

# 2024 MUC List Attachments: Hospital Harm: Anticoagulant-Related Major Bleeding

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FEBRUARY 2024



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# Table of Contents

## Contents

<b>1. SUPPLEMENTAL EVIDENCE (CLINICAL PRACTICE GUIDELINES) .....</b>	<b>4</b>
1.1 Evidence-Based Management of Anticoagulant Therapy: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012) .....	4
1.2 Prevention of VTE in Nonsurgical Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012) .....	8
1.3 Antithrombotic and Thrombolytic Therapy for Ischemic Stroke: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012) .....	10
1.4 Prevention of VTE in Nonorthopedic Surgical Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012) .....	12
1.5 Prevention of VTE in Orthopedic Surgery Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012) .....	15
1.6 Antithrombotic Therapy for VTE Disease: Second Update of the CHEST Guideline and Expert Panel Report (2021).....	17
1.7 American Society of Hematology (ASH) Guidelines for Management of Venous Thromboembolism: Optimal Management of Anticoagulation Therapy (2018) .....	21
1.8 Reversal of Direct Oral Anticoagulants (DOAC): Guidance from the Anticoagulation Forum (2019) .....	26
1.9 European Society of Anaesthesiology: 2018 .....	28
1.9 European Society of Anaesthesiology (ESA): Neurosurgery.....	35
<b>2. SUPPLEMENTAL EVIDENCE (ADDITIONAL EVIDENCE) .....</b>	<b>36</b>
2.1 The Anticoagulation Forum and National Quality Forum - Advancing Anticoagulation Stewardship: A Playbook (NQF, 2022) .....	36
2.2 The Anticoagulation Forum: Core Elements of Anticoagulation and Stewardship Program Guide (2019).....	36
2.3 The Joint Commission National Patient Safety Goal 03.05.01: Reduce the Likelihood of Patient Harm Associated with the Use of Anticoagulant Therapy (2021). Effective January 2022 for Hospital Program.....	37
2.4 National Quality Forum (NQF). (2010, April). Safe Practices for Better Healthcare – 2010 Update: A Consensus Report. Washington, D.C. ....	40

2.5 Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions—Part II: Recommendations. Management of Anticoagulation and/or Antiplatelet Agents Before and after A Procedure (2019) .....	40
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# 1. Supplemental Evidence (Clinical Practice Guidelines)

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## 1.1 Evidence-Based Management of Anticoagulant Therapy: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012)

[Holbrook, A., Schulman, S., Witt, D. M., Vandvik, P. O., Fish, J., Kovacs, M. J., Svensson, P. J., Veenstra, D. L., Crowther, M., & Guyatt, G. H. \(2012\). Evidence-based management of anticoagulant therapy: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. \*Chest\*, 141\(2 Suppl\), e152S–e184S.](#)

Guyatt et al. (2012) is the methodology document for all guidelines included in the ACCP Antithrombotic Therapy and Prevention of Thrombosis, 9th ed (2012).

[Guyatt, G. H., Norris, S. L., Schulman, S., Hirsh, J., Eckman, M. H., Akl, E. A., Crowther, M., Vandvik, P. O., Eikelboom, J. W., McDonagh, M. S., Lewis, S. Z., Gutterman, D. D., Cook, D. J., & Schünemann, H. J. \(2012\). Methodology for the development of antithrombotic therapy and prevention of thrombosis guidelines: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. \*Chest\*, 141\(2 Suppl\), 53S–70S.](#)

The American College of Chest Physicians (ACCP) Clinical Practice Guideline on the Management of Anticoagulant Therapy: Antithrombotic Therapy and the Prevention of Thrombosis, is an evidence based guideline. The guideline includes recommendations for 23 questions, of which only two are strong rather than weak recommendations. The ACCP assembled a panel of clinical experts, information scientists, decision scientists, and systematic review and guideline methodologists. The ACCP aimed to summarize and use randomized controlled trial (RCT) evidence to inform recommendations for clinicians, we found only lower-quality evidence to address most of our questions. Despite this low threshold, evidence was unavailable for several important clinical management questions. When randomized trials were available, confidence in estimates often decreased because of indirectness (surrogate outcomes) and imprecision (wide CIs). The guidelines review the evidence supporting each recommendation.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations, which were subject to public

comment. The recommendations were graded as strong when desirable effects were much greater than undesirable effects or vice versa. Strong recommendations were worded as “We recommend” and labeled as (1). Recommendations were graded as weak when desirable effects were not clearly greater or less great than undesirable effects. Weak recommendations were worded as “We suggest” and labeled as (2) (**Table 1**).

Strong or conditional practice recommendations are generated on an ACCP GRADE modified approach on high (A), moderate (B), or low (C) evidence (**Table 2**). The ACCP modified approach does not have a group for very low evidence.

The key guideline recommendation statements that inform the proposed measure can be found in Table 3.

**Table 1: ACCP Antithrombotic Therapy and Prevention of Thrombosis Collective Guidelines (2012) Strength of Recommendation Criteria**

Strength of Recommendation	Rationale
Strong Recommendation (1)	<b>“We recommend.”</b> We can be confident that the desirable effects of an intervention outweigh its undesirable effects.
Weak /Conditional Recommendation (2)	<b>“We suggest.”</b>
Not Graded / Best Practice Statement	<b>“Not Graded.”</b> This statement was used, typically, to provide guidance based on common sense or where the topic does not allow adequate application of evidence.

**Table 2: ACCP Antithrombotic Therapy and Prevention of Thrombosis Collective Guidelines (2012) Level of Evidence**

Level of Evidence	Quality of Evidence
A	High quality of evidence
B	Moderate quality of evidence
C	Low quality of evidence

**Table 3: Evidence-Based Management of Anticoagulant Therapy: Antithrombotic Therapy and Prevention of Thrombosis (2012)**  
**Additional Guidelines that Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>VKA—Initiation of Therapy</b>			
2.2	For patients initiating VKA therapy, we recommend against the routine use of pharmacogenetic testing for guiding doses of VKA	1	B
2.3	For patients with acute VTE, we suggest that VKA therapy be started on day 1 or 2 of LMWH or UFH therapy rather than waiting for several days to start	2	C
<b>Maintenance Treatment With VKAs</b>			
3.8	For patients taking VKAs, we suggest avoiding concomitant treatment with nonsteroidal anti-inflammatory drugs (NSAIDs), including cyclooxygenase (COX)-2-selective NSAIDs, and certain antibiotics	2	C
3.8	For patients taking VKAs, we suggest avoiding concomitant treatment with antiplatelet agents except in situations where benefit is known or is highly likely to be greater than harm from bleeding, such as patients with mechanical valves, patients with acute coronary syndrome, or patients with recent coronary stents or bypass surgery	2	C
<b>VKA—Monitoring</b>			
4.1 (Included in MUC form)	For patients treated with VKAs, we recommend a therapeutic INR range of 2.0 to 3.0 (target INR of 2.5) rather than a lower (INR ,2) or higher (INR 3.0-5.0) range (Included in MUC form)	1	B
4.2	For patients with antiphospholipid syndrome with previous arterial or venous thromboembolism, we suggest VKA therapy titrated to a moderate-intensity INR range (INR 2.0-3.0) rather than higher intensity (INR 3.0-4.5)	2	B
<b>VKA—Discontinuation of Therapy</b>			
5.0	For patients eligible to discontinue treatment with VKA, we suggest abrupt discontinuation rather than gradual tapering of the dose to discontinuation	2	C
<b>Parenteral Anticoagulants</b>			

