This care process model (CPM) was created by the Intensive Medicine Clinical Program at Intermountain Healthcare. Groups represented on this team include Emergency Medicine, Thrombosis, Pulmonary/Critical Care, Pharmacy, Radiology, Medical Informatics, and others. This CPM provides expert advice for the management of VTE using current national practice guidelines, including those of the American College of Chest Physicians, the American College of Physicians, the American College of Emergency Physicians, the European Society of Cardiology, and the International Society on Thrombosis and Haemostasis.

Why Focus ON VTE?

- **Prevalence.** VTE is the third most common cause of cardiovascular death in the U.S., after heart attack and stroke. As many as two million people in the U.S. are diagnosed with DVT each year, and half a million or more are affected by PE. As many as one-fifth of PE cases are expected to be fatal, leading to 100,000 deaths each year.\(^{20}\)

- **Difficulty of management.** VTE symptoms are often nonspecific and can range from mild to life-threatening. Medications for VTE carry a risk of bleeding, and there are a large number of medications to choose from.

- **Cost.** Patients with suspected VTE often undergo unneeded imaging tests. These tests drive up healthcare costs and expose patients to unnecessary medical risk.

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**Program Goals and Measures**

- Increase the number of patients with suspected VTE who have a pre-test probability assessment and D-dimer test
- Reduce number of CT pulmonary angiograms for suspected PE
- Reduce the number of venous duplex ultrasounds for suspected DVT
- Reduce the rate of hospitalization of patients with low-risk PE
- Decrease the number of patients who receive an anticoagulant despite a contraindication

Throughout this CPM, this icon indicates an Intermountain measure
OVERVIEW

Venous thromboembolism (VTE) comprises several conditions including pulmonary embolism (PE), deep vein thrombosis (DVT), and superficial vein thrombosis (SVT). See sidebar at left for definitions, signs, and symptoms of each condition.

The appropriate diagnosis and treatment of VTE depends crucially on the location of the thrombus. This CPM covers the diagnosis and treatment of each condition in descending order of clinical severity.

Deep veins are divided into proximal and distal (as thrombi in these locations have different management strategies) as follows:
- Proximal: popliteal, femoral, deep femoral, common femoral, and iliac
- Distal: anterior tibial, posterior tibial, peroneal, gastrocnemius, and soleus (soleus sinus)
PULMONARY EMBOLISM (PE)

Diagnosis

PE can be a life threatening condition, yet approximately half of patients are asymptomatic. Appropriate diagnostic management is critical to patient outcomes.

Pre-test risk assessment

If the patient’s pre-test disease risk is low, there may not be a need to conduct imaging. The clinician should use the tools described below to determine whether or not the patient is low risk (see PE diagnosis algorithm on page 4).

PERC. Pulmonary Embolism Rule-out Criteria (PERC) should always be considered before performing imaging tests. The number of criteria met are totaled. If the patient meets none of the criteria, PE is ruled out with no further testing needed.

RGS. If the patient meets any PERC criteria, the Revised Geneva Score (RGS) is calculated, and the number is used to direct further testing.

D-dimer. The D-dimer product forms during the breakdown of blood clots. If very little D-dimer is present, VTE is unlikely. The D-dimer test has higher than 95% sensitivity and can decrease probability of PE to about 1% in patients with RGS < 3 and less than 5% in patients with RGS 4 – 10. However, elevated D-dimer is diagnostically nonspecific as small amounts of blood clot are formed and broken down in many disease states (e.g., recent major surgery and cancer). Skipping the test and proceeding as if the result were positive is recommended in these cases. In patients 50 years and older, age adjustment of the D-dimer threshold (to age x 10) preserves the negative predictive value but increases the number of patients who can avoid imaging.

Imaging

- CTPA (CT pulmonary angiography) is highly sensitive and specific and can yield information about alternative diagnoses. However, CTPA carries a number of significant risks, including:
  - Exposure to radiation. The radiation dose for CTPA ranges from 10 to 15 mSv on average, the equivalent of up to 150 chest x-rays.
  - Contrast-induced nephropathy may occur, particularly in patients with chronic kidney disease, which in severe cases can result in the need for dialysis. Contrast is also associated with anaphylaxis and local tissue injury due to extravasation.
  - Overdiagnosis of PE occurs when CTPA identifies small filling defects in subsegmental pulmonary arteries that are either false-positive findings or clinically benign thrombi that require no treatment. Overdiagnosis increases the number of patients who suffer complications from anticoagulant therapy with no corresponding decrease in the number of PE-related deaths.

- V/Q (ventilation/perfusion) scans provide a definitive diagnosis in approximately 75% of suspected cases of PE. Like CTPA, V/Q scans are sensitive, but they are less specific than CTPAs. Radiation exposure especially to the breast is significantly less with V/Q scans when compared with CTPAs.

Treatment

Most cases of PE are treated with anticoagulation. However, more severe cases may require an intervention to rapidly dissolve or remove existing clots to reduce the risk of death. The most mild form of PE is isolated subsegmental PE (ISSPE), which is isolated to the subsegmental branches (i.e., no segmental or more proximal PE present). ISSPE may not require any specific treatment.
ALGORITHM 1: PULMONARY EMBOLISM (PE) DIAGNOSIS

Non-pregnant* patient presents with suspected PE

CALCULATE PERC score (a)

> 0

= 0

CALCULATE RGS (b)

(0 – 10)

(≥ 11)

PE unlikely

PE likely

TEST D-dimer

Cutoff values:
  - Age ≤ 50: ≤ 500 ng/mL
  - Age 51 or older: ≤ [age X 10] ng/mL

D-dimer below cutoff value?

no

yes

EXCLUDE PE, and CONSIDER a different diagnosis

no

eGFR < 30 or contrast allergy?

yes

PERFORM CTPA

EXCLUDE PE, and CONSIDER a different diagnosis

PERFORM V/Q scan (c)

normal

high probability

ASSESS anticoagulation contraindications (d)

Is anticoagulation contraindicated?

no

yes

PROCEED to PE treatment algorithm (see page 6)

PROCEED to (IVC) filter placement algorithm (see page 18)

*For pregnant patients, see Intermountain’s Evaluation of Suspected Pulmonary Embolism in Pregnancy CPM

D-dimer below cutoff value?

