

Venous Thromboembolism (VTE) Prophylaxis Guideline

Definitions:

Venous Thromboembolism (VTE) is a condition that occurs when a blood clot forms in a vein, which can block the flow of blood and cause swelling and pain. VTE can occur in any vein, but it most commonly affects the veins in the legs, pelvis, or arms. If a clot breaks free from the vein and travels through the bloodstream, it can become lodged in the lungs, causing a potentially life-threatening condition called a pulmonary embolism.

There are two main types of VTE: deep vein thrombosis (DVT) and pulmonary embolism (PE). DVT occurs when a blood clot forms in a deep vein, usually in the leg or thigh. PE occurs when a blood clot from another part of the body, usually the legs, breaks off and travels to the lungs, causing a blockage.

VTE prophylaxis is carried out using either drugs (eg, heparin) or mechanical methods (e.g., intermittent pneumatic compression device) that are effective for preventing deep vein thrombosis (DVT).

Incidence:

- The Presence of a central venous catheters is the most common risk factor for VTE In children⁽³⁹⁾. Since the risk factors and preventative measures for CVC related thrombosis are distinct from non CVL related thrombosis providers should refer to the DCMC EBOC Guidelines on Prevention of CVC related thrombosis for advice.
- The incidence of VTE in hospitalized children has increased by nearly 70% in the last decade. Young adults (18-21 years) and adolescents (14-17 years) had significantly increased rates of VTE compared with children (2-9 years) with an incidence rate ratio [IRR] 7.7, 95% CI 5.1-12.0; IRR 4.3, 95% CI 2.7-6.8, respectively.⁽³³⁾
- For the general pediatric ICU population, the incidence of VTE ranges from 0.3% - 0.9%.
 - The increase in this incidence is likely related to better detection methods, increased awareness, and advancements in the care of critically ill children.
 - Failure to provide prophylaxis can result in significant VTE morbidity including prolonged hospital length of stay, a 20% to 25 % incidence of post thrombotic syndrome, and increased hospitalization costs.
 - Excess inpatient costs can range from \$12,000 to \$28,000 per hospitalization.
- The incidence of VTE is higher in injured children than it is in the general pediatric population.
- Incidence ranges from 0.1% to 1.2% if the nearly one quarter of a million children hospitalized after trauma in the United States annually.

Etiology:

Most cases of VTE are caused by a hypercoagulable state that is promoted by a traumatic injury, an infection, or other states of illness. Virchow's triad, which consists of stasis, vessel wall abnormalities or intimal injury, and alterations in clotting cascades are all thought to contribute to hypercoagulability. There are however several developmental differences that help protect children from thrombosis. This includes improved thrombin regulation, decreased capacity to generate thrombin, increased levels of α -2-macroglobulin (a direct thrombin inhibitor) and reduced plasma concentrations of coagulation proteins.

Guideline Inclusion Criteria:

All admitted patients 12 years of age and older should be screened for [risk factors](#) and need for SCDs/ pharmacological prophylaxis to prevent VTE.

Guideline Exclusion Criteria:

Noted contraindications

Screening Evaluation:

Evaluate patient for deviation from normal mobility (altered mobility as compared to patient’s normal baseline) AND Key Risk Factors for VTE. This should be done daily during rounding starting on the first full day after admission.

Mobility Definitions:

Mobility can play a significant role in the development of Venous Thromboembolism (VTE).

- Baseline Mobility
 - Patient's usual state of ambulation.
 - If patients baseline mobility is altered prior to admission (i.e. wheelchair bound) then their mobility would not be considered altered.
- Altered Mobility
 - A temporary inability to ambulate freely
 - (i.e. bathroom privileges only or needs assistance to transfer to chair or ambulate)

Table 1 Risk Factors

Key Risk Factors for VTE
<p>Acute Medical Conditions ^(2,5,6, 11,14,15,16,19,20,22,23,26)</p> <ul style="list-style-type: none"> ● Sepsis or other high risk infection (CNS/head/neck infection, endocarditis, intra-abdominal or thoracic abscess, bone/joint infection, pneumonia) ● Active Cancer ● Pregnancy ● Active autoimmune, or rheumatologic disease ● Severe dehydration ● Major surgery within the past 30 days ● Critically ill (in Intensive care unit) ● Cardiac Disease (cardiomyopathy, Afib, single ventricle physiology and palliative surgery shunts)⁽³⁹⁾ ● Major Trauma (see examples) ^(1,5,9,11,12,13,19,22,23,26) <ul style="list-style-type: none"> ○ Traumatic brain injury

