommendation)

5.1 ≥ 18 years of age
5.2 Diagnosis of acute pulmonary embolism or deep vein thrombosis
5.3 Able and willing to comply with home care
5.4 Able to obtain necessary medications

If yes to all in section 5:
- For pulmonary embolism start at section 6.
- For deep vein thrombosis start at section 7.
6. If the patient meets the eligibility criteria, calculate either the Pulmonary Embolism Severity Index (PESI) score as described in Table 6 or the simplified PESI score as described in Table 7.\textsuperscript{22-26} (UW Health Moderate quality evidence, strong recommendation) The sPESI score has been shown to have similar sensitivity and negative predictive values as the PESI score. sPESI has an increased likelihood to over classify low risk patients as high risk patients.\textsuperscript{24-26}

Table 6. Pulmonary Embolism Severity Index Scoring Tool\textsuperscript{22,23}

<table>
<thead>
<tr>
<th>Age</th>
<th>1 per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>+ 10</td>
</tr>
<tr>
<td>Recent history of malignancy*</td>
<td>+ 30</td>
</tr>
<tr>
<td>Any history of Heart Failure</td>
<td>+ 10</td>
</tr>
<tr>
<td>Any history of Chronic Lung Disease</td>
<td>+ 10</td>
</tr>
<tr>
<td>HR &gt; 110</td>
<td>+ 20</td>
</tr>
<tr>
<td>SBP &lt; 100</td>
<td>+ 30</td>
</tr>
<tr>
<td>Temp &lt; 36°C</td>
<td>+ 20</td>
</tr>
<tr>
<td>RR &gt; 29</td>
<td>+ 20</td>
</tr>
<tr>
<td>Oxygen sat &lt; 90%</td>
<td>+ 20</td>
</tr>
<tr>
<td>Altered Mental Status</td>
<td>+ 60</td>
</tr>
</tbody>
</table>

* Any diagnosis of cancer other than basal-cell or squamous-cell carcinoma of the skin, within the prior 6 months, any treatment for cancer in the previous 6 months, or recurrent or metastatic cancer\textsuperscript{22}

6.1 If PESI score is ≥ 86, hospitalize the patient\textsuperscript{22,23} (UW Health Moderate quality evidence, strong recommendation)

6.2 If PESI score is ≤ 85, continue to additional exclusion criteria (section 7)\textsuperscript{22,23} (UW Health Moderate quality evidence, strong recommendation)

Table 7. Simplified Pulmonary Embolism Severity Index Scoring Tool\textsuperscript{24,26}

| Age > 80 years | + 1 |
| Chronic Cardiopulmonary Disease (heart failure or chronic lung disease) | + 1 |
| HR > 110 | + 1 |
| SBP < 100 | + 1 |
| Oxygen sat < 90% | + 1 |

6.3 If sPESI score ≥ 1, the patient is high risk, hospitalization is recommended\textsuperscript{24,26} (UW Health Moderate quality evidence, strong recommendation)

6.4 If sPESI score = 0, the patient is low risk. Continue to additional exclusion criteria\textsuperscript{24,26} (section 7) (UW Health Moderate quality evidence, strong recommendation)
7. Additional exclusion criteria\textsuperscript{2,22,23} (UW Health moderate quality evidence, weak/conditional recommendation)

For both PE and DVT
7.1 Requires admission for reasons other than acute PE/DVT
7.2 Not appropriate for long term anticoagulation (unreliable, or unable to comply with follow up)
7.3 Any stroke in the last 6 weeks
7.4 Brain, spinal, or ophthalmic surgery (excludes cataract) in the last 6 weeks
7.5 Non-cutaneous surgery in the last 2 weeks
7.6 GI bleed in the last 2 weeks
7.7 Active major bleeding
7.8 Therapeutic anticoagulation at the time of diagnosis (e.g. INR ≥ 2)
7.9 Thrombocytopenia (Plt< 75,000 K/uL)
7.10 Bleeding disorder (e.g. Von Willebrand Disease)
7.11 Creatinine clearance ≤ 30 mL/min
7.12 Treated with thrombolytics in the ED
7.13 Pregnant (verified by positive pregnancy test in woman of childbearing age)
7.14 > 150 kg

For PE Only
7.15 Intracardiac or central vein thrombus
7.16 Central PE (main pulmonary artery)
7.17 Hypoxia (< 90% at any time in the ED)
7.18 Hypotension (SBP < 100mmHg at any time in the ED)
7.19 Evidence of RV strain on ECHO or CT (if obtained)
7.20 Elevated biomarkers (i.e. troponin, BNP)