EXCLUDE PE, and CONSIDER a different diagnosis
# Algorithm Notes

## (a) Pulmonary Embolism Rule-out Criteria (PERC)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Age &gt; 50 years</td>
<td>1</td>
</tr>
<tr>
<td>□ Hemoptysis</td>
<td>1</td>
</tr>
<tr>
<td>□ Oxygen saturation &lt; 93 %*</td>
<td>1</td>
</tr>
<tr>
<td>□ Either surgery or trauma requiring treatment with general anesthesia in the previous 4 weeks</td>
<td>1</td>
</tr>
<tr>
<td>□ Unilateral leg swelling</td>
<td>1</td>
</tr>
<tr>
<td>□ Previous PE or DVT</td>
<td>1</td>
</tr>
<tr>
<td>□ Estrogen use</td>
<td>1</td>
</tr>
<tr>
<td>□ Heart rate ≥ 100 beats/minute</td>
<td>1</td>
</tr>
<tr>
<td>□ Gestalt suspicion of PE ≥ 15 %</td>
<td>1</td>
</tr>
</tbody>
</table>

**ADD total points**

* Value adjusted from the original 95% based on Intermountain altitude adjustment tables.

## (b) Revised Geneva Score (RGS)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Age &gt; 65 years</td>
<td>1</td>
</tr>
<tr>
<td>□ Hemoptysis</td>
<td>2</td>
</tr>
<tr>
<td>□ Active malignant condition</td>
<td>2</td>
</tr>
<tr>
<td>□ Surgery or fracture within 1 month</td>
<td>2</td>
</tr>
<tr>
<td>□ Unilateral lower limb pain</td>
<td>3</td>
</tr>
<tr>
<td>□ Previous PE or DVT</td>
<td>3</td>
</tr>
<tr>
<td>□ Pain on lower-limb deep venous palpation and unilateral edema</td>
<td>4</td>
</tr>
<tr>
<td>□ Heart rate 75–94 beats/minute</td>
<td>3</td>
</tr>
<tr>
<td>□ Heart rate ≥ 95 beats/minute</td>
<td>5</td>
</tr>
</tbody>
</table>

**ADD total points**

## (c) Ventilation-perfusion (V/Q) scan

If V/Q scan result is indeterminate or non-diagnostic, PERFORM CTPA (if not contraindicated).

- **If CTPA is contraindicated**, PERFORM bilateral CUS and TREAT if DVT present.
- **If CUS is negative**, CONSIDER additional testing or thrombosis consult. Thrombosis consultant can be contacted at 801-408-5060.

If V/Q scan result is high probability, but the clinician suspects a false-positive result—such as in a patient with low pre-test probability—PERFORM CTPA if not contraindicated.

## (d) Anticoagulation contraindication assessment*

<table>
<thead>
<tr>
<th>ABSOLUTE contraindications</th>
<th>RELATIVE contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Current active bleeding</td>
<td>□ Intracranial or intraspinal tumor</td>
</tr>
<tr>
<td>□ Major surgery in the last 7 days</td>
<td>□ Aortic dissection</td>
</tr>
<tr>
<td>□ Intracranial hemorrhage in last 30 days</td>
<td>□ GI bleeding in the last 7 days</td>
</tr>
<tr>
<td>□ Platelet count &lt; 25,000</td>
<td>□ Platelet count &lt; 50,000</td>
</tr>
</tbody>
</table>

* Do NOT give anticoagulants if patient has ANY absolute contraindication(s). Anticoagulants are strongly discouraged in the presence of a relative contraindication, but the clinician must weigh the risks and benefits in each case.
Algorithm 2: Risk Stratification & Treatment of PE

Patient presents with confirmed PE

**CALCULATE PESI score (a)**

- **≥ 86**
- **< 86**

**ANY of the following met?**
- PE in main pulmonary artery
- RV:LV ratio ≥ 1.0 on CTPA
- SpO\(_2\) < 90
- Systolic blood pressure < 100

**ORDER lab tests**
- q15 min vital signs
- ECG
- Troponin I
- PT / PTT
- CBC
- BMP
- CONSIDER cardiac echo and lactate (e.g., if more proximal PE, abnormal vital signs, severe symptoms)

**ANY hemodynamic decompensation signs?**
- Systolic blood pressure < 90 mmHg for > 15 min
- Vasopressors required
- Respiratory distress

**Troponin I > 0.04 AND EITHER**
- CT RV:LV ratio ≥ 1.0
- echo RV dysfunction?

**CALCULATE PESI score (a)**

- **≥ 86**
- **< 86**

**TREAT for low-risk PE**
- CONSIDER outpatient therapy and GIVE enoxaparin or DOAC* if no contraindication (b)

*If bleeding risk is high, inpatient therapy is likely appropriate even for low-risk PE.

