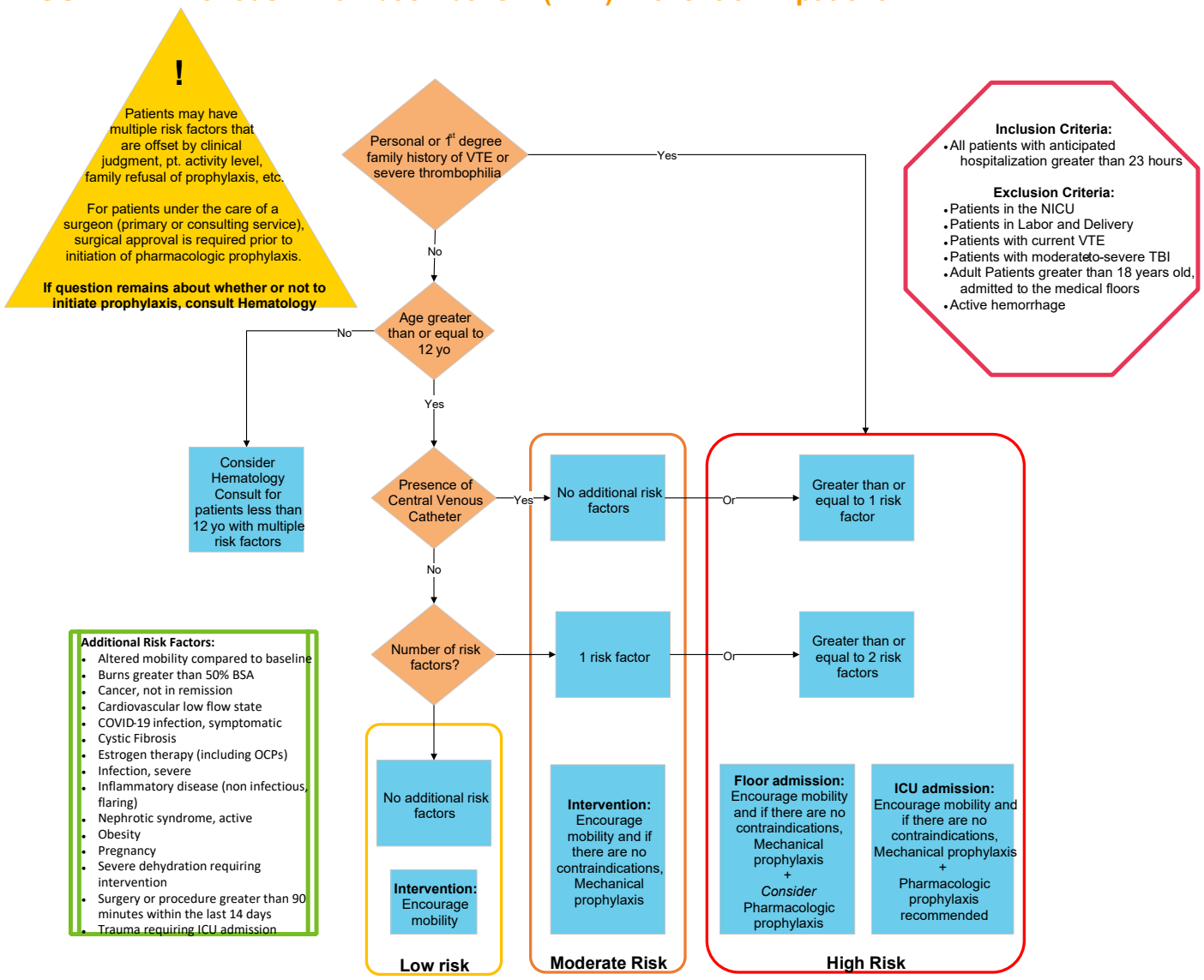
VENOUS THROMBOEMBOLISM (VTE) PREVENTION

ALGORITHM. Venous Thromboembolism (VTE) Prevention Inpatient



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TARGET POPULATION

Inclusion Criteria

Intended for:

- All patients with anticipated hospitalization greater than 23 hours

Exclusion Criteria

Not intended for:

- Patients with current VTE. Please consider Hematology consultation and refer to the Anticoagulation Dosing and Monitoring Protocol
- Patients in Neonatal Intensive Care Unit (NICU)
- Patients in the Labor and Delivery Unit (refer to Venous Thromboembolism (VTE) Prevention: Perinatal)
- Patients, 18 years and older, admitted to medical floors will be screened for VTE risk and prophylaxis ordered per the Best Practice Advisory.
- Patients with moderate/severe Traumatic Brain Injury

BACKGROUND | DEFINITIONS

Definitions

VTE: Venous Thromboembolism, including deep vein thrombosis (of the limbs, abdomen, neck/chest, cranial), intracardiac thrombosis, and pulmonary embolism.

INITIAL EVALUATION

All patients should be assessed for VTE risk within 24 hours of admission and on a daily basis. Patients are determined to be "at-risk" depending on the risk factors present. Refer to the Inpatient VTE algorithm.