<ul style="list-style-type: none"> ○ Spinal cord injury^(21,26) ● Orthopedic Injury (> 1 lower extremity fracture/complex pelvic fracture) ● Orthopedic surgery of hip, knee, spine
<p>Chronic Conditions^(2,5,11,14,15,16,19,20,22,23,26,39)</p> <ul style="list-style-type: none"> ● Obesity <ul style="list-style-type: none"> ○ Under 18 years <ul style="list-style-type: none"> ■ BMI \geq 95th percentile for age ○ Over 18 years <ul style="list-style-type: none"> ■ BMI \geq 30 ● Inflammatory disorders <ul style="list-style-type: none"> ○ e.g., autoimmune disorders, SLE, IBD ● Thrombophilia <ul style="list-style-type: none"> ○ Inherited <ul style="list-style-type: none"> ■ e.g., Factor V Leiden, Prothrombin mutation, Antithrombin deficiency ○ Acquired <ul style="list-style-type: none"> ■ e.g., Antiphospholipid syndrome or protein losing disorder (nephrotic syndrome, PLE, chylous effusion) ● Sickle cell disease (SCD)
<p>Historical Conditions</p> <ul style="list-style-type: none"> ● Personal history of DVT/PE, VTE, stroke, or venous sinus thrombosis ● Family hx of DVT/PE, VTE in 1st degree relative <50 years old or multiple relatives of any age⁽³⁵⁾
<p>High Risk Medications</p> <ul style="list-style-type: none"> ● High risk medications^(4,11,12,14,15,17,19,20,22,23,26) <ul style="list-style-type: none"> ○ Asparaginase use within past 2 months ○ Estrogen use within past 2 months (oral contraceptives, patch, nuvaring, intradermal implant)

Table 2: Identify patients at-risk for VTE^(14,19,22)

Scoring Criteria		
<u>Low Risk</u>	<u>Moderate Risk</u>	<u>High Risk</u>
<ul style="list-style-type: none"> ● Baseline mobility and 0 VTE risk factors 	<ul style="list-style-type: none"> ● Altered mobility and 0 VTE risk factors ● Baseline mobility and \geq 1 VTE risk factor 	<ul style="list-style-type: none"> ● Altered mobility and \geq 1 VTE Risk Factor

Table 3: Practice Recommendations

Practice Recommendations
<p>Encourage Mobility - (All risk categories)</p> <ul style="list-style-type: none"> ○ Encourage to achieve the highest degree of mobility ○ Obtain PT consult for all medium and high risk patients
<p>Mechanical Prophylaxis - (Moderate and High Risk Patients)</p> <p>SEQUENTIAL COMPRESSION DEVICE (SCD)</p> <ul style="list-style-type: none"> ● Bedside nurse should be a part of this daily conversation <p>Contraindications^(1,4,7,14,20,22,23)</p> <ul style="list-style-type: none"> ● If one extremity is not available for use, the other extremity should be considered if not affected. ● Lower extremity conditions which result in significant pain with compression (e.g. solid tumor, vaso-occlusive pain episode in sickle cell disease) ● Extremity to be used has acute fracture or patient at high risk of fracture (e.g. osteogenesis imperfecta) ● Skin conditions affecting extremity (e.g., dermatitis, burns, recent skin graft, wound) ● Extremity has distal PIV ● DVT Suspected or existing in lower extremity (can place on contralateral limb) ● Unable to achieve fit due to size ● Concern SCD could be used to cause self-harm
<p>Pharmacological Prophylaxis - (High Risk patients)</p> <ul style="list-style-type: none"> ● Recommended in cases where patient \geq 18 years ● Strongly considered where patients < 18 years ● Send screening labs CBC, PT, PTT, Fibrinogen ● Consult Hematology before initiating <p>Contraindications</p> <ul style="list-style-type: none"> ● Unable to maintain platelet count \geq 50K/microL^(21,38) ● CNS Bleed: unless approved by Neurosurgery <ul style="list-style-type: none"> ○ Spinal hematoma⁽³⁶⁾ ○ Intracranial Hemorrhage⁽¹²⁾ ○ CNS Disorder with high risk of bleeding (Including but not limited to AVM, aneurysm, CNS mass or Moya Moya)^(12,19,22,26) ● Ongoing or uncontrolled bleeding^(22,23,26) <ul style="list-style-type: none"> ○ Including Solid Organ Injury⁽¹²⁾ ● Known Bleeding Disorder^(20,22,23,26)

