Clinical Decision Support (CDS) Content and Health Level 7 (HL7)-compliant Knowledge Artifacts (KNARTs)

Cardiology: Inpatient Heparin Anticoagulation Protocol Clinical Content White Paper

Department of Veterans Affairs (VA)

Knowledge Based Systems (KBS)
Office of Informatics and Information Governance (OIIG)
Clinical Decision Support (CDS)

Clinical Decision Support (CDS) Content and Health Level 7 (HL7)-compliant Knowledge Artifacts (KNARTS): Cardiology: Inpatient Heparin Anticoagulation Protocol Clinical Content White Paper

by Department of Veterans Affairs (VA)

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Table 1: Relevant KNART Information: Cardiology: Inpatient Heparin Anticoagulation Protocol

Cardiology KNART	Associated CLIN
Inpatient Heparin Anticoagulation Protocol – Event Condition Action (ECA) Rule	CLIN0007CA
Inpatient Heparin Anticoagulation Protocol – Order Set	CLIN0008DA

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Introduction

The VA is committed to improving the ability of clinicians to provide care for patients while increasing quality, safety, and efficiency. Recognizing the importance of standardizing clinical knowledge in support of this goal, VA is implementing the Health Level 7 (HL7) Knowledge Artifact Specification for a wide range of VA clinical use cases. Knowledge Artifacts, referred to as (KNARTs), enable the structuring and encoding of clinical knowledge so the knowledge can be integrated with electronic health records to enable clinical decision support.

The purpose of this Clinical Content White Paper (CCWP) is to capture the clinical context and intent of KNART use cases in sufficient detail to provide the KNART authoring team with the clinical source material to construct the corresponding knowledge artifacts using the HL7 Knowledge Artifact Specification. This paper has been developed using material from a variety of sources: VA artifacts, clinical practice guidelines, evidence in the body of medical literature, and clinical expertise. After reviewing these sources, the material has been synthesized and harmonized under the guidance of VA subject matter experts to reflect clinical intent for this use case.

Unless otherwise noted, items within this white paper (e.g., documentation template fields, orderable items, etc.) are chosen to reflect the clinical intent at the time of creation. To provide an exhaustive list of all possible items and their variations is beyond the scope of this work.

Conventions Used

Conventions used within the knowledge artifact descriptions include:

- <obtain>: Indicates a prompt to obtain the information listed
  - The requested information should be obtained from the underlying system(s), if possible. If not, prompting the user for information may be required.
  - The technical and clinical notes associated with a section should be consulted for specific constraints on the information (e.g., time-frame, patient interview, etc.).
  - Default values: unless otherwise noted, <obtain> indicates to obtain the most recent. It is recognized that this default time-frame value may be altered by future implementations
- [...]: Square brackets enclose explanatory text that indicates some action on the part of the user, or general guidance to the clinical or technical teams. Examples include, but are not limited to:
  - [Begin ...], [End ...]: The start and end of specific areas to clearly delineate them for technical purposes.
  - [Activate ...]: Initiate another knowledge artifact or knowledge artifact section.
  - [Section Prompt: ...]: If this section is applicable, then the following prompt should be displayed to the user.
  - [Section Selection Behavior: ...]: Indicates technical constraints or considerations for the selection of items within the section.
  - [Attach: ...]: The specified item should be attached to the documentation template if available.
  - [Link: ...]: Rather than attaching, a link to the item should be included in the documentation template.
  - [Clinical Comment: ...]: Clinical rationale or guidance.
  - [Technical Note: ...]: Technical considerations or notes.
  - [If ...]: The beginning of a conditional section.
  - [Else, ...]: The beginning of the alternative branch of a conditional section.
- Check boxes: Indicates items that should be selected based upon the section selection behavior.

Chapter 1. Inpatient Heparin Anticoagulation Protocol

1. Clinical Context

[Begin Clinical Context.]