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
6.1	For patients starting IV unfractionated heparin (UFH), we suggest that the initial bolus and the initial rate of the continuous infusion be weight adjusted (bolus 80 units/kg followed by 18 units/kg per h for VTE; bolus 70 units/kg followed by 15 units/kg per h for cardiac or stroke patients) or use of a fixed dose (bolus 5,000 units followed by 1,000 units/h) rather than alternative regimens	2	C
<b>LMWH—Dosing</b>			
7.1	For patients receiving therapeutic LMWH who have severe renal insufficiency (calculated creatinine clearance , 30 mL/min), we suggest a reduction of the dose rather than using standard doses	2	C
<b>Fondaparinux—Dosing</b>			
8.1	For patients with VTE and body weight over 100 kg, we suggest that the treatment dose of fondaparinux be increased from the usual 7.5 mg to 10 mg daily SC	2	C
<b>Prevention and Management of Anticoagulant Complications</b>			
9.1(a)	For patients taking VKAs with INRs between 4.5 and 10 and with no evidence of bleeding, we suggest against the routine use of vitamin K	2	B
9.1(b)	For patients taking VKAs with INRs > 10.0 and with no evidence of bleeding, we suggest that oral vitamin K be administered	2	C
9.2	For patients initiating VKA therapy, we suggest against the routine use of clinical prediction rules for bleeding as the sole criterion to withhold VKA therapy	2	C
9.3	We suggest the additional use of vitamin K 5 to 10 mg administered by slow IV injection rather than reversal with coagulation factors alone	2	C

## 1.2 Prevention of VTE in Nonsurgical Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012)

[Kahn, S. R., Lim, W., Dunn, A. S., Cushman, M., Dentali, F., Akl, E. A., Cook, D. J., Balekian, A. A., Klein, R. C., Le, H., Schulman, S., & Murad, M. H. \(2012\). Prevention of VTE in nonsurgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest, 141\(2 Suppl\), e195S–e226S.](#)

This 2012 guideline focuses on the prevention of VTE in nonsurgical patients. The methodology for these guidelines follows the same approach as the other guidelines presented in the 9<sup>th</sup> edition (Guyatt et al. (2012)). A description of the methodology and grading can be found in Table 1 and Table 2 in section 1.1. This is an evidence based guideline.

Panel members conducted literature searches to update the existing evidence base, seeking systematic reviews and trials published since the previous iteration of the guidelines, and rated the quality of the evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework. The panel considered the balance of benefits and harm, patients' values and preferences, and patients' context and resources to develop weak or strong recommendations.

The recommendations were graded as strong when desirable effects were much greater than undesirable effects or vice versa. Strong recommendations were worded as "We recommend" and labeled as (1). Recommendations were graded as weak when desirable effects were not clearly greater or less great than undesirable effects. Weak recommendations were worded as "We suggest" and labeled as (2).

Strong or conditional practice recommendations are generated on an ACCP GRADE modified approach on high (A), moderate (B), or low (C) evidence. The ACCP modified approach does not have a group for very low evidence.

The key guideline recommendation statements that inform the proposed measure can be found in Table 4.



**Table 4: Prevention of VTE in Nonsurgical Patients (2012) Additional Guidelines That Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Hospitalized Acutely Ill Medical Patients</b>			
2.3	For acutely ill hospitalized medical patients at increased risk of thrombosis, we recommend anticoagulant thromboprophylaxis with low molecular-weight heparin [LMWH], low-dose unfractionated heparin (LDUH) bid, LDUH tid, or fondaparinux.	1	B
2.71	For acutely ill hospitalized medical patients who are bleeding or at high risk for bleeding, we recommend against anticoagulant thromboprophylaxis.	1	B
2.72	For acutely ill hospitalized medical patients at increased risk of thrombosis who are bleeding or at high risk for major bleeding, we suggest  When bleeding risk decreases, and if VTE risk persists, we suggest that pharmacologic thromboprophylaxis be substituted for mechanical thromboprophylaxis (Grade 2B) .	2	B
2.8	In acutely ill hospitalized medical patients who receive an initial course of thromboprophylaxis, we suggest against extending the duration of thromboprophylaxis beyond the period of patient immobilization or acute hospital stay.	2	B
<b>Critically Ill Patients</b>			
3.4.3	For critically ill patients, we suggest using LMWH or LDUH thromboprophylaxis over no prophylaxis.	2	B

### **1.3 Antithrombotic and Thrombolytic Therapy for Ischemic Stroke: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012)**

[Lansberg, M. G., O'Donnell, M. J., Khatri, P., Lang, E. S., Nguyen-Huynh, M. N., Schwartz, N. E., Sonnenberg, F. A., Schulman, S., Vandvik, P. O., Spencer, F. A., Alonso-Coello, P., Guyatt, G. H., & Akl, E. A. \(2012\). Antithrombotic and thrombolytic therapy for ischemic stroke: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest, 141\(2 Suppl\), e601S–e636S.](#)

This guideline focuses on the prevention of antithrombotic and thrombolytic therapy for ischemic stroke. The methodology for these guidelines follows the same approach as the other guidelines presented in the 9<sup>th</sup> edition (Guyatt et al. (2012)). A description of the methodology and grading can be found in Table 1 and Table 2 in section 1.1. This is an evidence based guideline.

A systematic review of the literature was conducted in November 2009. A systematic approach developed by the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) Working Group was used as the foundation to judge the quality of evidence and to determine the strength of our recommendations. A random effects model was used for all meta-analyses, with the exception of analyses that included only two studies or analyses that included a single dominant study with a markedly different result from the other studies.

The recommendations were graded as strong when desirable effects were much greater than undesirable effects or vice versa. Strong recommendations were worded as “We recommend” and labeled as (1). Recommendations were graded as weak when desirable effects were not clearly greater or less great than undesirable effects. Weak recommendations were worded as “We suggest” and labeled as (2).

Strong or conditional practice recommendations are generated on an ACCP GRADE modified approach on high (A), moderate (B), or low (C) evidence. The ACCP modified approach does not have a group for very low evidence.

The key guideline recommendation statements that inform the proposed measure can be found in Table 5.

**Table 5: Antithrombotic and Thrombolytic Therapy for Ischemic Stroke (2012) Additional Guidelines That Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
VTE Prevention in Ischemic Stroke			
3.1.1	In patients with acute ischemic stroke and restricted mobility, we suggest prophylactic-dose subcutaneous heparin (unfractionated heparin [UFH] or low-molecular-weight heparin [LMWH]) or intermittent pneumatic compression devices over no prophylaxis.	2	B
3.1.2	In patients with acute ischemic stroke and restricted mobility, we suggest prophylactic-dose LMWH over prophylactic-dose UFH.	2	B
Cerebral Venous Sinus Thrombosis			
5.1	In patients with cerebral venous sinus thrombosis, we suggest anticoagulation over no anticoagulant therapy during the acute and chronic phases.	2	C

#### **1.4 Prevention of VTE in Nonorthopedic Surgical Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012)**

Gould, M. K., Garcia, D. A., Wren, S. M., Karanicolas, P. J., Arcelus, J. I., Heit, J. A., & Samama, C. M. (2012). Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest, 141(2 Suppl), e227S–e277S.

