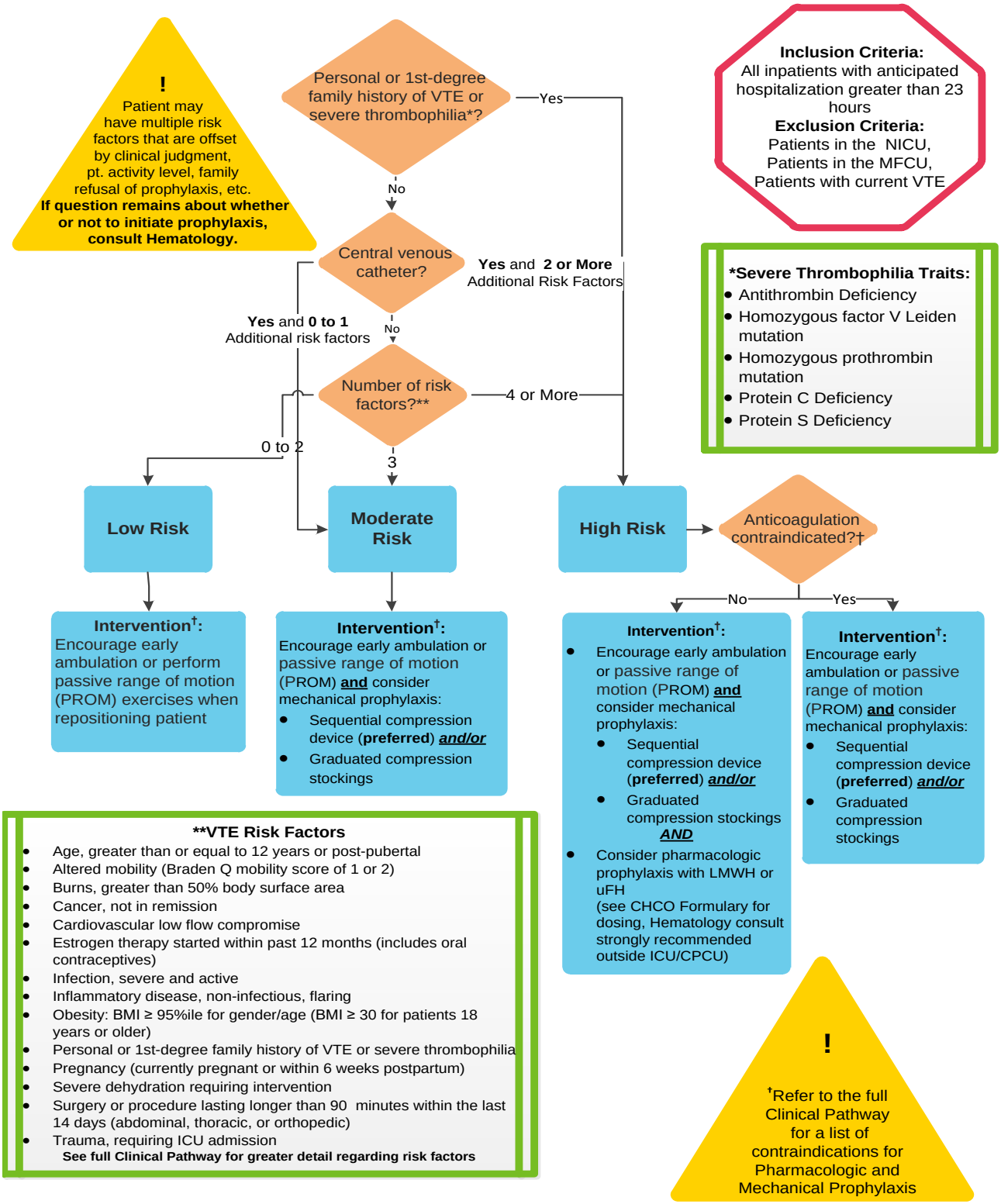
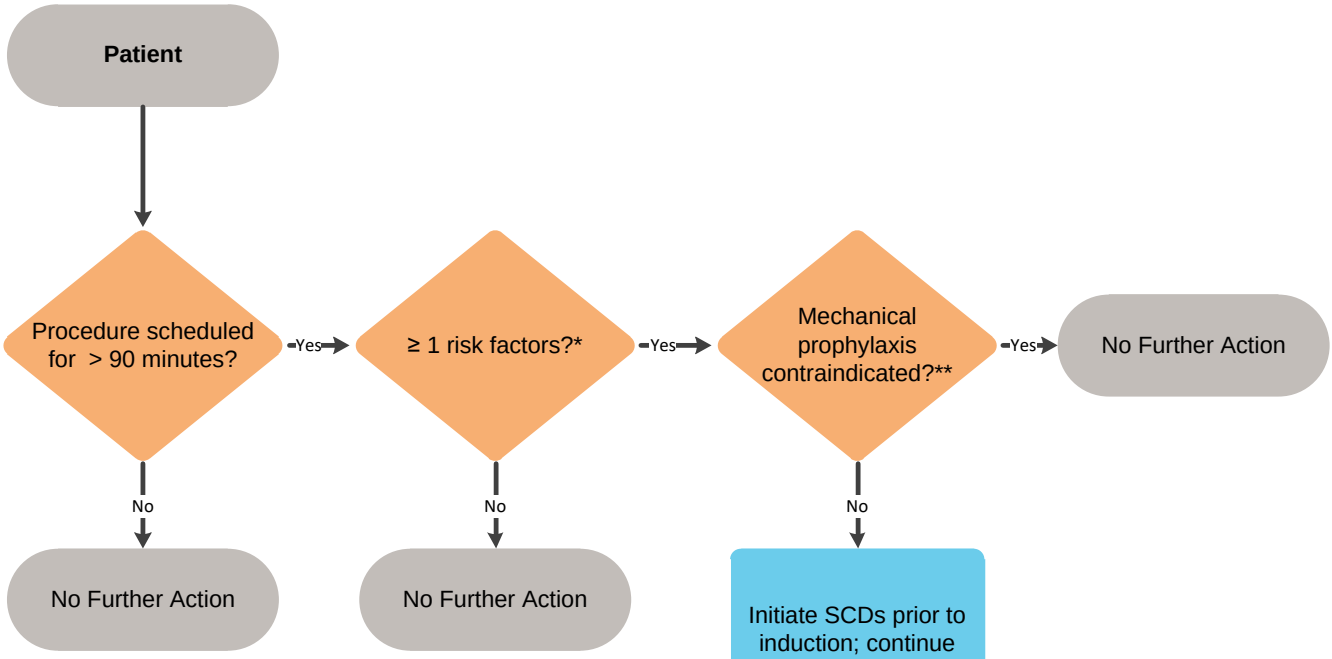
VENOUS THROMBOEMBOLISM (VTE) PREVENTION