This set of KNARTs is intended to facilitate identification of inpatients requiring therapeutic anticoagulation management and initiate actions for anticoagulation management in conditions for which unfractionated intravenous (IV) heparin is indicated. The primary focus is on therapeutic anticoagulation with unfractionated intravenous heparin for patients with Venous thromboembolism (VTE) disease in acute care, with branches within the order set for subpopulations of patients. Within each branch, as appropriate, orders will include nursing orders and protocols, unfractionated intravenous heparin protocol (including dose and timing adjustments), and patient body weight and other measures needed to guide therapy.

Table 1.1. Clinical Context Domains

Target User	Hospitalists, Residents and other ordering providers involved in managing the patient cohort, Nursing
Patient	Adult inpatients requiring therapeutic anticoagulation management
Priority	Routine
Specialty	Medical or Surgical service
Location	Inpatient

[End Clinical Context.]

2. Knowledge Artifacts

[Begin Knowledge Artifacts.]

This section describes the CDS knowledge artifacts that are part of the Cardiology Inpatient Heparin Anticoagulation Protocol group, and include:

- Order Set
  - Orderable items associated with the management of inpatients requiring therapeutic anticoagulation
  - Includes logic for appropriate display of the order set
- Event-Condition-Action (ECA) Rule
  - Rule logic for sending notifications, activating order sets, and providing guidelines to clinicians
  - Actions may include sending notification to providers relevant to therapeutic anticoagulation management, activating order sets, or ensuring that clinicians have access to the current guidelines for Inpatient Heparin Anticoagulation

[End Knowledge Artifacts.]

Chapter 2. Event Condition Action (ECA) Rule

1. Knowledge Narrative

[Begin Knowledge Narrative.]

Venous thromboembolism (VTE) is a common medical problem that results in substantial morbidity and mortality. Despite its prevalence, clinicians often fail to appreciate the risks for VTE and often fail to recognize its signs and symptoms; this has led the National Academy of Sciences to cite it as a frequent cause of diagnostic error (National Academies of Sciences 2015). The problem of diagnostic error in VTE is compounded by therapeutic error—largely involving anticoagulants, which are perennially among the medications most often associated with adverse drug events (Shehab 2016). Remediating the problem requires the adoption of evidence-based guidelines, notably those of the American College of Chest Physicians (Kearon 2012), across an entire health system. Rendering such guidelines operational requires meticulous curation of an array of granular elements across the full spectrum of clinical conditions (e.g., medical versus surgical patients, orthopedic versus nonorthopedic surgical patients, intracranial/spinal surgery, etc.) and the management of numerous comorbidities and factors that have potential to complicate care and predispose patients to iatrogenic bleeding (hemorrhagic diathesis, renal failure, etc.). Deploying such decision support within the VA system offers the potential for improvement in patient care, and avoidance of preventable morbidity and mortality.

[End Knowledge Narrative.]

2. ECA Rules: Event Condition Action

Inpatient Heparin Anticoagulation Protocol
[Begin ECA Rules: Event Condition Action.]

2.1. Acute Deep vein thrombosis (DVT) of Leg Treated with Vitamin K Antagonist

[Begin Acute Deep vein thrombosis (DVT) of Leg Treated with Vitamin K Antagonist.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute deep venous thrombosis of the leg. The patient is receiving vitamin K antagonist therapy. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Deep vein thrombosis (DVT) of Leg Treated with Vitamin K Antagonist.]

2.2. High Clinical Suspicion of Acute Venous thromboembolism (VTE)

[Begin High Clinical Suspicion of Acute Venous thromboembolism (VTE).]

Event. The patient is admitted as an inpatient.

Conditions. The patient has a highly suspected acute venous thromboembolism. Diagnostic test results are not available. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.

[End High Clinical Suspicion of Acute Venous thromboembolism (VTE).]

2.3. Intermediate Clinical Suspicion of Acute Venous thromboembolism (VTE) and Results of Diagnostic Tests Expected to Be Delayed > 4 Hours

[Begin Intermediate Clinical Suspicion of Acute Venous thromboembolism (VTE) and Results of Diagnostic Tests Expected to Be Delayed > 4 Hours.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an intermediately suspected acute venous thromboembolism. Diagnostic test results are not available. Diagnostic test results are not expected to be received within the next 4 hours. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Intermediate Clinical Suspicion of Acute Venous thromboembolism (VTE) and Results of Diagnostic Tests Expected to Be Delayed > 4 Hours.]