For DVT Only
7.21 Impending gangrene due to venous thrombosis

8. If no to all exclusion criteria, then the patient may be managed with anticoagulant therapy in the outpatient setting with proper home instructions. See section: Anticoagulation treatment options. (UW Health Moderate quality evidence, weak/conditional recommendation)

Anticoagulation Treatment Options:

Therapeutic anticoagulation should be initiated as soon as possible.\textsuperscript{1,2} Patient specific factors should be considered when selecting an anticoagulant, as well as the treatment setting (inpatient versus outpatient). Benefits and risks of therapy options should be discussed with the patient, being sure to incorporate their priorities in the decision making process.\textsuperscript{1}

The direct oral anticoagulants (apixaban, dabigatran, edoxaban and rivaroxaban) are now considered the preferred agents for treatment of uncomplicated VTE not caused by cancer.\textsuperscript{1,2} Dose adjusted vitamin K antagonist (i.e. warfarin), low molecular weight heparin (LMWH) and unfractionated heparin (UFH) remain therapeutic options and may be preferred in specific clinical scenarios.\textsuperscript{1,2} Therapeutic options and special considerations for use are provided below. An algorithm for selecting therapy is provided in Figure 5.
9. Direct Oral Anticoagulants (DOACs)

Each DOAC has data to support the use in VTE compared to traditional treatment (i.e., warfarin and LMWH). There is no published data comparing DOACs to one another.\(^\text{27-30}\) Each provides standardized dosing, quick onset of action (2-4 hrs), no monitoring of anticoagulation status, minimal lab monitoring, and minimal food and drug interactions. DOACs may interact with P-gp inducers and inhibitors and/or CYP 3A4 inducers or inhibitors. Refer to the drug interaction profile for the specific DOAC when prescribing.\(^\text{31-34}\) When selecting a DOAC consider patient specific risk factors (highlighted in Table 8) as well as cost to the patient.\(^\text{35}\)

9.1 DOACs are the preferred treatment option for uncomplicated VTE not caused by cancer.\(^\text{(CHEST Grade 1B)}\)

9.2 There is no indication for overlap of parenteral anticoagulation with LMWH or UFH\(^\text{35}\)\(^\text{(UW Health low quality of evidence, strong recommendation)}\)

9.3 If using dabigatran or edoxaban for VTE treatment, use of UFH or LMWH for 5-10 days before switching to oral agent is recommended.\(^\text{31,34}\)\(^\text{(UW Health low quality of evidence, weak/conditional recommendation)}\)

<table>
<thead>
<tr>
<th>DOAC</th>
<th>Parenteral Lead-In</th>
<th>Dose</th>
<th>Dose Adjustments</th>
<th>Avoid Use When:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apixaban</td>
<td>No</td>
<td>10 mg BID x 7 days then 5 mg BID</td>
<td>None</td>
<td>CrCl &lt; 25 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 6 months consider 2.5 mg BID for extended therapy</td>
<td></td>
<td>Aspirin doses &gt; 162 mg/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Severe liver disease (Child-Pugh C)</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>Yes</td>
<td>150 mg BID</td>
<td>None</td>
<td>CrCl &lt; 30 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LMWH 5-10 days prior</td>
<td></td>
<td>ALT 2x upper limit of normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Used with any P-gp inhibitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CrCl &lt; 50 mL/min and any P-gp inhibitor</td>
</tr>
<tr>
<td>Edoxaban (non-formulary inpatient)</td>
<td>Yes</td>
<td>60 mg daily</td>
<td>&lt; 60 kg: 30 mg daily</td>
<td>CrCl &lt; 15 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Use with any P-gp inhibitor: 30 mg daily</td>
<td>Moderate to severe liver disease (Child-Pugh B or C)</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>No</td>
<td>15 mg BID x 21 days then 20 mg daily</td>
<td></td>
<td>CrCl &lt; 30 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ALT 3X upper limit of normal or Child-Pugh B or C</td>
</tr>
</tbody>
</table>

9.4 Use caution with all DOACs in the setting of dual or triple antithrombotic therapy as bleeding risks may be increased.\(^\text{31-35}\)\(^\text{(UW Health low quality of evidence, weak/conditional recommendation)}\)
9.5 DOACs should not be used in the following conditions as they either are contraindicated or have not been adequately studied. An alternative anticoagulant should be utilized for:\(^{27-35}\) (UW Health low quality of evidence, weak/conditional recommendation)
- Prosthetic heart valves or significant valvular disease
- Pediatric patients (age < 18 years)
- Pregnant or lactating