This guideline focuses on the prevention VTE in nonorthopedic surgical patients. The methodology for these guidelines follows the same approach as the other guidelines presented in the 9<sup>th</sup> edition (Guyatt et al. (2012)). A description of the methodology and grading can be found in Table 1 and Table 2 in section 1.1. This is an evidence based guideline.

To develop recommendations for thromboprophylaxis among patients undergoing nonorthopedic surgery, the ACCP used the population, intervention, comparator, outcome format to generate a list of questions. Through the evidence review, the ACCP attempted to identify all relevant studies that compared one or more interventions for thromboprophylaxis with any alternative (including placebo or no treatment) among nonorthopedic surgical patients. ACCP favored studies or systematic reviews that limited inclusion to the target populations and considered indirect evidence from other populations when direct evidence was limited in quantity or quality.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations, which were subject to public comment. The recommendations were graded as strong when desirable effects were much greater than undesirable effects or vice versa. Strong recommendations were worded as “We recommend” and labeled as (1). Recommendations were graded as weak when desirable effects were not clearly greater or less great than undesirable effects. Weak recommendations were worded as “We suggest” and labeled as (2).

Strong or conditional practice recommendations are generated on an ACCP GRADE modified approach on high (A), moderate (B), or low (C) evidence. The ACCP modified approach does not have a group for very low evidence.

The key guideline recommendation statements that inform the proposed measure can be found in Table 6.

**Table 6: VTE in Nonorthopedic Surgical Patients (2012) Additional Guidelines That Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Risk Stratification, Rationale for Prophylaxis, and Recommendations in General, Abdominal-Pelvic, Bariatric, Vascular, and Plastic and Reconstructive Surgery</b>			
3.6.3	For general and abdominal-pelvic surgery patients at moderate risk for VTE (~3.0%; Roger's score, >10; Caprini score, 3-4) who are not at high risk for major bleeding complications, we suggest LMWH (2B) or LDUH (2B)	2 2	B B
3.6.5	For general and abdominal-pelvic surgery patients at high risk for VTE (~6.0%; Caprini score, ≥5) who are not at high risk for major bleeding complications, we recommend pharmacologic prophylaxis with LMWH (1B) or LDUH (1B) over no prophylaxis.	1 1	B B
3.6.6	For high-VTE-risk patients undergoing abdominal or pelvic surgery for cancer who are not otherwise at high risk for major bleeding complications, we recommend extended-duration pharmacologic prophylaxis (4 weeks) with LMWH over limited-duration prophylaxis.	1	B
3.6.8	For general and abdominal-pelvic surgery patients at high risk for VTE (~6%; Caprini score, ≥5) in whom both LMWH and unfractionated heparin are contraindicated or unavailable and who are not at high risk for major bleeding complications, we suggest fondaparinux (2C)	2	C
<b>Target Population: Cardiac Surgery</b>			
4.4.2	For cardiac surgery patients whose hospital course is prolonged by one or more nonhemorrhagic surgical complications, we suggest adding pharmacologic prophylaxis with LDUH or LMWH to mechanical prophylaxis.	2	C
<b>Target Population: Thoracic Surgery</b>			
5.4.1	For thoracic surgery patients at moderate risk for VTE who are not at high risk for major bleeding, we suggest LDUH (2B) or LMWH (2B)	2 2	B B
5.4.2	For thoracic surgery patients at high risk for VTE who are not at high risk for major bleeding, we suggest LDUH(1B), or LMWH (1B)	1 1	B B
<b>Target Population: Craniotomy</b>			
6.4.2	For craniotomy patients at very high risk for VTE (e.g., those undergoing craniotomy for malignant disease), we suggest adding pharmacologic prophylaxis to mechanical prophylaxis once adequate hemostasis is established and the risk of bleeding decreases.	2	C

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Target Population: Spinal Surgery</b>			
7.4.2	For patients undergoing spinal surgery at high risk for VTE (including those with malignant disease and those undergoing surgery with a combined anterior-posterior approach), we suggest adding pharmacologic prophylaxis to mechanical prophylaxis once adequate hemostasis is established and the risk of bleeding decreases.	2	C
<b>Target Population: Major Trauma, Including Traumatic Brain Injury, Acute Spinal Cord Injury, and Traumatic Spine Surgery</b>			
8.4.1	For major trauma patients, we suggest use of LDUH (2C) or LMWH (2C)	2 2	C C
8.4.3	For major trauma patients in whom LMWH and LDUH are contraindicated, we suggest adding pharmacologic prophylaxis with either LMWH or LDUH when the risk of bleeding diminishes or the contraindication to heparin resolves (2C).	2	C

### 1.5 Prevention of VTE in Orthopedic Surgery Patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (2012)

[Falck-Ytter, Y., Francis, C. W., Johanson, N. A., Curley, C., Dahl, O. E., Schulman, S., Ortel, T. L., Pauker, S. G., & Colwell, C. W., Jr \(2012\). Prevention of VTE in orthopedic surgery patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest, 141\(2 Suppl\), e278S–e325S.](#)

This guideline focuses on the prevention VTE in orthopedic surgical patients. The methodology for these guidelines follows the same approach as the other guidelines presented in the 9<sup>th</sup> edition (Guyatt et al. (2012)). A description of the methodology and grading can be found in Table 1 and Table 2 in section 1.1. This is an evidence based guideline.

These guideline recommendations are based on the use of prophylaxis to reduce the patient-important outcomes of fatal and symptomatic pulmonary embolism (PE) and symptomatic DVT balanced against the hazard of an increase in symptomatic bleeding events. If available, ACCP used existing systematic reviews as the basis of evidence. If existing reviews were unavailable or not up to date or the outcomes of interest were not reported, ACCP performed additional analyses.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations, which were subject to public comment. The recommendations were graded as strong when desirable effects were much greater than undesirable effects or vice versa. Strong recommendations were worded as “We recommend” and labeled as (1). Recommendations were graded as weak when desirable effects were not clearly greater or less great than undesirable effects. Weak recommendations were worded as “We suggest” and labeled as (2).

Strong or conditional practice recommendations are generated on an ACCP GRADE modified approach on high (A), moderate (B), or low (C) evidence. The ACCP modified approach does not have a group for very low evidence.

The key guideline recommendation statements that inform the proposed measure can be found in Table 7.