**TREAT for intermediate-to-high-risk PE**
- ADMIT to hospital ( telemetry or ICU)
- GIVE IV heparin, enoxaparin, or DOAC* if no contraindication (b)
- MONITOR for decompensation AND CHANGE TREATMENT as per high risk PE if ANY:
  - Systolic blood pressure < 90 mmHg for > 15 min
  - Vasopressors required
  - Respiratory distress
- CONSIDER tele-critical care consult

**TREAT for HIGH-risk PE**
- ADMIT to ICU
- GIVE IV heparin if no contraindication (b)
- GIVE interventional therapy (systemic thrombolysis or catheter-directed thrombolysis) after completing thrombolysis contraindication assessment (c)
  - CONSIDER embolectomy if ANY:
    - Thrombolitics contraindicated (c)
    - Unstable after thrombolysis
    - Thrombus-in-transit seen on imaging
  - CONSIDER tele-critical care consult

**PERFORM bilateral CUS of legs**

**DVT present?**

- **no**
- **yes**

**TREAT for low-risk PE**
- CONSIDER outpatient therapy and GIVE enoxaparin or DOAC* if no contraindication (b)

*If bleeding risk is high, inpatient therapy is likely appropriate even for low-risk PE.

**TREAT for low-risk PE**
- MONITOR in the hospital (ADMIT or CONTINUE observation)
- GIVE enoxaparin, DOAC, or IV heparin if no contraindication (b)
- CONSIDER early discharge

**TREAT for intermediate-to-high-risk PE**
- ADMIT to hospital (telemetry or ICU)
- GIVE IV heparin, enoxaparin, or DOAC* if no contraindication (b)
- MONITOR for decompensation AND CHANGE TREATMENT as per high risk PE if ANY:
  - Systolic blood pressure < 90 mmHg for > 15 min
  - Vasopressors required
  - Respiratory distress
- CONSIDER tele-critical care consult

**CONSIDER patient PE**

- Isolated sub-segmental PE (ISSPE)?

**no**

**yes**

**TREAT for low-risk PE**
- CONSIDER outpatient therapy and GIVE enoxaparin or DOAC* if no contraindication (b)

*If bleeding risk is high, inpatient therapy is likely appropriate even for low-risk PE.
## ALGORITHM NOTES

### (a) PESI score calculator

- **Factor**
  - Age in years
  - Male sex (+10)
  - Cancer (+30)
  - Heart failure (+10)
  - Chronic lung disease (+10)
  - Pulse ≥110 / min (+20)
  - Systolic blood pressure <100 mmHg (+30)
  - Respiratory rate ≥30 / min (+20)
  - Temperature < 36 °C (+20)
  - Altered mental status (+60)
  - Arterial oxygen saturation < 90% (+20)

**ADD total points**

### (b) Anticoagulation contraindication assessment*

**ABSOLUTE contraindications**
- Current active bleeding
- Major surgery in the last 7 days
- Intracranial hemorrhage in last 30 days
- Platelet count < 25,000

**RELATIVE contraindications**
- Intracranial or intraspinal tumor
- Aortic dissection
- GI bleeding in the last 7 days
- Platelet count < 50,000

*Do NOT give anticoagulants if patient has ANY absolute contraindication(s). Anticoagulants are strongly discouraged in the presence of a relative contraindication, but the clinician must weigh the risks and benefits in each case.

### (c) Thrombolytic contraindication assessment

**Contraindications (risk of bleeding is greater than the potential benefit)**
- Confirmed or suspected acute intracranial hemorrhage, subarachnoid hemorrhage, or major cerebral infarct
- Systolic blood pressure > 185 mmHg or diastolic blood pressure > 110 mmHg despite maximal treatment
- Platelet count < 100,000
- Known coagulopathy, including warfarin use with INR > 1.7
- Use of a thrombolytic agent in the last 4 days
- Pregnancy, lactation, or parturition within the last 30 days

**Warnings and precautions (use clinical judgment—benefits may merit the risk of thrombolysis*)**
- Recent surgery / major trauma (within prior 15 days)
- Recent active bleeding (within prior 22 days)
- Significant stroke or head trauma (within prior 3 months)
- Intracranial or spinal surgery (within prior 3 months)
- History of vascular malformation
- Any history of intracranial hemorrhage
- Any history of brain aneurysm or tumor

*The clinician must make an assessment tailored to each patient based on the above criteria.*
DEEP VEIN THROMBOSIS (DVT)

DVT usually affects large veins in the thighs and/or lower legs but can also occur in the pelvis or arms. The anatomical division of deep veins into proximal and distal is relevant for DVT management as thrombi in proximal veins are at higher risk for travelling to the lungs.

Diagnosis

Imaging with venous duplex ultrasound has become the reference standard for DVT diagnosis. However, DVT is confirmed in only about 10% of the patients in whom it is suspected. Therefore, an approach which combines pre-test probability assessment (see sidebar) and D-dimer, analogous to that used for PE, can be used both to rule out DVT in some cases and to reduce unnecessary ultrasound testing.

As a pre-test risk assessment, the two-level Wells score combines favorable diagnostic performance with relative simplicity. The simplified Wells Score is not sensitive or specific enough to definitively diagnose or exclude suspected DVT, but a Wells score of “DVT unlikely” (<2) can be combined with D-dimer testing to rule out DVT with a ~1% chance of missed DVT. This strategy avoids the need for imaging in more than one-third of suspected DVT cases.

Treatment

The prognosis and risk for complications from DVT vary widely depending upon the degree of thrombus burden and the proximal extent of thrombosis. Most DVT is treated with therapeutic anticoagulation, which prevents propagation and embolization of the existing thrombus and allows healing via the intrinsic thrombolytic system (see DVT treatment algorithm on page 11). Treatment considerations for specific types of DVT are as follows:

- **Isolated distal DVT (IDDVT)** confined to the calf veins (i.e., tibial, peroneal, gastrocnemius, or soleus) resolves without treatment in 80–90% of cases. Monitoring patients via serial ultrasounds is an alternative to initial anticoagulation. However, 10–20% of IDDVT propagate into proximal deep veins and require definitive treatment. Therefore, monitoring with serial CUS to exclude proximal propagation is necessary when therapeutic anticoagulation is not initiated.