- von Willebrand (vW) disease
- Hemophilia A/B
- Known platelet dysfunction disorder
- History of heparin-induced thrombocytopenia or allergy to Heparin^(12,26,21)
- Perioperative considerations
 - Surgical procedure scheduled within 24 hours^(8,12,22,23)
 - Postoperative patient within 72 hours of surgery
 - Unless cleared by surgeon
 - Postoperative patient within 96 hours of Neurosurgery⁽¹²⁾
 - Unless cleared by Neurosurgery
- Uncontrolled Hypertension⁽¹⁹⁾
 - ≥ 140/90
- Epidural catheter in place or recent removal (<12 hours)^(21,22,24)
 - Unless approved by Anesthesia

Consults: Before starting pharmacologic anticoagulation

- Hematology
 - All High Risk Patients
- Neurosurgery
 - Spinal hematoma
 - Intracranial Hemorrhage
 - CNS Disorder with high risk of bleeding- as listed above
 - Acute Spinal Cord Injury
- Orthopedics
 - Patients with orthopedic Injuries
 - Patients who have had surgery of hip, knee, spine
- Anesthesia
 - Epidural catheter in place
- Physical Therapy

Table 4: Prophylactic Anticoagulation

<i>Prophylactic Anticoagulation</i>
Prior to initiating Prophylactic Anticoagulation <ul style="list-style-type: none"> ● Obtain baseline CBC, PT/INR, PTT, and Fibrinogen ● Discontinue NSAIDs or aspirin
Initial Dosing of Enoxaparin Please refer to Enoxaparin pedi/neo prophylaxis/treatment power plan.

Methods

- P: Hospitalized children aged > 8 years or [minimum size for SCDs]
- I: Risk assessment and stratified VTE prophylaxis
- C: No prophylaxis
- O: Reduce VTE incidence without increased adverse events

Existing External Guidelines/Clinical Pathways

Existing External Guideline/Clinical Pathway	Organization and Author	Last Update
VTE Prophylaxis in Children and Adolescents	Cincinnati Children's Hospital	02/2014
VTE Prophylaxis in Children and Adolescents	Children's Hospital of Orange County (CHOC)	07/2017
VTE Prophylaxis for Hospitalized Surgical Pediatric Patients	MD Anderson Cancer Center	08/2017
VTE Risk Assessment	Children's Mercy Kansas City	05/2018
VTE screening Tool	Peyton Manning	12/2017
Pediatric VTE Screening Worksheet	Cook Children's	03/2018
Pediatric VTE Guideline & Algorithm	UT Health	06/2017
Children's Hospital of Philadelphia VTE Algorithm	CHOP	03/2023
University of Washington Pediatric Inpatient clinical practice Guideline	University of Washington	03/2023
Solutions for Patient Safety Non CVS Venous Thromboembolism		03/2003

Any published clinical guidelines have been evaluated for this review using the **AGREE II criteria**. The comparisons of these guidelines are found at the end of this document. **AGREE II criteria** include evaluation of: Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity of Presentation, Applicability, and Editorial Independence.

Review of Relevant Evidence: Search Strategies and Databases Reviewed

Search Strategies	Document Strategies Used
Search Terms Used:	Thromboembolism; VTE; DVT; research; pediatrics; lovenox or enoxaparin; prevention; guidelines; prophylaxis
Years Searched - All Questions	No specified limit
Language	English
Age of Subjects	Less than 21 years
Search Engines	Google scholar
EBP Web Sites	Cochrane Collaborative; Joanna Briggs Institute
Professional Organizations	American College of Thoracic Surgeons; Children's Oncology Group; Solutions for Patient Safety
Joint Commission	
Government/State Agencies	
Other	CINAHL, PubMed; Academic Search Premiere; Medline

Evidence Found with Searches

Check Type of Evidence Found	Summary of Evidence – All Questions	Number of Articles Obtained
<input checked="" type="checkbox"/>	Systematic Reviews	6
<input checked="" type="checkbox"/>	Meta-analysis articles	1
<input type="checkbox"/>	Randomized Controlled Trials	
<input checked="" type="checkbox"/>	Non-randomized studies	16
<input checked="" type="checkbox"/>	Review articles	2
<input type="checkbox"/>	Government/State agency regulations	
<input checked="" type="checkbox"/>	Professional organization guidelines, white papers, etc..	1
<input checked="" type="checkbox"/>	Other: Delphi study; Consensus paper	1

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Revision History

Original Date Approved: July 2023

Next Review Date: July 2027

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