10. Warfarin
10.1 Preferred oral anticoagulant option for patients who are not candidates for DOAC therapy (CHEST Grade 2C).
10.2 Due to delayed onset of action, overlap of parenteral anticoagulation with either LMWH or UFH should occur for at least 5 days AND until the INR ≥ 2 of two consecutive INRs.\(^{1,2,36-39}\) (UW Health High quality evidence, strong recommendation)
10.3 Warfarin should be started on the same day as parenteral anticoagulation.\(^{36-38}\) (CHEST Grade 1B)
10.4 A baseline INR should be resulted prior to initiating warfarin therapy (UW Health Very Low quality evidence, strong recommendation)

Table 9 provides initial dosing recommendations for warfarin, however, more information can be found:
Warfarin Management - CPG - Adult - Ambulatory
Warfarin Management - CPG - Adult - Inpatient

### Table 9. Warfarin dosing recommendations for VTE treatment\(^{36-38}\)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy individuals with no other reason for hospitalization or expected rapid INR response</td>
<td>Warfarin 10 mg x 2 doses then 5 mg daily for 1-2 days then based on INR</td>
</tr>
<tr>
<td>All other newly diagnosed VTE patients</td>
<td>Warfarin 2.5 - 5 mg PO daily for 3-4 days then based on INR</td>
</tr>
<tr>
<td>Start at lower dose (2.5 mg) if multiple risk factors for warfarin sensitivity exits:</td>
<td></td>
</tr>
<tr>
<td>• Baseline INR &gt; 1.5</td>
<td>• Chronic diarrhea</td>
</tr>
<tr>
<td>• Actual body weight (ABW) &lt; 45 kg</td>
<td>• Alcohol abuse history</td>
</tr>
<tr>
<td>• Significant drug interactions</td>
<td>• Decompensated heart failure</td>
</tr>
<tr>
<td>• Current antiplatelet therapy</td>
<td>• Malnourished or NPO &gt; 3 days</td>
</tr>
</tbody>
</table>

10.6 Prior to discharge from the emergency department, urgent care or hospital setting a follow up care plan that includes contact with the provider or clinic who will manage warfarin, plan for a follow up INR within 3-4 days of discharge, and education on compliance, dietary advice, follow up monitoring and drug interactions and adverse drug reactions must be provided to the patient and/or caregiver prior to ED discharge.\(^{36-38}\) (UW Health Low quality evidence, strong recommendation)

10.7 If outpatient INR monitoring cannot be established at the time of discharge then consider an alternative oral anticoagulant or parenteral anticoagulant. (UW Health Very Low quality evidence, weak/conditional recommendation)

11. Low Molecular Weight Heparin
11.1 Agent of choice for treatment of VTE in patients with cancer associated VTE, during pregnancy or for transitioning to warfarin.\(^{1,2,39}\) (CHEST Grade 2C)
11.2 Parenteral agent of choice for rapid therapeutic anticoagulation with an onset of action within 2 hours.1,2,39 (UW Health Low quality evidence, strong recommendation)

Dosing and special considerations are listed in Table 10.

Table 10 Enoxaparin dosing and special considerations for VTE treatment39,40

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoxaparin (CrCl &gt; 30 mL/min)</td>
<td>1 mg/kg subcutaneous every 12 hours</td>
</tr>
<tr>
<td>Enoxaparin (CrCl &lt; 30 mL/min) without renal replacement therapy</td>
<td>1 mg/kg subcutaneous every 24 hours</td>
</tr>
</tbody>
</table>

**Special considerations:**
- Dose based on actual body weight (no dose capping)
- Twice daily dosing is preferred
- Round to the nearest pre-filled syringe size

11.3 Routine anti-Xa monitoring is unnecessary for most patients as there is no evidence in the adult population to support this practice. (UW Health Very Low quality evidence, weak/conditional recommendation)

11.4 Anti-Xa monitoring may be considered in the following circumstances:39,41 (UW Health Very Low quality evidence, weak/conditional recommendation)
- Obesity (BMI > 40 kg/M²) within 48-96 hours of initiation
- CrCl < 30 mL/min after administration of 7-10 doses
- Pregnancy after every 1-3 months of therapy

11.5 If anti-Xa monitoring is appropriate the level should be checked 4 hours after administration of the dose.40 (UW Health Low quality evidence, weak/conditional recommendation)
- Table 11 provides dose adjustment recommendations for twice daily therapeutic LMWH dosing based on data from pediatric patients
- For once daily therapeutic LMWH dosing the target anti-Xa level is 1-2 unit/mL.
- Doses should be rounded to nearest syringe size.