- **Common femoral and iliac DVT**, in contrast, carry a high risk for the development of post-thrombotic syndrome (PTS). Interventional therapy with catheter-based techniques can be considered to hasten symptom relief and reduce the risk for PTS. Due to the increased bleeding risk and expense of these procedures, candidate patients should be carefully selected.

KEY RECOMMENDATIONS FOR DVT

- Use pre-test probability testing combined with D-dimer to rule out DVT and avoid unnecessary imaging.
- Monitor with serial CUS when anticoagulation is not initiated for isolated distal DVT (IDDVT).
- Carefully select patients with femoral and iliac DVT who are candidates for management with catheter-directed thrombolysis.
SUPERFICIAL VEIN THROMBOSIS (SVT)

Superficial vein thrombosis (SVT) is nearly as common as DVT (see page 8). Although historically considered a minor illness, SVT carries significant risks. Most importantly, it may lead to DVT by propagating through the two vein systems, especially at the junction between the greater saphenous and femoral veins near the groin.

**Diagnosis**

Diagnosis of SVT follows the same procedures as DVT. When a patient presents with symptoms of SVT, DVT is also present 25% of the time.

**Treatment**

Treatment of SVT differs from that for DVT, favoring more conservative measures in many cases, and requiring lower doses when anticoagulants are used. Treatment of SVT often includes:

- Local measures, such as warm compresses
- NSAIDs
- Low-dose anticoagulants in more severe cases

While anticoagulants are effective for the treatment of SVT, they are generally reserved for extensive and/or highly symptomatic cases of SVT due to their expense and potential complications. If NSAIDs are used, patients should be monitored for possible progressive disease.

KEY RECOMMENDATIONS FOR SVT

- SVT is common, carries significant risks, and can lead to DVT.
- Favor more conservative treatment measures unless SVT is extensive and/or patient is highly symptomatic.
- When using NSAIDs to treat SVT, monitor patient for possible progressive disease.
ALGORITHM 3: DVT DIAGNOSIS

Patient presents with suspected DVT

**TEST D-DIMER**  
(No age adjustment; negative (normal) is <500 ng/ml)

**Determine Wells score (a)**

- DVT unlikely <2
- DVT likely ≥2

**Perform venous ultrasound**

**Exclude DVT and consider a different diagnosis**

**Perform serial ultrasound once weekly for 2 weeks**

- Symptoms severe?
  - No
  - Yes

**Has DVT propagated?**

- No
  - Proceed to DVT treatment algorithm (see page 11)
- Yes
  - Proceed to SVT treatment algorithm (see page 12)

**Educate** patient to return for evaluation if new or progressive symptoms of DVT or PE occur

**Determine location of thrombosis (b)**

- Isolated distal DVT
- Proximal DVT
- SVT

**Algorithm Notes**

**(a) Wells Score**

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active cancer</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis, or recent cast</td>
<td>1</td>
</tr>
<tr>
<td>Bedridden or surgery in past 12 weeks</td>
<td>1</td>
</tr>
<tr>
<td>Localized tenderness</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swollen</td>
<td>1</td>
</tr>
<tr>
<td>≥3 cm calf asymmetry</td>
<td>1</td>
</tr>
<tr>
<td>Pitting edema in affected leg</td>
<td>1</td>
</tr>
<tr>
<td>Collateral (non-varicose) veins</td>
<td>1</td>
</tr>
<tr>
<td>Previous DVT</td>
<td>1</td>
</tr>
<tr>
<td>Alternate diagnosis as likely</td>
<td>-2</td>
</tr>
</tbody>
</table>

Add total points

Total points <2, DVT unlikely; ≥2, DVT likely.

**(b) Leg vein anatomy**

SUPERFICIAL:  
- External iliac
- Common femoral
- Greater saphenous
- Lesser saphenous
- Femoral
- Deep femoral
- Gastrocnemius veins
- Soleus sinus veins

DEEP:  
- Superficial veins (paired)
- Peroneal (paired)
- Posterior tibial (paired)
- Anterior tibial (paired)
- Popliteal
- Proximal
- Distal
Patient presents with a DVT of known location

- Femoral and/or popliteal
- Isolated distal
- Iliac and/or common femoral

**ALGORITHM 4: DVT TREATMENT**

1. **TREAT** per anticoagulation initiation algorithm (page 14)
2. **STRATIFY** by symptom severity (a)
   - Mild
   - Moderate
   - Severe

**CONSIDER propagation risk (b)**

- **PERFORM** serial ultrasound after 7 days (day 7)
- Did clot propagate? (b)
- Yes: **TREAT** per anticoagulation initiation algorithm (page 14)
- No: **CONFIRM** patient at risk for propagation?
  - Yes: **TREAT** per anticoagulation initiation algorithm (page 14)
  - No: **PERFORM** serial ultrasound after 7 days (day 14)

**ALGORITHM NOTES**

(a) Symptom severity stratification tool for DVT*

<table>
<thead>
<tr>
<th>Isolated distal DVT</th>
<th>Iliac and / or common femoral DVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILD</td>
<td></td>
</tr>
<tr>
<td>Mild pain or discomfort</td>
<td></td>
</tr>
<tr>
<td>Mild swelling, trace or mild pitting edema</td>
<td></td>
</tr>
<tr>
<td>Distal erythema</td>
<td></td>
</tr>
<tr>
<td>MODERATE</td>
<td></td>
</tr>
<tr>
<td>Moderate pain or discomfort</td>
<td></td>
</tr>
<tr>
<td>Moderate pitting edema</td>
<td></td>
</tr>
<tr>
<td>Diffuse erythema or hyperpigmentation</td>
<td></td>
</tr>
<tr>
<td>SEVERE</td>
<td></td>
</tr>
<tr>
<td>Severe pain</td>
<td></td>
</tr>
<tr>
<td>Severe edema</td>
<td></td>
</tr>
<tr>
<td>Difficulty bearing weight</td>
<td></td>
</tr>
<tr>
<td>Loss of sensation</td>
<td></td>
</tr>
<tr>
<td>Venous claudication</td>
<td></td>
</tr>
<tr>
<td>Phlegmasia</td>
<td></td>
</tr>
<tr>
<td>Severe pain</td>
<td></td>
</tr>
<tr>
<td>Difficulty bearing weight</td>
<td></td>
</tr>
<tr>
<td>Loss of sensation</td>
<td></td>
</tr>
<tr>
<td>Loss of strength / paresis</td>
<td></td>
</tr>
<tr>
<td>Venous claudication</td>
<td></td>
</tr>
<tr>
<td>Venous gangrene</td>
<td></td>
</tr>
</tbody>
</table>