**Table 7: VTE in Orthopedic Surgical Patients (2012) Additional Guidelines That Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Patients Undergoing Major Orthopedic Surgery: THA, TKA, HFS</b>			
2.1.1	In patients undergoing THA or TKA, we recommend use of one of the following for a minimum of 10 to 14 days rather than no antithrombotic prophylaxis: LMWH, fondaparinux, apixaban, dabigatran, rivaroxaban, LDUH, adjusted dose VKA	1	B
2.1.2	In patients undergoing HFS, we recommend use of one of the following rather than no antithrombotic prophylaxis for a minimum of 10 to 14 days: LMWH, fondaparinux, LDUH, adjusted dose VKA	1	B
2.2	For patients undergoing major orthopedic surgery (THA, TKA, HFS) and receiving LMWH as thromboprophylaxis, we recommend starting either 12 h or more preoperatively or 12 h or more postoperatively rather than within 4 h or less preoperatively or 4 h or less postoperatively.	1	B
2.3.1	In patients undergoing THA or TKA, irrespective of the concomitant use of an IPCD or length of treatment, we suggest the use of LMWH in preference to the other agents we have recommended as alternatives: fondaparinux, apixaban, dabigatran, rivaroxaban, LDUH, adjusted dose VKA	2	B
2.3.2	In patients undergoing HFS, irrespective of the concomitant use of an IPCD or length of treatment, we suggest the use of LMWH in preference to the other agents we have recommended as alternatives: fondaparinux, LDUH, (all 2B) adjusted dose VKA	2	B
2.5	In patients undergoing major orthopedic surgery, we suggest using dual prophylaxis with an antithrombotic agent and an IPCD during the hospital stay.	2	C
2.7	In patients undergoing major orthopedic surgery and who decline or are uncooperative with injections or an IPCD, we recommend using apixaban or dabigatran (alternatively rivaroxaban or adjusted dose VKA if apixaban or dabigatran are unavailable) rather than alternative forms of prophylaxis.	1	B



## 1.6 Antithrombotic Therapy for VTE Disease: Second Update of the CHEST Guideline and Expert Panel Report (2021)

[Stevens, S. M., Woller, S. C., Kreuziger, L. B., Bounameaux, H., Doerschug, K., Geersing, G. J., Huisman, M. V., Kearon, C., King, C. S., Knighton, A. J., Lake, E., Murin, S., Vintch, J. R. E., Wells, P. S., & Moores, L. K. \(2021\). Antithrombotic Therapy for VTE Disease: Second Update of the CHEST Guideline and Expert Panel Report. \*Chest\*, 160\(6\), e545–e608.](#)

Past Versions of Guideline:

[Kearon, C., Akl, E. A., Ornelas, J., Blaivas, A., Jimenez, D., Bounameaux, H., Huisman, M., King, C. S., Morris, T. A., Sood, N., Stevens, S. M., Vintch, J. R. E., Wells, P., Woller, S. C., & Moores, L. \(2016\). Antithrombotic Therapy for VTE Disease: CHEST Guideline and Expert Panel Report. \*Chest\*, 149\(2\), 315–352.](#)

[Kearon, C., Akl, E. A., Comerota, A. J., Prandoni, P., Bounameaux, H., Goldhaber, S. Z., Nelson, M. E., Wells, P. S., Gould, M. K., Dentali, F., Crowther, M., & Kahn, S. R. \(2012\). Antithrombotic therapy for VTE disease: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. \*Chest\*, 141\(2 Suppl\),](#)

This is the 2nd update to the 9th edition of these guidelines with the original guidelines released in 2012 (9th edition) , and the 1st update released in 2016. This is an evidence based guideline. The ACCP generated strong and weak recommendations based on high-, moderate-, and low-certainty evidence, using GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) methodology. The panel generated 29 guidance statements, 13 of which are graded as strong recommendations, covering aspects of antithrombotic management of VTE from initial management through secondary prevention and risk reduction of post thrombotic syndrome. Four new guidance statements have been added that did not appear in prior versions of this guideline. We present the relevant guidelines to this measure below.

When assessing a prior recommendation from AT9 or the 1st update, the panelists had three potential options: (1) carry forward (endorse) the prior guidance statement, and retain the original evidence profiles and summaries of findings; (2) carry forward (endorse) the prior guidance statement, but update the evidence profiles and summaries of findings, and create an evidence-to decision (EtD) framework; or (3) create a new guidance statement, produce updated evidence profiles and summaries of findings, and create an EtD framework.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations, which were subject to public comment. The strength of a recommendation is defined as the extent to which we can be confident that the desirable effects of an intervention outweigh its undesirable effects. The strength of recommendation was categorized as strong or weak/conditional.

Certainty of evidence was also based on the GRADE approach. Certainty of evidence is defined as the extent to which our confidence in the effect estimate is adequate to support a recommendation. The certainty of evidence is categorized as high, moderate, low, or very low. The rating of the certainty of evidence reflects the strengths and limitations of the body of evidence and was based on the study design, risk of bias, imprecision, inconsistency, indirectness of results, and likelihood of publication bias.

The methodology for determining strength of recommendations (Table 8) and strength of evidence, followed by key guideline recommendation statements that inform the proposed measure (Table 9). The panel agreed on 25 recommendations and 2 good practice statements to optimize management of patients receiving anticoagulants.

**Table 8: ACCP Antithrombotic Therapy for VTE Disease: Second Update GRADE Approach: Strength of Recommendation Criteria**

Strength of Recommendation	Rationale
Strong Recommendation	<b>“We recommend.”</b> We can be confident that the desirable effects of an intervention outweigh its undesirable effects.
Weak /Conditional Recommendation	<b>“We suggest.”</b>
Not Graded / Best Practice Statement	<b>“Not Graded.”</b> This statement was used, typically, to provide guidance based on common sense or where the topic does not allow adequate application of evidence.

**Table 9: Antithrombotic Therapy for VTE Disease: Second Update of the CHEST Guideline and Expert Panel Report (2021)**  
**Additional Guidelines That Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Initial Management</b>			
1	In patients with acute isolated distal DVT of the leg: and  (ii) with severe symptoms or risk factors for extension (see text), we suggest anticoagulation over serial imaging of the deep veins.	(ii) Very Low Evidence	(ii) Weak Recommendation
2	In patients with acute isolated distal DVT of the leg who are treated with serial imaging, we (ii) suggest anticoagulation if the thrombus extends but remains confined to the distal veins (weak recommendation, very low-certainty evidence), and (iii) recommend anticoagulation if the thrombus extends into the proximal veins.	(ii) Very Low Evidence  (iii) Moderate Evidence	(ii) Weak Recommendation  (iii) Strong Recommendation
3	In patients with subsegmental pulmonary embolism (PE) (no involvement of more proximal pulmonary arteries) and no proximal DVT in the legs who have a (ii) high risk for recurrent VTE, we suggest anticoagulation over clinical surveillance.	(ii) Very Low Evidence	(ii) Weak Recommendation
4	In patients who are incidentally found to have asymptomatic PE, we suggest the same initiation and treatment phase anticoagulation as for comparable patients with symptomatic PE.	Moderate Evidence	Weak Recommendation
5	In patients with cerebral vein/venous sinus thrombosis, we recommend anticoagulation therapy for at least the treatment phase (first 3 months) over no anticoagulant therapy.	Very Low Evidence	Strong Recommendation
6	In patients with acute DVT of the leg we suggest anticoagulant therapy alone over interventional (thrombolytic, mechanical, or pharmacomechanical) therapy.	Moderate Evidence	Weak Recommendation
7	In patients with acute PE associated with hypotension (e.g., systolic BP < 90 mm Hg) who do not have a high bleeding risk, we suggest systemically administered thrombolytic therapy over no such therapy.	Very Low Evidence	Weak Recommendation
8	In most patients with acute PE not associated with hypotension, we recommend against systemically administered thrombolytic therapy.	Very Low Evidence	Strong Recommendation
9	In selected patients with acute PE who deteriorate after starting anticoagulant therapy but have yet to develop hypotension and who have an acceptable bleeding risk, we suggest systemically administered thrombolytic therapy over no such therapy.	Very Low Evidence	Weak Recommendation