ALGORITHM. Venous Thromboembolism (VTE) Prevention Inpatient



ALGORITHM. Perioperative/Procedural VTE Risk Screening & Mechanical Prophylaxis



***VTE Risk Factors:**

- Age, greater than or equal to 12 years or post-pubertal
- Cancer, not in remission
- Central venous catheter (including PICC, Broviac, Mediport, femoral or jugular line)
- Cardiovascular low flow compromise
- Inflammatory disease, non-infectious, flaring
- Obesity: BMI ≥ 95%ile for gender/age (BMI ≥ 30 for patients 18 years or older)
- Personal or 1st-degree family history of VTE or severe thrombophilia
- Orthopedic surgery (lower extremity joint replacement, hip surgery, sarcoma resection, spine trauma, spinal cord injury)
- Spine surgery
- Trauma, requiring ICU admission

****Contraindications to Mechanical Prophylaxis:**

- Unable to achieve correct fit due to patient size
- Suspected or existing deep vein thrombosis
- Bilateral extremities with acute fracture, skin condition, or requiring surgery
- Lower extremity that has peripheral IV access (place on unaffected extremity)
- Lower extremity that has skin condition, e.g. dermatitis, burn (place on unaffected extremity)
- Lower extremity with acute fracture (place on unaffected extremity)

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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 see Anticoagulation Dosing and Monitoring Protocol (for assistance with VTE treatment, contact Hematology)
- Patients in Neonatal Intensive Care Unit (NICU)
- Patients in Maternal Fetal Care Unit (MFCU)

BACKGROUND | DEFINITIONS

Definitions

VTE: Venous Thromboembolism, including deep vein thrombosis (of the limbs, abdomen, neck/chest, cranial) 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 number and types of risk factors present. Refer to the Inpatient VTE algorithm and Perioperative/Procedural VTE algorithm.

VTE Risk Factors include:

- Age, greater than or equal to 12 years of age or post-pubertal [10]
- Altered mobility: in comparison to patient's baseline greater than 48 hours (including that resulting from sedation for mechanical ventilation, acute spinal injury, transverse myelitis, or Guillain-Barre syndrome), defined as a Braden Q mobility score of 1 (completely immobile) or 2 (very immobile).[1,2,7]
- Burns: greater than 50% of body surface area.
- Cancer: not in remission.[1-6]
- Cardiovascular low flow compromise: including, but not limited to, structural cardiac defect with associated turbulent blood flow[1,8], structural compression of a vessel, single ventricle physiology, unrepaired Tetralogy of Fallot, tricuspid atresia.
- Central venous catheter (CVC): includes peripherally inserted catheter (PICC), tunneled CVCs, non-tunneled CVCs, implanted ports, hemodialysis catheters.[1-3,8,9]
- Estrogen therapy: current taking (consider all formulations, including oral, transdermal patches, injections, etc.).1,2,7
- Infection, severe and active: patient with positive blood cultures and currently on antibiotics.[4,7]
- Inflammatory disease, non-infectious, flaring: including, but not limited to, arthritis, inflammatory bowel disease [IBD], systemic lupus erythematosus [SLE], nephrotic syndrome, graft versus host disease [GVHD].[2,3]
- Obesity: body mass index (BMI) greater than or equal to 95%ile for gender/age3 (for patients 18 years of age or older, defined as BMI greater than or equal to 30).
- 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)[1,2,8]. 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 after delivery.[11]
    - 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, suggested by obtundation, capillary refill time longer than 4 seconds, parched/cracked mucous membranes, absent tears, increased heart rate, decreased blood pressure, faint pulse, tenting skin, sunken fontanel and eyes, and/or anuria.[12]
- Surgery or procedure lasting longer than 90 minutes within the last 14 days: includes, but is not limited to, abdominal, thoracic, or orthopedic surgeries.[3]
- Trauma: requiring an ICU admission.[1,4]