(b) Propagation risk factors for distal DVT

If a patient has any of these risk factors, **CONSIDER** proceeding with anticoagulation (c) rather than serial ultrasound, even if symptoms are mild or moderate. Risk factors are:

- D-dimer is positive (particularly when markedly so without an alternative reason)
- Thrombosis is extensive (e.g., > 5 cm in length, involves multiple veins, > 7 mm in maximum diameter)
- Thrombosis close to the proximal veins
- No reversible provoking factor for DVT
- Active cancer
- History of VTE
- Inpatient status or persistent immobility

**ABSOLUTE contraindications**

- Current active bleeding
- Major surgery in the last 7 days
- Intracranial hemorrhage in last 30 days
- Platelet count < 25,000

**RELATIVE contraindications**

- Intracranial or intraspinal tumor
- Aortic dissection
- GI bleeding in the last 7 days
- Platelet count < 50,000

*The patient’s preferences are an important component of management decisions. A given patient may prefer treatment or serial ultrasound for isolated distal DVT, or may prefer anticoagulation or catheter-directed thrombolysis (CDT) for iliac or femoral DVT.

*Do NOT give anticoagulants if patient has ANY absolute contraindication(s). Anticoagulants are strongly discouraged in the presence of a relative contraindication, but the clinician must weigh the risks and benefits in each case.
ALGORITHM 5: SVT TREATMENT

Patient with SVT diagnosed

DETERMINE location (a)

STRATIFY by severity

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe (Saphenofemoral SVT)</th>
</tr>
</thead>
</table>
| If ANY of the following:  
  • Lesser saphenous vein or varicosity  
  • Distal location  
  • < 5 cm in length  
  • Mild symptoms |
| If ANY of the following:  
  • Greater saphenous vein  
  • Proximal location  
  • ≥ 5 cm in length  
  • Severe symptoms |
| If proximal clot < 5 cm from junction of the greater saphenous and common femoral vein |

TREAT SVT

• INITIATE NSAID therapy
• INITIATE local treatment measures
• FOLLOW UP after approx. 1 week

TREAT SVT

• COMPLETE anticoagulation contraindication assessment (b)
• INITIATE low-dose anticoagulant if no contraindication (b) (see low dose section of table 1 on page 15)
• INITIATE local treatment measures

MANAGE as DVT (see DVT treatment algorithm on page 11)

FOLLOW UP as needed after completion of therapy

Did symptoms progress?

yes

no

PERFORM serial ultrasound (Day 7 & 14), and CONSIDER low-dose anticoagulation if thrombi have propagated

CONTINUE management for approx. 6 weeks, and FOLLOW UP as needed after completion of therapy

ALGORITHM NOTES

(a) Superficial vein anatomy

Greater saphenous

Lesser saphenous

(b) Anticoagulation contraindication assessment*

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Current active bleeding</td>
<td>□ Intracranial or intraspinal tumor</td>
</tr>
<tr>
<td>□ Major surgery in the last 7 days</td>
<td>□ Aortic dissection</td>
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<tr>
<td>□ Intracranial hemorrhage in last 30 days</td>
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</tr>
<tr>
<td>□ Platelet count &lt; 25,000</td>
<td>□ Platelet count &lt; 50,000</td>
</tr>
</tbody>
</table>

*Do NOT give anticoagulants if patient has ANY absolute contraindication(s). Anticoagulants are strongly discouraged in the presence of a relative contraindication, but the clinician must weigh the risks and benefits in each case.
ANTICOAGULATION

Progressive VTE occurs in fewer than 5% of patients after starting anticoagulant therapy, making anticoagulation an extremely effective treatment for VTE.\(^{\text{KEA}}\) The major risk of all anticoagulants is bleeding, which can be estimated with the bleeding risk assessment tool on page 16 (see also the anticoagulation contraindication assessment on page 14). Because anticoagulants do not dissolve existing thrombi, an interventional therapy may be needed to more rapidly remove existing clots in very severe cases. See Algorithm 4: DVT treatment (page 11) and Algorithm 2: Risk stratification and treatment of PE (page 6).

Initiation (first several days of therapy)

The clinical goal during this phase is to impair the activated state of the coagulation system and to arrest the active formation and embolization of new thrombi. This is achieved through the use of rapid-acting anticoagulant agents at high doses. Initiation uses different dosing strategies depending upon the anticoagulant regimen selected. The potential approaches are:

- **Overlapping**: A rapid-acting parenteral anticoagulant is started immediately, and overlapped with warfarin for the initiation period.
- **Switching**: Low molecular weight heparin is used for the initiation period and then changed to an oral anticoagulant.
- **Loading**: A direct oral anticoagulant (DOAC) is used at a higher dose for the initiation period, and the dose is then reduced.

See Algorithm 6: Anticoagulation initiation (page 14) and table 1 (page 15).