2.4. Acute Isolated Distal Deep vein thrombosis (DVT) of Leg and Severe Symptoms or Risk Factors for Extension

[Begin Acute Isolated Distal Deep vein thrombosis (DVT) of Leg and Severe Symptoms or Risk Factors for Extension.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute isolated distal deep venous thrombosis of the leg. The patient has severe symptoms related to the deep venous thrombosis OR the patient has risk factors for extension. The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Isolated Distal Deep vein thrombosis (DVT) of Leg and Severe Symptoms or Risk Factors for Extension.]

2.5. Acute Isolated Distal Deep vein thrombosis (DVT) of Leg if Thrombus Extends within Distal System or into Proximal Veins

[Begin Acute Isolated Distal Deep vein thrombosis (DVT) of Leg if Thrombus Extends within Distal System or into Proximal Veins.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute isolated distal deep venous thrombosis of the leg. The thrombus extends within the distal veins OR the thrombus extends into the proximal veins. The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Isolated Distal Deep vein thrombosis (DVT) of Leg if Thrombus Extends within Distal System or into Proximal Veins.]

2.6. Acute Deep vein thrombosis (DVT) of Leg with Thrombectomy

[Begin Acute Deep vein thrombosis (DVT) of Leg with Thrombectomy.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute deep venous thrombosis of the leg. The patient is undergoing thrombectomy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Notify the provider that the patient should be considered for the same intensity and duration of anticoagulation therapy irrespective of the thrombosis removal. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Deep vein thrombosis (DVT) of Leg with Thrombectomy.]

2.7. Acute Proximal Deep vein thrombosis (DVT) of Leg and Inferior vena cava (IVC) Filter If Risk of Bleeding Resolves

[Begin Acute Proximal Deep vein thrombosis (DVT) of Leg and Inferior vena cava (IVC) Filter If Risk of Bleeding Resolves.]

Event. The patient is admitted as an inpatient

Conditions. The patient has an acute proximal deep venous thrombosis of the leg. The patient has received an inferior vena cava (IVC) filter. The patient does not have a current active risk of bleeding. The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Proximal Deep vein thrombosis (DVT) of Leg and Inferior vena cava (IVC) Filter If Risk of Bleeding Resolves.]

2.8. Acute Pulmonary Embolism (PE)

[Begin Acute Pulmonary Embolism (PE).]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute pulmonary embolism. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Pulmonary Embolism (PE).]

2.9. High Clinical Suspicion of Acute Pulmonary Embolism (PE)

[Begin High Clinical Suspicion of Acute Pulmonary Embolism (PE).]

Event. The patient is admitted as an inpatient.

Conditions. The patient has a highly suspected acute pulmonary embolism. Diagnostic test results are not available. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End High Clinical Suspicion of Acute Pulmonary Embolism (PE).]

2.10. Intermediate Clinical Suspicion of Acute Pulmonary Embolism (PE) if Results of Diagnostic Tests Expected to Be Delayed > 4 Hours

[Begin Intermediate Clinical Suspicion of Acute Pulmonary Embolism (PE) if Results of Diagnostic Tests Expected to Be Delayed > 4 Hours.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an intermediately suspected acute pulmonary embolism. Diagnostic test results are not available. Diagnostic test results are not expected to be received within the next 4 hours. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Intermediate Clinical Suspicion of Acute Pulmonary Embolism (PE) if Results of Diagnostic Tests Expected to Be Delayed > 4 Hours.]

2.11. Acute Pulmonary Embolism (PE) and Inferior vena cava (IVC) Filter if Risk of Bleeding Resolves

[Begin Acute Pulmonary Embolism (PE) and Inferior vena cava (IVC) Filter if Risk of Bleeding Resolves.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute pulmonary embolism. The patient has received an inferior vena cava (IVC) filter. The patient does not have a current active risk of bleeding. The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Pulmonary Embolism (PE) and Inferior vena cava (IVC) Filter if Risk of Bleeding Resolves.]