VTE Risk Factors include:

- Age, greater than or equal to 12 years of age or post-pubertal
- Altered mobility: relative to patient's baseline, affecting one or more extremities greater than 48 hours (including that resulting from sedation for mechanical ventilation, acute spinal injury, transverse myelitis, or Guillain-Barre syndrome, etc.), defined as a Braden Q mobility score of 1 (completely immobile) or 2 (very immobile).
- Burns: greater than 50% of body surface area.
- Cancer: not in remission
- Cardiovascular low flow compromise: including, but not limited to, ventricular dysfunction or structural cardiac defect with associated turbulent blood flow (single ventricle physiology, cyanotic congenital heart defects, cavopulmonary anastomoses)
- Central venous catheter (CVC): includes peripherally inserted catheter (PICC), tunneled CVCs, non-tunneled CVCs, implanted ports, hemodialysis catheters
- COVID-19 infection, symptomatic requiring inpatient admission: Observational studies in adults have suggested that SARS-CoV-2 infection causes a prothrombotic state. The incidence of VTE in pediatric acute COVID-19 is unknown. For more information, refer to the Guidelines for the Prevention and Treatment of VTE in Hospitalized Patients with COVID-19.
- Cystic fibrosis (CF)
- Estrogen therapy: currently taking (consider all formulations, including oral, transdermal patches, injections, etc.)
- Severe infection, confirmed (culture positive) or presumed requiring initiation of antimicrobials. Patients with osteomyelitis, particularly due to MRSA, are at high risk for developing VTE.
- Inflammatory disease flare, non-infectious: including, but not limited to, arthritis, inflammatory bowel disease (IBD), systemic lupus erythematosus (SLE), graft versus host disease (GVHD)
- Obesity: body mass index (BMI) greater than or equal to 95%-ile for gender/age (or greater than or equal to 30)
- Nephrotic syndrome, active
- Personal or 1st-degree family history of VTE or severe thrombophilia (acquired or inherited; however, new inpatient testing for purpose of risk categorization not recommended). For 1st-degree family history, only consider family members less than 50 years of age. For patients, consider whether they have been previously informed that they require blood thinners during hospitalization. Severe thrombophilia traits include:
    - Severe Antithrombin deficiency
    - Severe Protein S deficiency
    - Severe Protein C deficiency
    - Homozygous factor V Leiden mutation
    - Homozygous prothrombin mutation 20210
- Pregnancy: currently pregnant or within 6 weeks post-partum
    - Note: Low molecular weight heparin (LMWH) preferred over heparin for pregnant women due to FDA pregnancy category (does not cross placenta)
- Severe dehydration: including ongoing hyperosmolar acidotic state like diabetic ketoacidosis
- Surgery or procedure lasting longer than 90 minutes within the last 14 days
- Trauma: requiring an ICU admission. Excludes patients with acute traumatic brain injury. See the TBI: Moderate/Severe Clinical Pathway for more guidance

CLINICAL MANAGEMENT

Interventions

Appropriateness of therapeutic intervention is determined by each patient's level of risk balanced against any contraindications. In some circumstances, the patient may have multiple risk factors that are offset by clinical judgment, patient's activity level, family refusal of prophylaxis, etc. If a question remains about whether to initiate prophylaxis, consult hematology. A hematology consult is strongly recommended prior to starting pharmacologic prophylaxis outside of the ICU/CPCU.

General Measures

- Both dehydration and altered mobility are independent risk factors for thrombosis. Therefore, adequate hydration should be maintained and patients should be mobilized as early as possible.
- The primary care team should discuss the indications for all CVCs daily and should promptly remove any CVC that is no longer indicated.

Mechanical Prophylaxis

- Mechanical prophylaxis refers to either sequential compression devices (SCDs) or graduated compression stockings and is indicated for all patients at moderate-to-high risk for VTE, unless contraindicated.
- Mechanical prophylaxis can reduce clot formation through both physical and biochemical mechanisms. Compression of a blood vessel results in forward movement of blood and the shear and strain forces will trigger endothelium to release nitric oxide, prostacyclin, and tissue plasminogen activator. In addition, there is a reduction in plasminogen activator inhibitor.
- Contraindications to mechanical prophylaxis include:
  - Acute fracture of extremity (mechanical prophylaxis is to be applied to unaffected extremity)
  - Allergy to garment fabric
  - Osteogenesis imperfecta
  - Peripheral intravenous access in extremity (mechanical prophylaxis is to be applied to be applied to unaffected extremity)
  - Skin conditions affecting extremity mechanical prophylaxis is to be applied to (e.g., dermatitis, burns, recent skin grafts, leg wounds)
  - Suspected or existing deep vein thrombosis in extremity in question (can use graduated compression stockings in this circumstance)
  - Unable to achieve correct fit due to patient size
- The effectiveness of mechanical prophylaxis is dependent on the correct fit of the stocking or device. Patients should be measured to ensure proper fit. See Sequential Compression Device and Graduated Compression Stocking Use for Prevention of Venous Thromboembolism (VTE).
- For patients that are unable to move on their own, passive range of motion (PROM) exercises should be completed with repositioning.
- Sequential Compression Devices (SCDs):
  - SCDs are available in adult and pediatric sizes for maximum calf sizes between 25 cm and 76 cm in circumference (no minimum circumference listed). Moleskin or other dermatologic protection may be necessary to prevent skin breakdown.