Indefinite anticoagulation vs. cessation

Anticoagulant use carries a risk of major bleeding, which can be fatal. Following three months of anticoagulation treatment after a VTE event, the goal of continued anticoagulation treatment is secondary prevention. Despite past guidelines, it is no longer recommended to continue anticoagulation for intermediate durations (i.e. 12–24 months).\(^{\text{KEA}}\) Therefore, the treatment options are either time-limited therapy (i.e., at least three months), and indefinite/extended therapy (no planned stop date).

The decision to continue anticoagulation into the extended/indefinite phase is based on:

- An assessment of the risk for recurrent thrombosis if anticoagulation is stopped.
- The risk for major bleeding if anticoagulation is continued. (See the bleeding risk table on page 16.) This tool has not been validated in VTE populations, but may inform shared decision making with the patient regarding comparative potential harms and benefits of anticoagulation therapy for VTE.
- Patient preference.

Bleeding risk and patient preferences may change over time. Patients continuing anticoagulation into the extended/indefinite phase should be reevaluated annually and/or when there is any major change to their clinical status.
ALGORITHM 6: ANTICOAGULATION INITIATION

VTE patient who is an anticoagulation therapy candidate

Perform anticoagulation contraindication assessment*

<table>
<thead>
<tr>
<th>ABSOLUTE contraindications</th>
<th>RELATIVE contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Current active bleeding</td>
<td>☐ Intracranial or intraspinal tumor</td>
</tr>
<tr>
<td>☐ Major surgery in the last 7 days</td>
<td>☐ Aortic dissection</td>
</tr>
<tr>
<td>☐ Intracranial hemorrhage in last 30 days</td>
<td>☐ GI bleeding in the last 7 days</td>
</tr>
<tr>
<td>☐ Platelet count &lt; 25,000</td>
<td>☐ Platelet count &lt; 50,000</td>
</tr>
</tbody>
</table>

*Do NOT give anticoagulants if patient has ANY absolute contraindication(s). Anticoagulants are strongly discouraged in the presence of a relative contraindication, but the clinician must weigh the risks and benefits in each case.

BEGIN IV heparin (dose using VTE protocol), AND TRANSITION to warfarin same day unless contraindicated

ASSESS renal function

- CClr < 30 mL/min
- CClr ≥ 30 mL/min

Does patient have cancer (active or diagnosed) in last 6 months?

- no
- yes

TREAT with extended duration, low-molecular weight heparin per table 1 on page 15

Assess special considerations for specific agents

- Non-absolute considerations:
  - Avoiding injections – CONSIDER apixaban or rivaroxaban
  - Once-daily dosing – CONSIDER warfarin, rivaroxaban, edoxaban
  - Avoiding lab monitoring – CONSIDER direct oral anticoagulants (DOACs)

See Intermountain’s Choosing a Direct Oral Anticoagulant (DOAC) clinical guideline

INITIATE anticoagulant (see table 1, initiation phase, on page 15)

PROCEED to indefinite anticoagulation vs. cessation algorithm on page 16
### TABLE 1. Anticoagulant dosing by phase and type of therapy

<table>
<thead>
<tr>
<th>Medication</th>
<th>Initiation (5 – 30 days)</th>
<th>Acute Phase (3 months)</th>
<th>Extended/Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IV unfractionated heparin (UFH) per Intermountain’s VTE Power Plan</strong></td>
<td>Overlap with <strong>warfarin</strong> (^2)</td>
<td><strong>CONTINUE warfarin</strong>, INR 2.0 – 3.0</td>
<td><strong>CONTINUE warfarin</strong>, INR 2.0 – 3.0</td>
</tr>
<tr>
<td><strong>enoxaparin</strong> (overlapped to warfarin)</td>
<td>Overlap with <strong>warfarin</strong> (^2)</td>
<td><strong>CONTINUE warfarin</strong>, INR 2.0 – 3.0</td>
<td><strong>CONTINUE warfarin</strong>, INR 2.0 – 3.0</td>
</tr>
<tr>
<td><strong>enoxaparin</strong> (switched to dabigatran)</td>
<td>1 m/kg twice daily x 7 days</td>
<td><strong>STOP enoxaparin AND CHANGE to dabigatran</strong>, 150 mg twice daily</td>
<td><strong>CONTINUE dabigatran</strong>, 150 mg twice daily</td>
</tr>
<tr>
<td><strong>enoxaparin</strong> (switched to edoxaban)</td>
<td>1 mg/kg twice daily x 7 days</td>
<td><strong>STOP enoxaparin AND CHANGE to edoxaban</strong>, 60 mg daily</td>
<td><strong>CONTINUE edoxaban</strong>, 60 mg daily</td>
</tr>
<tr>
<td><strong>enoxaparin</strong> (extended therapy for cancer-associated thrombosis)</td>
<td>1 mg/kg twice daily x 30 days [no transition to oral agents in cancer patients]</td>
<td><strong>CONTINUE enoxaparin</strong>, 1 mg/kg twice daily (^5)</td>
<td><strong>CONTINUE enoxaparin</strong>, 1 mg/kg twice daily (^6)</td>
</tr>
<tr>
<td><strong>dalteparin</strong> (extended therapy for cancer-associated thrombosis)</td>
<td>200 IU/kg daily x 30 days [no transition to oral agents in cancer patients]</td>
<td><strong>REDUCE dalteparin</strong> dose to 150 IU/kg daily</td>
<td><strong>CONTINUE dalteparin</strong>, 150 IU/kg daily</td>
</tr>
<tr>
<td><strong>apixaban</strong></td>
<td>10 mg twice daily x 7 days</td>
<td><strong>REDUCE apixaban</strong> dose to 5 mg twice daily</td>
<td><strong>REDUCE apixaban</strong> dose to 2.5 mg twice daily</td>
</tr>
<tr>
<td><strong>rivaroxaban</strong></td>
<td>15 mg twice daily x 21 days</td>
<td><strong>CHANGE rivaroxaban</strong> dose to 20 mg daily</td>
<td><strong>REDUCE rivaroxaban</strong> dose to 10 mg once daily</td>
</tr>
<tr>
<td><strong>Medication</strong></td>
<td><strong>Low-dose anticoagulation therapy (for SVT)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enoxaparin</td>
<td>40 mg SQ daily x 4 – 6 weeks</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>fondaparinux</td>
<td>2.5 mg daily x 45 days</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>rivaroxaban</td>
<td>10 mg daily x 45 days</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

\(^1\) This figure reviews the dosing of various anticoagulants through the successive phases of therapy, including instances in which agents or doses are changed as the phases of therapy progress. **Renal adjustment may be necessary.** Please see relevant package inserts for details.