Table 11 LMWH dose adjustments for twice daily therapeutic dosing41

<table>
<thead>
<tr>
<th>Anti-Xa Level (units/ml)</th>
<th>Hold Next Dose</th>
<th>Dosage Change</th>
<th>Next Anti-Xa Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.35</td>
<td>No</td>
<td>Increase by 25%</td>
<td>4 h after next dose</td>
</tr>
<tr>
<td>0.35 - 0.49</td>
<td>No</td>
<td>Increase by 10%</td>
<td>4 h after next dose</td>
</tr>
<tr>
<td>0.50 - 1.10</td>
<td>No</td>
<td>No</td>
<td>If indicated</td>
</tr>
<tr>
<td>1.11 - 1.50</td>
<td>No</td>
<td>Decrease by 20%</td>
<td>4 h after next dose</td>
</tr>
<tr>
<td>1.51 - 2.00</td>
<td>anti-Xa before next dose if ≤ 0.5 unit/mL then give dose</td>
<td>Decrease by 30%</td>
<td>4 h after next dose</td>
</tr>
<tr>
<td>&gt; 2.01</td>
<td>Until anti-Xa &lt; 0.5 units/ml</td>
<td>Decrease by 40%</td>
<td>Every 12 h until anti-Xa &lt; 0.5 units/ml</td>
</tr>
</tbody>
</table>
11.6 Patients at risk for rectus sheath hematoma should discuss the risks versus benefit of using LMWH. Risk factors include:¹² *(UW Health Low quality evidence, weak/conditional recommendation)*

- Chronic kidney disease
- Concomitant antiplatelet therapy
- Concomitant immunosuppression therapies
- Concomitant steroids
- Cough
- Female
- Injection technique: too close to the belly button
- Pregnancy
- Recent abdominal surgery
- Recent trauma

12. Unfractionated Heparin³⁹

12.1 Parenteral agent of choice for patients with renal dysfunction, on renal replacement therapy or when an anticoagulant with a shorter duration of action is needed (i.e. prior to surgical procedure). *(UW Health Very Low quality evidence, weak/conditional recommendation)*

12.2 Routine monitoring is not needed for subcutaneous administration.³⁹ *(UW Health Very Low quality evidence, weak/conditional recommendation)*

Dosing and special considerations are listed in Table 12, however more information can be found: *Therapeutic Dosing of Unfractionated Heparin - CPG - Adult*

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfractionated Heparin</td>
<td>Bolus: 80 units/kg</td>
</tr>
<tr>
<td><em>(Intravenous)</em></td>
<td>Infusion rate: 18 units/kg/hr</td>
</tr>
<tr>
<td>Unfractionated Heparin</td>
<td>Bolus: 333 units/kg</td>
</tr>
<tr>
<td><em>(Subcutaneous)</em></td>
<td>Maintenance dose: 250 units/kg every 12 hours</td>
</tr>
</tbody>
</table>

**Special considerations:**

- Dose based on actual body weight
- Anticoagulation occurs within 18-24 hours (IV administration)
- Requires frequent monitoring to ensure therapeutic levels
- Subcutaneous administration requires patient education for both preparation and administration of dose
Figure 5. Anticoagulation Therapy Algorithm for Inpatient and Ambulatory Settings

**INPATIENT ONLY**
Surgery anticipated in 24 hrs
Unstable renal function
Hemodialysis
High bleeding risk (recent surgery, trauma, hepatic dysfunction)
Mechanical valve (during admission)

Yes → UFH & Plan for long term anticoagulation
No → Active cancer

Yes → LMWH Only
No → Mechanical heart valve
Significant valvular disease
Antiphospholipid syndrome
Breastfeeding

Yes → LMWH and Warfarin
No → History of GI bleed

Yes → Apixaban or Edoxaban*
No → Apixaban

Dabigatran*
Edoxaban*
Rivaroxaban

*Recommend UFH or LMWH alone 5-10 days before switching to oral agent
**Thrombolytic Therapy Options:**

In a hemodynamically unstable patient with PE and significant right ventricular dysfunction, removal of the PE can improve respiratory and cardiovascular function, reduce symptoms of PE and improve survival. These, along with reducing the incidence of recurrent PE, preventing chronic thromboembolism pulmonary hypertension and improving quality of life are the main goals of thrombolytic therapy.