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
10	In patients with acute PE who are treated with a thrombolytic agent, we suggest systemic thrombolytic therapy using a peripheral vein over catheter-directed thrombolysis (CDT).	Very Low Evidence	Weak Recommendation
15	In patients with VTE (DVT of the leg or PE) we recommend apixaban, dabigatran, edoxaban, or rivaroxaban over vitamin K antagonist (VKA) as treatment-phase (first 3 months) anticoagulant therapy.	Moderate Evidence	Strong Recommendation
16	In patients with acute VTE in the setting of cancer (cancer-associated thrombosis) we recommend an oral Xa inhibitor (apixaban, edoxaban, rivaroxaban) over low molecular weight heparin (LMWH) for the initiation and treatment phases of therapy.	Moderate Evidence	Strong Recommendation
17	In patients with confirmed antiphospholipid syndrome being treated with anticoagulant therapy, we suggest adjusted dose VKA (target INR 2.5) over direct oral anticoagulant (DOAC) therapy during the treatment phase.	Very Low Evidence	Weak Recommendation
18	In patients with superficial venous thrombosis (SVT) of the lower limb at increased risk of clot progression to DVT or PE we suggest the use of anticoagulation for 45 days over no anticoagulation.	Moderate Evidence	Weak Recommendation
19	In patients with SVT who are treated with anticoagulation, we suggest fondaparinux 2.5 mg daily over other anticoagulant treatment regimens such as (prophylactic or therapeutic dose) LMWH.	Very Low Evidence	Weak Recommendation
20	In patients with SVT who refuse or are unable to use parenteral anticoagulation, we suggest rivaroxaban 10 mg daily as a reasonable alternative for fondaparinux 2.5 mg daily.	Very Low Evidence	Weak Recommendation

## 1.7 American Society of Hematology (ASH) Guidelines for Management of Venous Thromboembolism: Optimal Management of Anticoagulation Therapy (2018)

Guideline:

[Witt, D. M., Nieuwlaat, R., Clark, N. P., Ansell, J., Holbrook, A., Skov, J., Shehab, N., Mock, J., Myers, T., Dentali, F., Crowther, M. A., Agarwal, A., Bhatt, M., Khatib, R., Riva, J. J., Zhang, Y., & Guyatt, G. \(2018\). American Society of Hematology 2018 guidelines for management of venous thromboembolism: optimal management of anticoagulation therapy. Blood advances, 2\(22\), 3257–3291.](#)

User Guide:

[Izcovich, A., Cuker, A., Kunkle, R., Neumann, I., Panepinto, J., Pai, M., Seftel, M., Cheung, M. C., Lottenberg, R., Byrne, M., Plovnick, R., Terrell, D., Holter-Chakrabarty, J. L., Djulbegovic, B., Hicks, L. K., Wiercioch, W., Nieuwlaat, R., & Schünemann, H. J. \(2020\). A user guide to the American Society of Hematology clinical practice guidelines. Blood advances, 4\(9\), 2095–2110.](#)

The American Society of Hematology (ASH) formed a multidisciplinary guideline that agreed on 25 recommendations and 2 good practice statements to optimize management of patients receiving anticoagulants.

The ASH panel prioritized clinical questions and outcomes according to their importance for clinicians and patients. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations. The methodology for determining strength of recommendations (Table 10 and 11) and strength of evidence is presented below, followed by key guideline recommendation statements that inform the proposed measure (Table 12).

Within each recommendation, the strength of a recommendation is expressed as either strong (“the guideline panel recommends...”), or conditional (“the guideline panel suggests...”) and has the following interpretations:

**Table 10: ASH (2018) Guidelines for Management of Venous Thromboembolism: Strength of Recommendation Rationale**

Strength of Recommendation	Rationale
Strong Recommendation	<ul style="list-style-type: none"> <li>• <b>For patients:</b> Most individuals in this situation would want the recommended course of action, and only a small proportion would not.</li> <li>• <b>For clinicians:</b> Most individuals should follow the recommended course of action. Formal decision aids are not likely to be needed to help individual patients make decisions consistent with their values and preferences.</li> <li>• <b>For policy makers:</b> The recommendation can be adopted as policy in most situations. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator.</li> <li>• <b>For researchers:</b> The recommendation is supported by credible research or other convincing judgments that make additional research unlikely to alter the recommendation. On occasion, a strong recommendation is based on low or very low certainty in the evidence. In such instances, further research may provide important information that alters the recommendations.</li> </ul>
Conditional Recommendation	<ul style="list-style-type: none"> <li>• <b>For patients:</b> The majority of individuals in this situation would want the suggested course of action, but many would not. Decision aids may be useful in helping patients to make decisions consistent with their individual risks, values, and preferences.</li> <li>• <b>For clinicians:</b> Different choices will be appropriate for individual patients, and clinicians must help each patient arrive at a management decision consistent with the patient's values and preferences. Decision aids may be useful in helping individuals to make decisions consistent with their individual risks, values, and preferences.</li> <li>• <b>For policy makers:</b> Policymaking will require substantial debate and involvement of various stakeholders. Performance measures should assess whether decision-making is duly documented.</li> <li>• <b>For researchers:</b> This recommendation is likely to be strengthened (for future updates or adaptation) by additional research. An evaluation of the conditions and criteria (and the related judgments, research evidence, and additional considerations) that determined the conditional (rather than strong) recommendation will help identify possible research gaps.</li> </ul>

Table 11 presents the criteria used in the ASH recommendations with how the criterion influenced the decision of the strength of the recommendation.

**Table 11: ASH (2018) Guidelines for Management of Venous Thromboembolism: Strength of Recommendation Criteria**

Criteria	How the criterion influences the direction and strength of a recommendation
1. Problem	The judgment about the problem is determined by the importance and frequency of the health care issue that is addressed (burden of disease, prevalence, cost, or baseline risk). If the problem is of great importance an intervention is more likely to exert large effects and a strong recommendation may be more likely. However, this is a guiding principle and not universally applicable to all recommendations.
2. Values and preferences or the importance of outcomes	This describes how important health outcomes are to those affected, how variable they are, and whether there is uncertainty about this.
3. Certainty in the evidence about the health benefits and harm	The higher the certainty in the evidence, the more likely is a strong recommendation.
4. Health benefits and harms and burden and their balance	This requires an evaluation of the absolute effects of both the benefits and harms and their importance including the judgment about criterion 2. The greater the net benefit or net harm, the more likely is a strong recommendation for or against the option.
5. Resource implications	This describes how resource intense an option is if it is cost-effective and if there is incremental benefit. The more advantageous or clearly disadvantageous these resource implications are, the more likely is a strong recommendation.
6. Equity	The greater the likelihood to reduce inequities or increase equity and the more accessible an option is, the more likely is a strong recommendation.
7. Acceptability	The greater the acceptability of an option to all or most stakeholders, the more likely is a strong recommendation.
8. Feasibility	The greater the acceptability of an option to all or most stakeholders, the more likely is a strong recommendation.