2.12. Asymptomatic Pulmonary Embolism (PE)

[Begin Asymptomatic Pulmonary Embolism (PE).]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an asymptomatic pulmonary embolism. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Notify the provider that the patient should be considered for the same anticoagulation therapy irrespective of the absence of symptoms related to the pulmonary embolism. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Asymptomatic Pulmonary Embolism (PE).]

2.13. Acute Upper-Extremity Deep vein thrombosis (DVT) That Involves Axillary or More Proximal Veins

[Begin Acute Upper-Extremity Deep vein thrombosis (DVT) That Involves Axillary or More Proximal Veins.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute upper extremity deep venous thrombosis involving the axillary veins OR the patient has an acute upper extremity deep venous thrombosis involving more proximal veins. The patient is not receiving low-molecular-weight heparin. The patient is not receiving fondaparinux. The patient is not receiving intravenous unfractionated heparin. The patient is not receiving subcutaneous unfractionated heparin. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Upper-Extremity Deep vein thrombosis (DVT) That Involves Axillary or More Proximal Veins.]

2.14. Acute Upper-Extremity Deep vein thrombosis (DVT) with Thrombolysis

[Begin Acute Upper-Extremity Deep vein thrombosis (DVT) with Thrombolysis.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has an acute upper extremity deep venous thrombosis. The patient is undergoing thrombolysis. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Notify the provider that the patient should be considered for the same intensity and duration of anticoagulation therapy irrespective of the thrombolysis. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Acute Upper-Extremity Deep vein thrombosis (DVT) with Thrombolysis.]

2.15. Symptomatic Splanchnic Vein Thrombosis

[Begin Symptomatic Splanchnic Vein Thrombosis.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has symptomatic splanchnic vein thrombosis (defined as portal, mesenteric, splenic, or a combination of these). The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Symptomatic Splanchnic Vein Thrombosis.]

2.16. Symptomatic Hepatic Vein Thrombosis

[Begin Symptomatic Hepatic Vein Thrombosis.]

Event. The patient is admitted as an inpatient.

Conditions. The patient has symptomatic hepatic vein thrombosis. The patient is not receiving anticoagulation therapy. The patient is not pregnant.

Actions. Notify the provider that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred. Generate the Inpatient Heparin Anticoagulation Order Set KNART.
[End Symptomatic Hepatic Vein Thrombosis.]

2.17. Perioperative Anticoagulation with Mechanical Heart Valve, Atrial Fibrillation, or Venous thromboembolism (VTE) at High Risk for Additional Thromboembolism

[Begin Perioperative Anticoagulation with Mechanical Heart Valve, Atrial Fibrillation, or Venous thromboembolism (VTE) at High Risk for Additional Thromboembolism.]

Event. The patient is admitted as an inpatient.

Conditions. The patient is undergoing elective surgery. The patient is receiving vitamin K antagonist therapy. The patient has a mechanical heart valve OR the patient has atrial fibrillation OR the patient has a venous thromboembolism. The patient has a high risk for thromboembolism. The patient is not receiving bridging anticoagulation therapy.

Actions. Notify the provider that the patient should be managed according to the American College of Chest Physicians perioperative anticoagulation management guidelines and include a link to the guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278059/), (Douketis, 2012, section 2.4).

[Clinical Comment: “Bridging anticoagulation therapy” that is referred to in the Conditions statement for this rule refers to “the administration of a short-acting anticoagulant, consisting of subcutaneous (SC) low-molecular-weight heparin (LMWH) or IV unfractionated heparin (UFH), for an ~10- to 12-day period during

interruption of VKA therapy when the international normalized ratio (INR) is not within a therapeutic range" (Douketis, 2012, section 2.4).]

[Clinical Comment: The link to the guidelines noted in the Action statement of this ECA Rule is the Douketis 2012 article "Perioperative Management of Antithrombotic Therapy", and is the article that the URL in the Action statement links to. Note that a large majority of individuals who have a mechanical heart valve, or atrial fibrillation, or a current VTE would also be on current anticoagulation therapy such as a vitamin K antagonist (for example, coumadin). The Douketis article contains detailed discussion and recommendations for managing these patients when they require surgery. For example, for this group of patients who also are considered high risk for thromboembolism, the Douketis article recommends discontinuing vitamin K antagonist treatment and instituting bridging anticoagulation therapy, and gives specific guidelines regarding the choice of timing for implementing each of these actions.]
[End Perioperative Anticoagulation with Mechanical Heart Valve, Atrial Fibrillation, or Venous thromboembolism (VTE) at High Risk for Additional Thromboembolism.]