An acute DVT in the iliac and common femoral veins have a higher risk for developing post-thrombotic syndrome (PTS). Removal of the DVT may reduce the risk of PTS and symptoms of DVT. Additionally, in patients with limb-threatening circulatory compromise, thrombolytics can save a limb or organ and improve quality of life.

However, thrombolytic strategies for removal of PE or DVT carry additional risks that must be considered (i.e. bleeding). Table 13 lists both absolute and relative contraindications to thrombolytic therapy. Strategies for thromboembolism removal may include systemic thrombolysis or catheter-directed thrombolysis.

### Table 13 Contraindications to thrombolytic therapy

<table>
<thead>
<tr>
<th>Absolute Contraindication</th>
<th>Relative Contraindication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior hemorrhagic CVA</td>
<td>Blood pressure &gt; 180/110 mmHg</td>
</tr>
<tr>
<td>Any cerebrovascular event &lt; 1 year</td>
<td>Use of anticoagulants</td>
</tr>
<tr>
<td>Active bleeding</td>
<td>Prolonged CPR &gt; 10 minutes</td>
</tr>
<tr>
<td>Suspected aortic dissection</td>
<td>Prior gastrointestinal hemorrhage</td>
</tr>
<tr>
<td>Known intracranial neoplasm, arteriovenous malformation or aneurysm</td>
<td>Pregnancy</td>
</tr>
</tbody>
</table>

13. Systemic thrombolysis

13.1 Systemic thrombolysis is indicated in massive PE with hypotension and right ventricular dysfunction. (CHEST Grade 2B)

13.2 It is not recommended for DVT as only partial efficacy was seen with increased bleeding when compared to anticoagulation alone. (UW Health High quality evidence, strong recommendation)

13.3 Systemic thrombolysis should be avoided in code situations where PE has not been confirmed. (UW Health Weak quality evidence, weak/conditional recommendation)

13.4 Systemic thrombolysis is associated with an increased risk for bleeding and intracranial hemorrhage when high doses are used. (e.g. alteplase 100 mg). (UW Health High quality evidence, strong recommendation)

To reduce bleeding risks low dose thrombolysis is preferred (e.g. alteplase 50 mg). (UW Health moderate quality evidence, weak/conditional recommendation)

13.5 If a low dose is utilized and the patient condition does not improve or worsens a second low dose (to equal a full 100 mg of TPA) may be considered (UW Health low quality evidence, weak/conditional recommendation)
Table 14 Alteplase and heparin dosing strategies for PE (UW Health moderate quality evidence, weak/conditional recommendation)

<table>
<thead>
<tr>
<th>Dose</th>
<th>Alteplase Dose</th>
<th>Heparin Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Dose (preferred)</td>
<td>10 mg IV bolus, 40 mg IV infusion over 2 hours</td>
<td>70 unit/kg (max = 6000 units) bolus, 10 unit/kg/hr (max 1000 unit/hr) – no titration, 3 hours after alteplase completed then increase infusion rate to 18 unit/kg/hr and titrate with rapid nomogram</td>
</tr>
<tr>
<td>High Dose</td>
<td>10 mg IV bolus, 90 mg IV infusion over 2 hours</td>
<td>No bolus, 10 unit/kg/hr (max 1000 unit/hr) – no titration, 3 hours after alteplase completed then increase infusion rate to 18 unit/kg/hr and titrate with rapid nomogram</td>
</tr>
<tr>
<td>Code Dose</td>
<td>50 mg IV bolus given over 1 min</td>
<td></td>
</tr>
</tbody>
</table>

14. Catheter-Directed Thrombolysis (CDT)

CDT utilizes targeted therapy at the site of the thrombus. CDT has a benefit of utilizing lower doses of thrombolytics and lower incidence of intracranial hemorrhage than systemic thrombolysis. However, there are no randomized trials comparing outcomes with CDT versus systemic thrombolysis.