In ASH guidelines, the certainty in the evidence is categorized according to GRADE as high, moderate, low, or very low. The rating of the certainty of evidence reflects the strengths and limitations of the body of evidence and was based on the study design, risk of bias, imprecision, inconsistency, indirectness of results, and likelihood of publication bias. A high or moderate overall certainty in the evidence indicates that we can be confident in our knowledge of these criteria is typically not labeled in the recommendation.

**Table 12: ASH (2018) Guidelines for Management of Venous Thromboembolism: Additional Guidelines that Support the Measure**

Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
<b>Initial anticoagulant dose selection</b>			
Recommendation #1	In obese patients receiving LMWH therapy for treatment of acute VTE, the ASH guideline panel <i>suggests</i> initial LMWH dose selection according to actual body weight rather than dose selection based on a fixed maximum daily dose (i.e., capped dose).	Very Low Evidence	Conditional Recommendation
<b>Drug-interaction management</b>			
Recommendation #2	For patients requiring administration of inhibitors or inducers of P-glycoprotein (P-gp) or strong inhibitors or inducers of cytochrome P450 (CYP) enzymes, the ASH guideline panel <i>suggests</i> using an alternative anticoagulant (such as vitamin K antagonist [VKA] or LMWH) rather than a direct oral anticoagulant (DOAC) for the treatment of VTE.	Very Low Evidence	Conditional Recommendation
<b>Laboratory monitoring of the anticoagulant response</b>			
Recommendation #7	For patients with renal dysfunction (creatinine clearance, <30 mL/min) receiving LMWH therapy for treatment of VTE, the ASH guideline panel <i>suggests against</i> using anti-factor Xa concentration monitoring to guide LMWH dose adjustment.	Very Low Evidence	Conditional Recommendation
Recommendation #8	For patients with obesity receiving LMWH therapy for treatment of VTE, the ASH guideline panel <i>suggests against</i> using anti-factor Xa concentration monitoring to guide LMWH dose adjustment.	Very Low Evidence	Conditional Recommendation
<b>Transitions between anticoagulants</b>			
Recommendation #10	For patients transitioning from DOAC to VKA, the ASH guideline panel <i>suggests</i> overlapping DOAC and VKA therapy until the INR is within the therapeutic range <i>over</i> using LMWH or UFH “bridging therapy.”	Very Low Evidence	Conditional Recommendation
<b>Structured patient education</b>			
Recommendation #12	For patients receiving oral anticoagulation therapy for VTE treatment, the ASH guideline panel <i>suggests</i> using supplementary patient education in addition to basic education.	Very Low Evidence	Conditional Recommendation
<b>Invasive procedure management</b>			
Recommendation #14	For patients at low to moderate risk of recurrent VTE who require interruption of VKA therapy for invasive procedures, the ASH guideline panel <i>recommends against</i> periprocedural bridging with LMWH or UHF in favor of interruption of VKA alone.	Moderate Evidence	Strong Recommendation



Recommendation #	Verbatim Guideline	Strength of Evidence	Strength of Recommendation
Recommendation #15	For patients interrupting DOAC therapy for scheduled invasive procedures, the ASH guideline panel <i>suggests against</i> performing laboratory testing for DOAC anticoagulant effect prior to procedures	Very Low Evidence	Conditional Recommendation
<b>Excessive anticoagulation and bleeding management</b>			
Recommendation #16	For patients receiving VKA for treatment of VTE with INRs of >4.5 but <10 and without clinically relevant bleeding, the ASH guideline panel <i>suggests</i> using temporary cessation of VKA alone <i>without</i> the addition of vitamin K.	Very Low Evidence	Conditional Recommendation

## **1.8 Reversal of Direct Oral Anticoagulants (DOAC): Guidance from the Anticoagulation Forum (2019)**

[Cuker, A., Burnett, A., Triller, D., Crowther, M., Ansell, J., Van Cott, E. M., Wirth, D., & Kaatz, S. \(2019\). Reversal of direct oral anticoagulants: Guidance from the Anticoagulation Forum. American journal of hematology, 94\(6\), 697–709.](#)

The purpose of this document is to provide clinical guidance from the Anticoagulation Forum, a North American organization of anticoagulation providers, regarding the use of DOAC reversal agents based upon the best available information, including situations in which high-quality evidence is absent. This guidance discusses DOAC reversal, provides detailed guidance on how the individual reversal agents should be administered, and offers suggestions for management strategies and stewardship at the health system level.

The Anticoagulation forum prioritized a set of key questions regarding DOAC reversal through discussion and consensus among the authors and searched PubMed to identify evidence related to these questions. This search was supplemented by articles from the authors' files and manual review of references. The forum prioritized studies of patients that reported patient-important outcomes (i.e., bleeding, thromboembolism, mortality) over in vitro, animal, and healthy volunteer studies. The forum also reviewed relevant information in US FDA product package inserts and on [www.clinicaltrials.gov](http://www.clinicaltrials.gov). For each question, a summary of the evidence is provided, followed by guidance representing the unanimous consensus of the authors.

Four of the nine separate guidance statements are provided in Table 13 and are relevant to our measure. The guidance statements are not graded, but a discussion of the evidence supporting each statement is included in the Cuker et al. (2019) document.

**Table 13: Guidance Statements on the Reversal of Direct Oral Anticoagulants (2019) that Support the Measure**

Question	Guidance Statement
(4) When should reversal agents be used before an invasive procedure?	In DOAC-treated patients who require an invasive procedure, we suggest that a reversal agent be administered only if the procedure cannot be safely performed while the patient is anticoagulated, cannot be delayed, and there is demonstration or reasonable expectation that the patient has clinically relevant plasma DOAC levels.
(5) How should reversal agents be used to manage a dabigatran treated patient before an invasive procedure?	In dabigatran-treated patients who require an urgent procedure and in whom a reversal agent is warranted, we suggest treatment with idarucizumab 5 g IV. If idarucizumab is not available, we suggest treatment with APCC 50 units/kg IV.
(6) How should reversal agents be used to manage a factor Xa inhibitor-treated patient before an invasive procedure?	In factor Xa inhibitor-treated patients who require an urgent procedure and in whom a reversal agent is warranted, we suggest treatment with andexanet alfa at the same dosing used for major bleeding. If andexanet alfa is not available, we suggest treatment with four-factor PCC 2000 units.
(9) What strategies can be employed by health systems to promote optimal utilization of DOAC reversal agents?	To promote optimal use of DOAC reversal, we suggest that health systems develop and implement overarching strategies that promote multidisciplinary, shared stewardship of these agents. We suggest utilization of evidence-based clinical tools and processes that facilitate adherence with agreed-upon restrictions for judicious prescribing and use. We suggest system-level approaches be streamlined to the fullest extent possible via leveraging of the electronic health record, as well as maximized efficiency of pharmacy order processing, admixture, and delivery strategies. We further suggest that health systems develop contingency plans to be prepared for a variety of acquisition challenges, as well as close collaboration with vendors and billing departments to capitalize on cost mitigation opportunities. We suggest periodic formal evaluation of DOAC reversal practices to assess for appropriateness and identify opportunities for further optimization. Lastly, we suggest that dedicated stewardship programs be established, whenever possible, to drive development, implementation, consistent application, and evaluation of anticoagulation-related optimization strategies including, but not limited to, appropriate and judicious use of DOAC reversal agents.