2.18. Perioperative Anticoagulation with Unfractionated heparin (UFH) - Timing of Pre-surgical Stopping of UFH

[Begin Perioperative Anticoagulation with Unfractionated heparin (UFH) - Timing of Pre-surgical Stopping of UFH.]

Event. The patient is admitted as an inpatient.

Conditions. The patient is undergoing elective surgery. The patient is receiving bridging anticoagulation with a therapeutic dose of intravenous unfractionated heparin.

Actions. Notify the provider that the patient should be managed according to the American College of Chest Physicians perioperative anticoagulation management guidelines and include a link to the guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278059/), (Douketis, 2012, section 4.2).
[End Perioperative Anticoagulation with Unfractionated heparin (UFH) - Timing of Pre-surgical Stopping of UFH.]

2.19. Pregnancy with Antiphospholipid Antibodies (APLA) Syndrome

[Begin Pregnancy with Antiphospholipid Antibodies (APLA) Syndrome.]

Event. The patient is admitted as an inpatient.

Conditions. The patient is pregnant. The patient meets laboratory criteria for antiphospholipid antibody (APLA) syndrome. The patient has a history of >= 3 pregnancy losses.

Actions. Notify the provider that the patient should be managed according to the American College of Chest Physicians pregnancy anticoagulation guidelines and include a link to the guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278054/), (Bates, 2012, abstract).
[End Pregnancy with Antiphospholipid Antibodies (APLA) Syndrome.]

2.20. Pregnancy with Mechanical Heart Valve

[Begin Pregnancy with Mechanical Heart Valve.]

Event. The patient is admitted as an inpatient.

Conditions. The patient is pregnant. The patient has a mechanical heart valve.

Actions. Notify the provider that the patient should be managed according to the American College of Chest Physicians pregnancy anticoagulation guidelines and include a link to the guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278054/), (Bates, 2012, section 12/1/1).
[End Pregnancy with Mechanical Heart Valve.]
[End ECA Rules: Event Condition Action.]

Chapter 3. Order Set

[Begin Order Set.]

1. Knowledge Narrative

[Begin Knowledge Narrative.]

[See Clinical Context in Chapter 1.]
[End Knowledge Narrative.]

2. Medications

[Begin Medications.]

[Technical Note: This section should be available for all patients for whom the ECA rule Inpatient Heparin Anticoagulation Protocol is triggered.]

Acute DVT of Leg Treated with Vitamin K Antagonist

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- fondaparinux,
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56–68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68–82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50-100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight > 100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

High Clinical Suspicion of Acute VTE

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- fondaparinux,
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight <= 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56-68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight <50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight > 100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight solution intravenous 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Intermediate Clinical Suspicion of Acute VTE and Results of Diagnostic Tests Expect to Be Delayed > 4 Hours

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- fondaparinux,

- subcutaneous unfractionated heparin,

- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight <= 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56-68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily

- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours

- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Isolated Distal DVT of Leg and Severe Symptoms or Risk Factors for Extension

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours

- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Isolated Distal DVT of Leg if Thrombus Extends within Distal System or into Proximal Veins

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- subcutaneous unfractionated heparin,

- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =<56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Deep Vein Thrombosis of Leg with Thrombosis Removal

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012); (http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The provider should be advised that the patient should be considered for the same intensity and duration of anticoagulation therapy irrespective of the thrombosis removal.]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight <50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Proximal Deep Vein Thrombosis of Leg and Inferior Vena Cava Filter if Risk of Bleeding Resolves

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]
[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,

- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),

- subcutaneous unfractionated heparin,

- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin.]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Pulmonary Embolism