14.1 CDT may be considered for massive PE with hypotension and right ventricular dysfunction or in sub-massive PE with right ventricular dysfunction. (UW Health Moderate quality evidence, weak/conditional recommendation)

14.2 CDT may be considered for acute proximal DVT involving the iliac or common femoral vein at high risk for post thrombotic complications, or for limb threatening thrombosis if at low risk for bleeding. (UW Health Moderate quality evidence, weak/conditional recommendation)

14.3 Initiate UFH infusion prior to or during CDT procedure at the gradual intensity with no initial bolus. (UW Health Moderate quality evidence, weak/conditional recommendation)

14.4 After the alteplase infusion is complete and when the bleeding risk normalizes, transition the patient to a long term anticoagulation plan. (UW Health Moderate quality evidence, weak/conditional recommendation)

Non-pharmacologic Interventions

15. Surgical Intervention

15.1 Cardiac surgical consultation for emergent pulmonary embolectomy can be considered in the setting of significant hemodynamic instability with main or branch pulmonary arterial embolus. (UW Health Very Low quality evidence, weak/conditional recommendation)

15.2 May also consider surgical intervention with evidence of arterial embolism suggesting a patent foramen ovale (PFO) or with evidence of right heart dysfunction or strain on echocardiogram. (UW Health Very Low quality evidence, weak/conditional recommendation)

15.3 Therapeutic anticoagulation should be initiated as soon as adequate hemostasis is achieved. (UW Health Very Low quality evidence, weak/conditional recommendation)
16. Percutaneous Mechanical Intervention
16.1 Percutaneous mechanical intervention (i.e. AngioVac) may be considered if patient is not a surgical candidate and contraindications to thrombolitics exist. \(^5^6\) \((UW\ Health\ Very\ Low\ quality\ evidence,\ weak/conditional\ recommendation)\)
16.2 Initiate UFH infusion prior to or during procedure at the gradual intensity with no initial bolus. \((UW\ Health\ Moderate\ quality\ evidence,\ weak/conditional\ recommendation)\)

17. Inferior Vena Cava (IVC) Filter
17.1 IVC filters may be considered in patients with acute VTE (within 4 weeks) who have contraindications to therapeutic anticoagulation\(^1^,^9\) \((UW\ Health\ Low\ quality\ evidence,\ weak/conditional\ recommendation)\) Indications for IVC filters are provided in Table 15

<table>
<thead>
<tr>
<th>Approved Indications</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraindication to anticoagulation</td>
<td>Active bleeding</td>
</tr>
<tr>
<td></td>
<td>Acute stroke</td>
</tr>
<tr>
<td></td>
<td>Thrombocytopenia (platelet &lt; 50)</td>
</tr>
<tr>
<td>Failure or complication from anticoagulation</td>
<td>Recurrent VTE while anticoagulated</td>
</tr>
<tr>
<td></td>
<td>Bleeding while anticoagulated</td>
</tr>
<tr>
<td>Unable to achieve or maintain anticoagulation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative Indications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive PE with high fatality risk</td>
<td>Poor cardiopulmonary reserve</td>
</tr>
<tr>
<td></td>
<td>Underlying cardiopulmonary disease</td>
</tr>
<tr>
<td></td>
<td>Hemodynamically unstable</td>
</tr>
<tr>
<td>Massive PE treated with thrombolysis or thrombectomy</td>
<td></td>
</tr>
<tr>
<td>VTE prophylaxis</td>
<td>Trauma with contraindication to anticoagulation</td>
</tr>
<tr>
<td></td>
<td>Hip and knee replacement</td>
</tr>
<tr>
<td></td>
<td>Bariatric surgery</td>
</tr>
<tr>
<td></td>
<td>Neurosurgery</td>
</tr>
<tr>
<td></td>
<td>Thrombolysis</td>
</tr>
</tbody>
</table>

17.2 IVC filters do not treat VTE. Therapeutic anticoagulation should be initiated as soon as adequate hemostasis is achieved. \((UW\ Health\ Low\ quality\ evidence,\ weak/conditional\ recommendation)\)
17.3 IVC filters should be considered for removal when the risk for thrombosis or bleeding risk resolves and preferably within 6 months of placement. \(^1^,^9\) \((UW\ Health\ Low\ quality\ evidence,\ weak/conditional\ recommendation)\)

18. Venous Catheter Removal
18.1 In patients with catheter-associated thrombosis, routine catheter removal is not recommended. \(^2^,^5^7-^5^9\) \((UW\ Health\ Low\ quality\ evidence,\ weak/conditional\ recommendation)\)
18.2 Removal may be warranted under the following conditions:
   - Catheter malfunction
   - Catheter-associated infection
   - Contraindication to anticoagulation therapy
   - Persistent signs or symptoms of thrombosis despite anticoagulation therapy
• Catheter is no longer needed

18.3 If removal is warranted, the presence of thrombosis should not prevent catheter removal by authorized individual.

18.4 Refer to Policy #1.56 AP Central Vascular Access Device Use, Maintenance and Removal for who is authorized to remove catheters.