\(^2\) IV unfractionated heparin (UFH) or enoxaparin should be overlapped with warfarin until 2 standards have been met — (1) at least 5 days of overlapping therapy have been given, AND (2) the INR has been \(\geq 2.0\) for at least 24 hours.

\(^3\) The acute phase is defined as 3 months by most guidelines. Some practitioners prefer a 6-month acute phase of treatment.

\(^4\) For patients who will proceed with indefinite (no planned stop date) therapy. See indefinite anticoagulation vs. cessation algorithm on page 16.

\(^5\) Enoxaparin can be changed to 1.5 mg/kg subcutaneous injection once daily if patient prefers fewer injections.

\(^6\) Also see Intermountain’s [Choosing a Direct Oral Anticoagulant (DOAC) clinical guideline](#).
ALGORITHM 7: INDEFINITE ANTICOAGULATION VS. CESSATION

Patient completed acute phase (≥ 3 mo.) of anticoagulation

**ASSESS for clear transient provocation**

**MAJOR** transient risk factors (MUST have occurred within 3 months of VTE):
- Surgery with anesthesia > 30 minutes
- Hospitalization with bedrest (or bathroom privileges only) for ≥ 3 days
- Cesarean section

**MINOR** transient risk factors (MUST have occurred within 2 months of VTE):
- Surgery of < 30 minutes duration
- Hospitalization < 3 days
- Estrogen use
- Pregnancy (non-cesarean) and post-partum
- Home bedrest for at least 3 days
- Leg injury with reduced mobility for at least 3 days

**Does patient have clear transient provocation?**

- no
- yes

**ASSESS bleeding risk (a)**

- **LOW bleeding risk AND patient agreeable to anticoagulation**
  - **INITIATE** indefinite anticoagulation
  - **REASSESS** annually

- **INTERMEDIATE bleeding risk AND patient agreeable to anticoagulation**
  - **INITIATE** indefinite anticoagulation
  - **REASSESS** at least once annually

- **HIGH bleeding risk OR patient prefers no anticoagulation**
  - **STOP** anticoagulation
  - **CONSIDER** aspirin therapy (b)

**STOP anticoagulation**

- **ADVISE** patient to seek care promptly if future signs or symptoms of thrombosis develop.
- **ENSURE** VTE prophylaxis is given in risk situations, such as surgery or hospitalization.
- **ADVISE** patient to ambulate frequently and/or wear compression stockings during long travel.
- **ADVISE** female patients to avoid using estrogens.
- **RECOMMEND** smoking cessation if applicable.

---

**ALGORITHM NOTES AND ASSESSMENT TOOLS**

**(a) Bleeding risk factors (1 point each)**

- Age > 65 years (2 points if age > 75 years)
- Previous bleeding
- Cancer
- Metastatic cancer
- Renal failure
- Liver failure
- Thrombocytopenia
- Previous stroke
- Diabetes
- Anemia
- Antiplatelet therapy
- Poor anticoagulant control
- Comorbidity and reduced functional capacity
- Recent surgery
- Frequent falls
- Alcohol abuse
- Nonsteroidal anti-inflammatory drug (NSAID) use

**Total number of bleeding risk factors (points):**

Based on the number of points at left, the following provides an estimate for the risk of major bleeding during the first 3 months of anticoagulation, and the annual risk if anticoagulation is continued beyond 3 months. High bleeding risk is not considered a contraindication to using anticoagulation for the acute phase of therapy, but these patients should be monitored carefully during treatment, and anticoagulation should be discontinued if possible after 3 months.

<table>
<thead>
<tr>
<th>(a) Bleeding risk factors (1 point each)</th>
<th>Low risk (0 risk factors)</th>
<th>Intermediate risk (1 risk factors)</th>
<th>High risk (≥2 risk factors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 — 3 months</td>
<td>1.6 %</td>
<td>3.2 %</td>
<td>12.8 %</td>
</tr>
<tr>
<td>&gt; 3 months (annualized)</td>
<td>0.8 %</td>
<td>1.6 %</td>
<td>6.5 % +</td>
</tr>
</tbody>
</table>

**(b) Aspirin therapy**

Low-dose aspirin (100 mg was used in the relevant trials) was found to reduce the risk of recurrent VTE by about 35% vs. placebo. This is much less effective than the risk reduction from anticoagulants (85 — 90 %); therefore, aspirin should **not** be considered as a reasonable alternative for patients without a contraindication to continuing anticoagulants. Patients for whom anticoagulants are contraindicated may also have contraindications to aspirin.
INFERIOR VENA CAVA (IVC) FILTERS

Potential benefits
IVC filters are intended to capture a venous embolism from the lower extremity veins while allowing for blood flow through the vein. IVC filters are placed under fluoroscopic guidance in the infrarenal inferior vena cava. The primary potential benefit of an IVC filter is a ~50% reduced risk for PE. See decision guide box below for situations in which IVC filters may be considered.