## 1.9 European Society of Anaesthesiology: 2018

[Samama, C. M., & Afshari, A. \(2018\). European guidelines on perioperative venous thromboembolism prophylaxis. \*European Journal of Anaesthesiology\*, 35\(2\), 73–76. <https://doi.org/10.1097/EJA.0000000000000702>](#)

The European Society of Anaesthesiology (ESA) provides guidance via a series of clinical practice guidelines for perioperative venous thromboembolism prophylaxis. A task force was developed with seven ESA representatives and eight representatives from other European and international societies. There are twelve distinct chapters of this guideline, each focusing on a different patient population or clinical practice. Two of these chapters were excluded from this attachment as they do not pertain to the target population for this measure (pregnancy and postpartum and day and fast track surgery chapters). The guideline is based on an update to the literature search conducted for the 2012 ACCP guidelines, and for those clinical questions that were not covered by the ACCP or other recently published guidelines with the same level of scientific robustness, separate search strategies were utilized covering citations of relevance published during the last 10 years. The primary target population varies by chapter, but in its entirety includes all surgical patients.

The methodology for determining strength of recommendations (**Table 14**) and strength of evidence (**Tables 15 and 16**) is based on the GRADE approach and presented below. The AGREE II tool (**Tables 17 and 18**) was additionally used to address the issue of variability and to evaluate the process of the guideline development and quality reporting. Following the methodology, a short summary of each chapter followed by key recommendations from each chapter that inform the proposed measure are included below (Sections 1.4.1 to 1.4.10).

Within each recommendation, the strength of recommendation is indicated as strong recommendation (1), or weak/conditional recommendation (2).

**Table 14: ESA (2018): Strength of Recommendation Criteria (GRADE)**

Recommendation Grading	Meaning	Rationale
1	Strong	The panel is highly confident of the balance between desirable and undesirable consequences.
2	Weak/Conditional	The panel is less confident of the balance between desirable and undesirable consequences

Within each recommendation, the quality of the supporting evidence is shown as high (A), moderate (B), or low/very low (C).

**Table 15: ESA (2018): Strength of Evidence Criteria (GRADE)**

Evidence Grading	Strength of Evidence	Rationale
A	High	The quality of the body of evidence is rated as 4+ We are very confident that the true effect lies close to that of the estimate of the effect.
B	Moderate	The quality of the body of evidence is rated as 3+ We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
C	Low	The quality of the body of evidence is rated as 2+ Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.
	Very Low	The quality of the body of evidence is rated as 1+ We have very little confidence in the effect of the estimate: The true effect is likely to be substantially different from the estimate of the effect.

Additionally, the level of evidence also indicates the quality of the body of evidence used to inform the recommendations.

**Table 16: ESA (2018): Level of Evidence Criteria (GRADE)**

Study Design	Initial quality of a body of evidence	Lower if	Higher if
Randomized Trials	High	Risk of bias -1 serious -2 very serious Inconsistency -1 serious -2 very serious Indirectness -1 serious -2 very serious	Large effect +1 large +2 very large Dose response +1 Evidence of a gradient All plausible residual confounding +1 would reduce a demonstrated effect +1 would suggest a spurious effect if no effect was observed
Observational Studies	Low	Indirectness -1 serious -2 very serious Imprecision -1 serious -2 very serious Publication bias -1 likely -2 very likely	

The AGREE II tool was also utilized to assess overall guideline quality. The AGREE II tool has 23 questions within 6 domains that are rated on a scale of 1 (strongly disagree) to 7 (strongly agree). The quality of the overall guideline is then determined using this scale where 1 indicates the lowest possible quality and 7 indicates the highest possible quality.

**Table 17: ESA (2018): Guideline Quality Assessment (AGREE II)**

Domain	Item
Scope and Purpose	The overall objective(s) is (are) specifically described
	The health questions(s) covered by the guideline is (are) specifically described
	The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described
Stakeholder Involvement	The guideline development group includes individuals from all the relevant professional groups
	The views and preferences of the target population (patients, public, etc.) have been sought
	The target users of the guideline are clearly defined
Rigor of Development	Systematic methods were used to search for evidence
	The criteria for selecting the evidence are clearly described

Domain	Item
	The strengths and limitations of the body of evidence are clearly described
	The methods for formulating the recommendations are clearly described
	The health benefits, side effects, and risks have been considered in formulating the recommendations
	There is an explicit link between the recommendations and the supporting evidence
	The guideline has been externally reviewed by experts prior to its publication
	A procedure for updating the guideline is provided
Clarity of Presentation	The recommendations are specific and unambiguous
	The different options for management of the condition or health issue are clearly presented
	Key recommendations are easily identifiable
Applicability	The guideline describes facilitators and barriers to its application
	The guideline provides advice and/or tools on how the recommendations can be put into practice
	The potential resource implications of applying the recommendations have been considered
	The guideline presents monitoring and/or auditing criteria
Editorial Independence	The views of the funding body have not influenced the content of the guideline
	Competing interests of guideline development group members have been recorded and addressed

### 1.9.1 European Society of Anaesthesiology (ESA): Surgery in the obese patient

Venclauskas, L., Maleckas, A., & Arcelus, J. I. (2018). European guidelines on perioperative venous thromboembolism prophylaxis: Surgery in the obese patient. *European Journal of Anaesthesiology*, 35(2), 147–153. <https://doi.org/10.1097/EJA.0000000000000703>

Key guideline recommendations for obese patients undergoing surgery are included in **Table 18** below.

**Table 18: ESA (2018): Additional Guidelines that Support the Measure**

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
<b>Bariatric surgery</b>		
We suggest using only anticoagulants or IPC for obese patients with a low risk of VTE during and after bariatric procedures.	2	C
We recommend using anticoagulants and IPC together for obese patients with a high risk of VTE (age >55 years, BMI >55 kgm <sup>-2</sup> , history of VTE, venous disease, sleep apnoea, hypercoagulability or pulmonary hypertension) during and after bariatric procedures.	1	C

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
We recommend the use of LMWH over LDUH.	1	C
We suggest a dose of LMWH (3000 to 4000 anti-Xa IU 12 h <sup>-1</sup> subcutaneously) depending on BMI as acceptable for obese patients with a lower risk of VTE.	2	B
We suggest the use of a higher dose of LMWH (4000 to 6000 anti-Xa IU 12 h <sup>-1</sup> subcutaneously) as acceptable for obese patients with a higher risk of VTE.	2	B
<b>Nonbariatric surgery</b>		
We suggest that in surgery with an indication for VTE prophylaxis, a higher prophylactic dose of LMWH (3000 to 4000 anti-Xa IU 12 h <sup>-1</sup> subcutaneously) should be considered for obese patients with a BMI more than 40 kgm <sup>-2</sup> undergoing nonbariatric surgery.	2	C

### 1.9.2 European Society of Anaesthesiology (ESA): Surgery in the elderly

Kozek-Langenecker, S., Fenger-Eriksen, C., Thienpont, E., & Barauskas, G. (2018). European guidelines on perioperative venous thromboembolism prophylaxis: Surgery in the elderly. *European Journal of Anaesthesiology*, 35(2), 116-122. <https://doi.org/10.1097/EJA.0000000000000705>

Key guideline recommendations for elderly patients undergoing surgery are included in **Table 19** below.