**Length of Anticoagulation Therapy**

19. For most VTE events treatment should continue for at least 3-6 months¹ ² (CHEST Grade 1B)

19.1 After 3-6 months of therapy a re-evaluation of VTE recurrence, bleeding risk, and patient preference should occur to determine if anticoagulation should continue or stop. (UW Health Low quality evidence, weak/conditional recommendation)

Table 16 lists recurrence rates for both provoked and unprovoked VTE.

<table>
<thead>
<tr>
<th>Type of VTE</th>
<th>Recurrence rates per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provoked (surgical)</td>
<td>0.7%</td>
</tr>
<tr>
<td>Provoked (non-surgical)</td>
<td>4%</td>
</tr>
<tr>
<td>Unprovoked</td>
<td>7%</td>
</tr>
</tbody>
</table>

13.3 For unprovoked VTE prediction tools have been used to identify lower risk women who may consider discontinuing anticoagulation. The HER DOO2 prediction tool was validated in a prospective multicenter study with a first provoked VTE.⁶² The HER DOO2 prediction tool is listed in Table 17. (UW Health High quality evidence, strong recommendation)

13.4 Men have been shown to be associated with higher recurrent VTE rates per year for unprovoked VTE than compared to women (13.7% versus 5.5%) and should consider indefinite anticoagulation.⁶² (UW Health High quality evidence, strong recommendation)

Table 17 HER DOO2 prediction tool⁶²

<table>
<thead>
<tr>
<th>Risk Variables</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 65 years</td>
<td>1</td>
</tr>
<tr>
<td>BMI &gt; 30 kg/M²</td>
<td>1</td>
</tr>
<tr>
<td>D Dimer &gt; 250 mcg/L (while on anticoagulation therapy)</td>
<td>1</td>
</tr>
<tr>
<td>Signs of post-thrombotic syndrome (hyperpigmentation, swelling or redness of the leg)</td>
<td>1</td>
</tr>
</tbody>
</table>

Score

<table>
<thead>
<tr>
<th>Score</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1: Low Risk</td>
<td>May consider discontinuing anticoagulation</td>
<td></td>
</tr>
<tr>
<td>&gt; 2: High Risk</td>
<td>Continue anticoagulation indefinitely</td>
<td></td>
</tr>
</tbody>
</table>

13.5 Additional risk factors for recurrent VTE are listed in Table 18

Table 18 Risk Factors for Recurrent VTE¹

<table>
<thead>
<tr>
<th>Non-Reversible Risk Factors</th>
<th>Reversible Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflammatory Bowel Disease</td>
<td>Hormone therapy</td>
</tr>
<tr>
<td>Antiphospholipid syndrome</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Male Gender</td>
<td>Post – partum (6-12 weeks)</td>
</tr>
<tr>
<td>Cancer</td>
<td>Obesity (BMI &gt; 30 kg/M²)</td>
</tr>
<tr>
<td>Abnormal D-Dimer (after 3 months of anticoagulant therapy)</td>
<td></td>
</tr>
</tbody>
</table>
20. Discharge considerations

20.1 If a patient is discharged on warfarin a follow-up care plan for monitoring the INR must be in place prior to discharge from inpatient, emergency department or urgent care setting. *(UW Health Low quality evidence, weak/conditional recommendation)*

20.1.1 Contact must be made with the patient’s primary care provider

20.1.2 If patient is discharged from the ED when the PCP clinic is closed, the ED case manager will contact the PCP on the following clinic day.

20.1.3 If outpatient INR monitoring cannot be established than an anticoagulant that does not require monitoring should be selected.

20.2 If an outpatient medication that can either increase bleeding or thrombotic risk is stopped, the prescribing provider will be notified of the change through either electronic medical record notification or through patient notification. *(UW Health Very Low quality evidence, weak/conditional recommendation)*

20.3 Follow up with a PCP should occur within 3-4 days of discharge. *(UW Health Low quality evidence, weak/conditional recommendation)*
UW Health Implementation

Potential Benefits:
Anticipated benefits associated with implementation and adherence to guidelines:
- Standardized approach to VTE management
- Avoid unnecessary admissions
- Increased patient satisfaction
- Cost avoidance (admissions, drug costs, lab costs)

Potential Harms:
Potential risks or adverse consequences associated with implementation and adherence to guidelines:
- Recurrent venous thromboembolism
- Patient non-adherence
- Possible higher readmission rate