- Graduated compression stockings (if SCDs contraindicated, unavailable, or refused, or if patient has an existing DVT in that limb):
  - Graduated compression stockings reduce the overall cross-sectional area of the limb, increase linear velocity of venous flow, reduce venous wall distension, and improve valvular function.
  - Knee length stockings have been shown to be as effective as thigh length stockings and are associated with greater patient compliance and less skin breakdown.
  - Graduated compression stockings are manufactured for adults in small, medium, large, and extra-large sizes; regular and long lengths; light to firm support. Fit is determined according to measurements taken from thigh, calf, ankle, and foot. It is unlikely that graduated compression stockings will fit very young or small pediatric patients.

Pharmacologic prophylaxis

Note: Hematology consult is strongly recommended prior to starting pharmacologic prophylaxis outside of the ICU/CPCU, since there is lack of evidence demonstrating the safety or efficacy of pharmacologic prophylaxis of VTE in children.

Patients under the care of a surgeon must have approval from the attending surgeon prior to initiation of pharmacologic prophylaxis.

Pharmacologic prophylaxis, most commonly with low-molecular weight heparin (enoxaparin) or unfractionated heparin, should be considered for high-risk patients without contraindications. Risks commonly associated with any pharmacological prophylaxis include bleeding and bruising at injection site but could also include severe hemorrhagic complications (although this is unlikely at prophylactic dosing).

Clinical and possible laboratory monitoring of patients receiving pharmacologic prophylaxis:

- Patients should be observed for signs/symptoms of bleeding and therapy should be discontinued if bleeding is clinically significant.
- Low-molecular weight heparin may be held twelve (12) hours prior to any invasive procedure.
- In general, laboratory monitoring of anti-Xa levels (heparin assay) is not warranted. There are, however, certain circumstances in which a patient with expected alterations in pharmacokinetics (e.g., obesity, renal insufficiency, acute thermal burns and states of high inflammation) should have a heparin assay obtained to validate appropriateness of prophylactic dosing.
- If checking levels is warranted, typical VTE prophylaxis target for enoxaparin is between 0.2-0.4 units/mL (collected 4-hrs post-dose, using the heparin, low-molecular weight assay). Typical VTE prophylaxis target for unfractionated heparin is between 0.1-0.3 units/mL (collected 4-hrs after every dose change, using the heparin, unfractionated assay).

Contraindications to pharmacologic prophylaxis include:

- Absolute:
  - Evidence of active hemorrhage
  - Epidural catheter or lumbar puncture performed within last hour
  - Intravascular thrombolytic therapy within the last 24 hours
  - Known arterio-venous malformation, aneurysm, or moyamoya
  - Acute period following neurosurgery or severe traumatic brain injury (see appendix B in the TBI Moderate/Severe Clinical Pathway for more guidance)

  - Acute large-territory arterial ischemic stroke
  - Platelet count unable to be sustained above 30,000/mm^3 (platelet transfusions for the sole purpose of elevating the platelet count to an acceptable level for pharmacologic prophylaxis are not recommended)
  - Plasma fibrinogen concentration unable to be maintained above 100 g/dL
  - Prior history of unexplained spontaneous hemorrhage
  - For Low Molecular Weight Heparin (LMWH): known allergy/anaphylaxis to LMWH or pork products
- Relative:
  - Known bleeding disorder or hemophilia
  - Recent hemorrhage
  - Uncontrolled hypertension
  - Unexplained coagulopathy
  - Liver failure-associated coagulopathy
  - For Low Molecular Weight Heparin (LMWH): moderate or severe renal insufficiency, with creatinine clearance less than 30 mL/min

Dosing:

- See CHCO Formulary for dosing:
- Low molecular weight heparin (LMWH)/enoxaparin
- Unfractionated heparin (uFH)

PARENT | CAREGIVER EDUCATION

Provide parents and caregivers with information regarding VTE prophylaxis, the need for it, and any risks associated with the indicated prophylaxis.

KEY CONTACTS

Consult with Anticoagulation Clinical Pharmacist for specific questions around pharmacologic prophylaxis.

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Venous Thromboembolism Steering Committee – January 26, 2021
Pharmacy & Therapeutics – May 6, 2021

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COLORADO SPRINGS REVIEWED BY	 Michael DiStefano, MD Chief Medical Office, Colorado Springs
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REVIEW | REVISION SCHEDULE

Scheduled for full review on May 6, 2025

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