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012); (http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Clinical Comment: The provider should be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred; the options for this patient subpopulation cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered: dabigatran (a drug of choice in patients without cancer), rivaroxaban (a drug of choice in patients without cancer), apixaban (a drug of choice in patients without cancer), edoxaban, warfarin (preferred over low molecular weight heparin in patients without cancer), dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban), enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban), subcutaneous unfractionated heparin, and intravenous heparin. Links to the American College of Chest Physicians VTE treatment guidelines should be provided (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/; http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf). Links to related KNARTs should be created as such KNARTs become available.]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight <= 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

High Clinical Suspicion of Acute Pulmonary Embolism

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight <= 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Intermediate Clinical Suspicion of Acute Pulmonary Embolism if Results of Diagnostic Tests Expected to Be Delayed >4 Hours

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Pulmonary Embolism and Inferior Vena Cava Filter if Risk of Bleeding Resolves

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Asymptomatic Pulmonary Embolism

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The provider should be advised that the patient should be considered for the same anticoagulation therapy irrespective of the absence of symptoms related to the pulmonary embolism.]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight <= 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Upper-Extremity Deep Vein Thrombosis that Involves Axillary or More Proximal Veins

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily
- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Acute Upper-Extremity Deep Vein Thrombosis with Thrombolysis

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous fondaparinux,
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Section Prompt: A patient with Acute Upper-Extremity Deep Vein Thrombosis with Thrombolysis should be considered for the same intensity and duration of anticoagulation therapy irrespective of the thrombolysis.]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following fondaparinux order should be available for patients with body weight < 50 kg.]

[Section Prompt: For patients with body weight < 50 kg.]

- ☐ Fondaparinux 5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight =>50–100 kg.]

[Section Prompt: For patients with body weight =>50-100 kg.]

- ☐ Fondaparinux 7.5 mg solution subcutaneous, daily

[Technical Note: The following fondaparinux order should be available for patients with body weight > 100 kg.]

[Section Prompt: For patients with body weight >100 kg.]

- ☐ Fondaparinux 10 mg solution subcutaneous, daily

- ☐ Unfractionated heparin 15,000 U solution subcutaneous every 12 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Symptomatic Splanchnic Vein Thrombosis

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

> If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.
>
> If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.
>
> If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Symptomatic Hepatic Vein Thrombosis

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Be advised that the patient is a candidate for intravenous unfractionated heparin, although other options may be preferred based on individual patient characteristics, clinical co-conditions or co-morbidities, and patient values and preferences. The medication treatment options for this patient subpopulation include the following, but the options cannot be strictly rank-ordered in terms of a universal preference, and individual patient circumstances must be considered in selecting the optimal treatment:

- dalteparin (a drug of choice in patients with cancer and in patients with recurrent venous thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- enoxaparin (a drug of choice in patients with cancer and in patients with recurrent venous
- thromboembolism on warfarin, rivaroxaban, apixaban, or edoxaban),
- subcutaneous unfractionated heparin,
- intravenous heparin.

These are links to the American College of Chest Physicians VTE treatment guidelines:
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278049/), (Kearon, 2012);
(http://journal.chestnet.org/article/S0012-3692(15)00335-9/pdf), (Kearon, 2016).]

[Technical Note: The following dalteparin order should be available for patients with body weight =< 56 kg.]

[Section Prompt: For patients with body weight =< 56 kg.]

- ☐ Dalteparin 10,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >56–68 kg.]

[Section Prompt: For patients with body weight >56-68 kg.]

- ☐ Dalteparin 12,500 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >68–82 kg.]

[Section Prompt: For patients with body weight >68-82 kg.]

- ☐ Dalteparin 15,000 IU solution subcutaneous, daily

[Technical Note: The following dalteparin order should be available for patients with body weight >82 kg.]

[Section Prompt: For patients with body weight >82 kg.]