Pertinent UW Health Policies & Procedures
1. None identified

Patient Resources
1. Health Facts For You #7522 – Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE) Treatment and Prevention
2. Health Facts For You #6915 – Heparin (Unfractionated and Low Molecular Weight Heparin)
3. Health Facts For You #6900 – Warfarin (Coumadin®, Jantoven®)

Guideline Metrics
Using a numbered list, describe metrics to assess compliance with the stated recommendations or to gauge improvement resulting from implementation of the guideline.
NOTE: All metrics required or reported externally should be included (consider guidance from QSI).
1. Guideline adherence
2. VTE Performance Measure – VTE 3 – VTE patients with anticoagulation overlap therapy
3. VTE Performance Measure – VTE 5 – VTE discharge instructions
4. Hospital Acquired Condition – VTE events
5. Patient Safety Indicator (PSI) 12 – Post Operative VTE
6. PERT Consortium Registry – Benchmarking
7. IVC Filter Registry

Implementation Plan/Clinical Tools
1. Guideline will be posted on uConnect in a dedicated location for Clinical Practice Guidelines and externally on the uwhealth.anticoagulation.org/anticoagulation webpage.
2. Release of the guideline will be advertised in the Physician/APP Briefing newsletter.
3. Content and hyperlinks within clinical tools, documents, or Health Link related to the guideline recommendations (such as the following) will be reviewed for consistency and modified as appropriate.
Delegation Protocols
Initiation and Management of Warfarin – Adult – Ambulatory [7]
Heparin Infusion Titration Practice Protocol – Adult – Inpatient [4]

Order Sets & Smart Sets
ED – VTE Outpatient Care Discharge Order Set [4781]
ED/IP – Heparin Anticoagulation – Adult – Supplemental Order Set [4373]
ED/IP – Pulmonary Embolism Thrombolytic Therapy – Adult – Supplement Order Set [6111]
ED/IP – Venous Thromboembolism Anticoagulation – Adult – Supplemental Order Set [6275]
IP – Warfarin Therapy – Adult – Supplemental Order Set [2441]
IP – Heart and Vascular Care Center – Deep Vein Thrombosis and Pulmonary Embolism –
Adult – Preprocedure Order Set [4744]

Disclaimer
Clinical practice guidelines assist clinicians by providing a framework for the evaluation and
treatment of patients. This guideline outlines the preferred approach for most patients. It is not
intended to replace a clinician’s judgment or to establish a protocol for all patients. It is
understood that some patients will not fit the clinical condition contemplated by a guideline and
that a guideline will rarely establish the only appropriate approach to a problem.
Appendix A. Evidence Grading Scheme(s)

Figure 1. GRADE Methodology adapted by UW Health

GRADE Ranking of Evidence

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>We are confident that the effect in the study reflects the actual effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.</td>
</tr>
<tr>
<td>Low</td>
<td>The true effect may differ significantly from the estimate.</td>
</tr>
<tr>
<td>Very Low</td>
<td>The true effect is likely to be substantially different from the estimated effect.</td>
</tr>
</tbody>
</table>

GRADE Ratings for Recommendations For or Against Practice

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.</td>
</tr>
<tr>
<td>Weak/conditional</td>
<td>Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.</td>
</tr>
</tbody>
</table>
Figure 4. Treatment algorithm for pulmonary embolism

**High-risk ( Massive) PE**
- Activate PERT
- Bleeding risk
  - High: Surgical, mechanical, catheter tx, or AC
  - Mod/Low: CDT or lysis

**Intermediate risk ( Sub-massive) PE**
- sPESI ≥ 1 AND Moderate or > RV systol AND ↑ (troponin or BNP)
- High-Int risk PE
- CDT or lysis
- Surgical, mechanical, catheter tx, or AC

**Low Int risk PE**
- Low-Int risk PE
- CDT or lysis
- If clinical decompensation
  - For patients without echocardiogram, consider other markers of RV strain such as T wave inversions on ECG, severity of RV dilatation on CT
  - *PE consult will result in an initial screen by primary clinician covering the pager. Full team activation will occur for massive and sub-massive PE*

**PE Consult\* (unless d/c from ED)**
- SBP < 90 for 15 min or requiring pressor
- LV:RV > 1.0 on CT, TTE with RV dil/dys, and/or ↑ troponin, ↑ BNP

**Low risk PE**
- Activate PERT
- No

**AC**
References


32. Xarelto [prescribing information]. Titusville, NJ: Janssen Pharmaceuticals, Inc.; 12/2014