Risks
IVC filter placement is associated with the following risks:
- Increased risk for recurrent DVT
- IVC perforation
- Filter migration / embolization
- Filter fracture with embolization of components
- Infection
- Inferior vena cava syndrome

Given these risks, IVC filters should not be placed solely on the basis of SVT or for DVT isolated to the calf veins. Isolated distal DVT (i.e., DVT confined to the tibial, peroneal, soleus, or gastrocnemius veins) has a low risk of causing PE without first propagating to the proximal deep veins. IVC filters should not be used for a purely prophylactic indication.

Decision guide
The only evidence-based indication for placing an IVC filter is the presence of an acute proximal DVT or PE AND a contraindication to anticoagulation. Some guidelines suggest IVC filter placement in other situations, listed in the “consider” category below. While the benefit of an IVC filter is not proven in these situations, a clinician may choose to place an IVC filter after careful consideration.

<table>
<thead>
<tr>
<th>IVC FILTER PLACEMENT CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLACE filter if BOTH: (see page 18)</td>
</tr>
<tr>
<td>• Confirmed PE or proximal DVT AND</td>
</tr>
<tr>
<td>• Anticoagulation contraindication</td>
</tr>
<tr>
<td>CONSIDER placing IF ANY:</td>
</tr>
<tr>
<td>• New proximal DVT or PE despite adequate anticoagulation</td>
</tr>
<tr>
<td>• Anticoagulation therapy must be interrupted during acute phase of treatment after new proximal DVT or PE</td>
</tr>
<tr>
<td>• Impaired cardiac reserve and significant proximal DVT</td>
</tr>
<tr>
<td>• Undergoing interventional therapy for DVT (catheter-directed thrombolysis)</td>
</tr>
</tbody>
</table>

If an IVC filter is placed, anticoagulation contraindications should be monitored over time and anticoagulation should be reconsidered when resolved. If anticoagulants are resumed and are tolerated, the IVC filter should be removed. The chance of a successful retrieval remains high for at least the first two to three months that the filter is in place. Be sure to implement a follow-up plan with a reminder system to ensure that the IVC filter is retrieved when anticoagulation has been resumed and is being tolerated.

See the IVC filter placement algorithm on page 18 for further instructions.
ALGORITHM 8: INFERIOR VENA CAVA (IVC) FILTER PLACEMENT

Patient with anticoagulation contraindicated

- Distal DVT
  - PERFORM serial ultrasound once/week for 2 weeks
  - Did clot propagate?
    - no
      - EDUCATE patient to return for evaluation if new or progressive symptoms of DVT or PE occur
    - yes
      - Has anticoagulation contraindication resolved?
        - no
          - DO NOT PLACE FILTER; INITIATE anticoagulation therapy (see anticoagulation initiation algorithm on page 14)
        - yes
          - PLACE IVC filter

- Proximal DVT
  - PLACE IVC filter
  - REASSESS patient contraindications as needed (a)

- Pulmonary Embolism
  - PLACE IVC filter

ALGORITHM NOTE

(a) REASSESS patient contraindications

REASSESS patient weekly for up to approximately 3 mo.
If contraindication resolves:
- Begin anticoagulant therapy (see table 1 on page 15)
- Retrieve IVC filter if patient tolerates anticoagulation therapy (1–2 weeks of therapy without bleeding)
If contraindication does not resolve and is not expected to resolve upon re-evaluation, consider leaving IVC filter in place permanently. Some clinicians consider retrieving IVC filter after 3–6 months if the original thrombosis resolved. There is no strong evidence to guide this decision, and individual clinical judgment is required.
RESOURCES

Intermountain-approved patient education

Intermountain education materials are designed to support educating and engaging patients and families. They complement and reinforce clinical team interventions by providing a means for patients to reflect and learn in another mode and at their own pace.

To access these materials, go to intermountainphysician.org, and search for the patient education library under A—Z. Then, search the title in the appropriate area. Clinicians can also order Intermountain patient education booklets and fact sheets for distribution to their patients from Intermountain’s iprintstore.org.

Fact sheets (non-medication related):
- Computed Tomography (CT) Scan
- Deep Vein Thrombosis and Pulmonary Embolism
- Deep Vein Thrombosis: Prevention during and after pregnancy
- Radiation Exposure in Medical Tests

Fact sheets (medication-related):
- Anticoagulant Injections
- Apixaban (Eliquis): What you need to know and do
- Coumadin (Warfarin) Anticoagulation Therapy: What you need to know and do
- Coumadin (Warfarin) Eating Plan
- Dabigatran (Pradaxa): What you need to know and do
- Rivaroxaban (Xarelto): What you need to know and do

Provider resources

To find this CPM, clinicians can go to intermountainphysician.org/clinicalprograms and click on "Clinical Topics A - Z" on the left side of the screen. Then, select "Vascular disease" under "V."

To find and print Intermountain anticoagulation guidelines, go to intermountain.net, and type "ATF" in the search bar. Select "Anticoagulation Task Force (ATF)" from the query results.

Care Process Models (CPMs):
- Evaluation of Suspected Pulmonary Embolism in Pregnancy
- Imaging Radiation Exposure
- Proven Imaging: Suspected Pulmonary Embolism

Anticoagulation Task Force guidelines:
- Disease State Guidelines
- Medication Guidelines
- Direct Oral Anticoagulants
REFERENCES


BIBLIOGRAPHY


This CPM presents a model of best care based on the best available scientific evidence at the time of publication. It is not a prescription for every physician or every patient, nor does it replace clinical judgment. All statements, protocols, and recommendations herein are viewed as transitory and iterative. Although physicians are encouraged to follow the CPM to help focus on and measure quality, deviations are a means for discovering improvements in patient care and expanding the knowledge base. Send feedback to Scott Stevens, MD, Intermountain Healthcare, Co-director, Intermountain Medical Center Thrombosis Clinic (scott.stevensmd@imail.org).

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