- ☐ Dalteparin 18,000 IU solution subcutaneous, daily
- ☐ Enoxaparin 1 mg/kg solution subcutaneous every 12 hours
- ☐ Enoxaparin 1.5 mg/kg solution subcutaneous every 24 hours

[Technical Note: The following orders are for use in management of IV heparin]

[Section Prompt: Orders for Initiation and Maintenance of IV Heparin infusion:]

[Section Selection Behavior: One or both boxes may be selected]

☐ Heparin 80 U/kg body weight intravenous solution 1 time bolus now

☐ Start Heparin 18 U/kg body weight/hour IV continuous infusion. Draw aPTT lab 6 hours after initiating heparin infusion, and for any aPTT lab result titrate heparin IV infusion per the following protocol:

If aPTT < 35 sec, give 80 U/kg heparin bolus, then increase heparin infusion rate by 4 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 35-45 sec, give 40 U/kg heparin bolus, then increase heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT 46-70 sec, no change in heparin infusion rate. If both the current and the previous aPTT value are >=46 and <=70, then draw the next aPTT lab with the next morning lab draw. Otherwise, draw aPTT lab in 6 hours.

If aPTT 71-90 sec, then decrease heparin infusion rate by 2 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

If aPTT > 90 sec, hold the heparin infusion for 1 hour, then decrease heparin infusion rate by 3 U/kg/h, and draw aPTT lab 6 hours after heparin infusion rate change.

Perioperative Anticoagulation with Mechanical Heart Valve, Atrial Fibrillation or Venous Thromboembolism at High Risk for additional (perioperative)Thromboembolism

[Technical note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Perioperative patients with Mechanical Heart Valve, Atrial Fibrillation or Venous Thromboembolism at High Risk for additional (perioperative)Thromboembolism should be managed according to the American College of Chest Physicians perioperative anticoagulation management guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278059/), (Douketis, 2012, Section 2.4).]

Perioperative Anticoagulation with Unfractionated Heparin Timing of Pre-surgical Stopping of Unfractionated Heparin

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: Timing of Pre-surgical stoppage of Unfractionated Heparin should be managed according to the American College of Chest Physicians perioperative anticoagulation management guidelines. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278059/), (Douketis, 2012, Section 4.2).]

Pregnancy with Antiphospholipid Antibody Syndrome

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: The provider should be advised that pregnant patients with Antiphospholipid Antibody Syndrome should be managed according to the American College of Chest Physicians pregnancy anticoagulation guidelines (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278054/), (Bates, 2012, Section 10.2.3).]

Pregnancy with Mechanical Heart Valve

[Technical Note: This subsection should be available for all patients meeting the conditions for the subsection as specified in the ECA rule Inpatient Heparin Anticoagulation Protocol.]

[Section Prompt: The provider should be advised that the patient should be managed according to the American College of Chest Physicians pregnancy anticoagulation guidelines. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278054/), (Bates, 2012, Section 12.1.1).]
[End Medications.]

3. Laboratory Tests

[Begin Laboratory Tests.]

[Technical Note: This section should be available for all patients for whom the ECA rule Inpatient Heparin Anticoagulation Protocol is triggered.]

- ☐ Complete blood count 1 time now
- ☐ Complete blood count 1 time in the morning
- ☐ Basic metabolic profile 1 time now
- ☐ Basic metabolic profile 1 time in the morning

[If the following order for activated partial thromboplastin time is placed, the provider should be prompted to consider discontinuing the activated partial thromboplastin time order after the heparin dose has been stable for 48 hours.]

- ☐ Activated partial thromboplastin time every 6 hours routine
- ☐ International normalized ratio daily 1 time routine

[End Laboratory Tests.]

[End Order Set.]

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Appendix A. Acronyms

Acronyms	Description
APLA	Antiphospholipid Antibody
CCWP	Clinical Content White Paper
CDS	Clinical Decision Support
DVT	Deep Vein Thrombosis
ECA	Event Condition Action
HL7	Health Level 7
IV	Intravenous
IVC	Inferior vena cava
KBS	Knowledge Based Systems
KNART	Knowledge Artifact
LMWH	Low-molecular-weight heparin
OIIG	Office of Informatics and Information Governance
PE	Pulmonary Embolism
SC	Subcutaneous
SME	Subject Matter Expert
TO	Task Order
UFH	Unfractionated Heparin
VA	Department of Veteran Affairs
VAMC	VA Medical Center
VTE	Venous Thromboembolism