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, all patients should be kept appropriately hydrated (in context of any specific underlying disease: central nervous system tumor, hemoglobin SS disease, etc.) with oral or IV fluids as necessary and should be mobilized as early as possible.
- The care team should discuss the indication of any CVC daily and should promptly remove any CVC that is no longer indicated.

Mechanical Prophylaxis

- Mechanical prophylaxis refers to either sequential compression devices (SCDs) (preferred based on evidence) 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
    - 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)[13]
    - 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.
- The greatest risks associated with mechanical prophylaxis include increased fall risk (due to slipping on floor while wearing stockings or if patient attempts to ambulate while SCDs are still connected to pump) and increased potential for skin breakdown (if stockings bunch or fit improperly).
- 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[14] 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 little 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, 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.
- Pharmacologic therapy 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) should have a heparin assay obtained to validate appropriateness of prophylactic dosing.
- Typical VTE prophylaxis target for enoxaparin is between 0.1-0.4 units/mL (collected 4-hrs post-dose, using the heparin, low-molecular weight assay). Monitoring of unfractionated prophylactic heparin is rare.

Contraindications to pharmacologic prophylaxis include:

- Absolute:
  - Evidence of active hemorrhage
  - Epidural catheter or lumbar puncture performed within last hour[15]
  - Intravascular thrombolytic therapy within the last 24 hours
  - Known arterio-venous malformation, aneurysm, or moyamoya
  - Within acute period (within 72 hours) 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 100g/dL

  - Prior history of unexplained spontaneous hemorrhage
  - For Low Molecular Weight Heparin (LMWH): known allergy/anaphylaxis to LMWH[2] or pork products
- Relative:
  - Aspirin or other irreversible platelet inhibitor use within preceding 7 days
  - Known bleeding disorder/tendency
  - Recent hemorrhage
  - Uncontrolled hypertension
  - Unexplained coagulopathy
  - For Low Molecular Weight Heparin (LMWH): moderate or severe renal insufficiency, with creatinine clearance less than 30 mL/min[2]

Dosing:

- See CHCO Formulary for dosing for low molecular weight heparin (LMWH)/enoxaparin and 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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CLINICAL IMPROVEMENT TEAM MEMBERS

Brian Branchford, MD | Hematology

Beth Wathen, MSN, PNP | Clinical Practice Specialist

Bryce Clark, MPA, BSN, RN, CPHQ | Process Improvement Lead

Pamela D Reiter, PharmD | Clinical Pharmacy Specialist, Pediatric ICU

Joanne M. Hilden | Medical Director, Center for Cancer and Blood Disorders

Jon Kaufman, MD | Cardiology

Kelly Reichert, MS, FNP-C, CCRN | Clinical Practice Specialist

Ken Hammett | Clinical Data Analyst

Timothy Schardt, PharmD, BCPS | Clinical Pharmacist for Investigational Drug Services and Anticoagulation

Christine Peyton, MS, CPNP-AC | Clinical Practice Specialist

Mary Wintz, RN, MSN, CPHQ | Clinical Practice Specialist

Michael Wang, MD | Hematology

Beth Warren, MD | Hematology/Oncology Fellow

Jenae Neiman, RN, MBA | Quality and Process Improvement

Rebecca Coughlin | Quality and Process Improvement

Sherry Tomac | Process Improvement

Sondra Valdez, RN, BSN | Process Improvement

Daksha Ranade, MPH, MBA | Clinical Data Analyst

Melony Prince, RN, BSN | Operative Services

APPROVED BY

Clinical Pathways and Measures Committee – April 12, 2017
Venous Thromboembolism Core Team – March 28, 2017
Perioperative Services Operational Team (PSOT) – February 16, 2017
Perioperative Leadership Committee – January 19, 2017
Anticoagulation Safety – December 23, 2016

MANUAL/DEPARTMENT	Clinical Care Guidelines/Quality
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APPROVED BY	 Lalit Bajaj, MD Medical Director, Clinical Effectiveness

REVIEW | REVISION SCHEDULE

Scheduled for full review on date here April 12, 2021

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