**Table 19: ESA (2018): Additional Guidelines that Support the Measure**

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
<b>Surgery in the elderly</b>		
We suggest timing and dosing of pharmacological VTE prophylaxis as in the non-aged population.	2	C
In elderly patients with renal failure, low-dose unfractionated heparin may be used or weight-adjusted dosing of LMWH.	2	C
In the elderly, we recommend careful prescription of postoperative VTE prophylaxis and early postoperative mobilisation.	1	C
We recommend multi-faceted interventions for VTE prophylaxis in elderly and frail patients, including pneumatic compression devices, LMWH (and/or direct oral anti-coagulants after knee or hip replacement).	1	C



### 1.9.3 European Society of Anaesthesiology (ESA): Intensive care

Duranteau, J., Taccone, F. S., Verhamme, P., & Ageno, W. (2018). European guidelines on perioperative venous thromboembolism prophylaxis: Intensive care. *European Journal of Anaesthesiology*, 35(2), 142–146. <https://doi.org/10.1097/EJA.0000000000000707>

Key guideline recommendations for intensive care patients undergoing surgery are included in **Table 20** below.

**Table 20: ESA (2018): Additional Guidelines that Support the Measure**

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
<b>Intensive Care</b>		
For critically ill patients, we recommend using thromboprophylaxis with LMWH or LDUH and we recommend LMWH over LDUH.	1	B
For VTE prophylaxis in critically ill patients with severe renal insufficiency, we suggest the use of LDUH,	1	B
dalteparin or	2	C
reduced doses of enoxaparin.	2	B
Monitoring of anti-Xa activity may be considered when LMWH is used in these patients.	2	C
The use of pharmacological prophylaxis in patients with severe liver dysfunction should be carefully balanced against the risk of bleeding. If a treatment is administered, the use of LDUH or LMWH is suggested.	2	C
In critically ill patients with a suspected or confirmed diagnosis of heparin-induced thrombocytopenia (HIT), all forms of heparin must be discontinued.	2	C
In these patients, immediate anticoagulation with a nonheparin anticoagulant rather than discontinuation of heparin alone is recommended, unless there is a strong contraindication to anticoagulation.	1	B
The selection of nonheparin anticoagulants should be based on patient characteristics: argatroban is the first choice in patients with renal insufficiency, and bivalirudin in patients undergoing or after cardiac surgery.	1	C
The use of fondaparinux can also be considered in these patients.	2	C

#### 1.9.4 European Society of Anaesthesiology (ESA): Cardiovascular and thoracic surgery

Ahmed, A. B., Koster, A., Lance, M., & Faraoni, D. (2018). European guidelines on perioperative venous thromboembolism prophylaxis: Cardiovascular and thoracic surgery. *European Journal of Anaesthesiology*, 35(2), 84–89. <https://doi.org/10.1097/EJA.0000000000000708>

Key guideline recommendations for patients undergoing cardiovascular and thoracic surgery are included in **Table 21** below.

**Table 21: ESA (2018): Additional Guidelines that Support the Measure**

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
<b>Cardiac and Vascular Surgery</b>		
The presence of one or more risk factors [age above 70 years, transfusion of more than four units of RBC concentrate/fresh frozen plasma/cryoprecipitate/fibrinogen concentrate, mechanical ventilation more than 24 h, postoperative complication (e.g. acute kidney injury, infection/sepsis, neurological complication)] should place the cardiac population at high risk for VTE. In this context, we suggest the use of pharmacological prophylaxis as soon as satisfactory haemostasis has been achieved, in addition to IPC.	2	C
Patients undergoing other valve surgery and those with atrial fibrillation should be considered a specific entity at high risk of VTE, as they will mostly require postoperative therapeutic medical 'bridging' prior to long-term anti-coagulation.	No grade provided	No grade provided
Patients undergoing peripheral vascular surgery are considered to have a low risk of VTE and low risk of bleeding. Stringent medical prophylaxis appears to reduce the event rate significantly. In this population, we suggest medical therapy.	2	C
In patients undergoing AAA repair, particularly when an open surgical approach is used, the risk of VTE is higher with a high bleeding risk. These patients should be considered as having a moderate risk. Patients with additional risk factors including BMI at least 30 kgm <sup>-2</sup> , preoperative dyspnoea, chronic steroid usage, ruptured aneurysm, open surgery, operative duration at least 5 h, transfusion of at least 5 U, postoperative mechanical ventilation more than 48 h, postoperative complication (acute kidney injury, infection/sepsis) and re-operation, should be considered as moderate-to-high risk. In this context, we suggest the use of pharmacological prophylaxis as soon as satisfactory haemostasis is achieved.	2	C
UFH is associated with the highest risk of developing the pro-thrombotic condition of HIT. Therefore, in an attempt to minimise the risk of HIT, we suggest that UFH should be used as briefly as possible and replaced by LMWH as soon as the bleeding risk decreases.	2	C
In patients with severely impaired renal function (creatinine clearance <30 ml min <sup>-1</sup> ) and a high risk of haemorrhagic complications, we suggest close monitoring of the administration of therapeutic UFH and LMWH and adaptation of the dosage.	2	C

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
In high-risk patients, we suggest the use of pharmacological prophylaxis in addition to IPC.	2	B

### 1.9 European Society of Anaesthesiology (ESA): Neurosurgery

Faraoni, D., Comes, R. F., Geerts, W., & Wiles, M. D. (2018). European guidelines on perioperative venous thromboembolism prophylaxis: Neurosurgery. *European Journal of Anaesthesiology*, 35(2), 90–95. <https://doi.org/10.1097/EJA.0000000000000710>

Key guideline recommendations for patients undergoing neurosurgery are included in **Table 22** below.

**Table 22: ESA (2018): Additional Guidelines that Support the Measure**

Verbatim Guideline	Strength of Recommendation	Strength of Evidence
<b>Patients undergoing craniotomy</b>		
If LMWH or low-dose unfractionated heparin (LDUH) are used, we suggest delayed initiation until at least 24 h after surgery.	2	C
In craniotomy patients at particularly high risk of VTE (additional risk factors including malignancy, motor impairment, prolonged operative time), we suggest considering the initiation of mechanical thromboprophylaxis with IPC preoperatively with addition of LMWH or LDUH postoperatively when the risk of bleeding is presumed to be decreased.	2	C
We suggest that thromboprophylaxis should be continued until discharge.	2	C
<b>Spinal surgery</b>		
For patients undergoing spinal surgery with additional risk factors (limited mobility, active cancer, complex surgical procedure), and we suggest the addition of LMWH postoperatively when the risk of bleeding is presumed to be decreased.	2	C
If LMWH is used, we recommend delayed initiation at least until 24 h after surgery and only when haemostasis occurs.	1	C
We suggest continued thromboprophylaxis until discharge in high-risk patients.	2	C
In patients with spinal cord injury or significant motor impairment, we suggest extending the thromboprophylaxis into the rehabilitation phase of hospital care.	2	C

## 2. Supplemental Evidence (Additional Evidence)

### 2.1 The Anticoagulation Forum and National Quality Forum - Advancing Anticoagulation Stewardship: A Playbook (NQF, 2022)

[The Anticoagulation Forum and National Quality Forum - Advancing Anticoagulation Stewardship: A Playbook \(NQF, 2022\)](#)

The Anticoagulation Forum is a nonprofit organization that has advocated for safe and effective use of anticoagulants. The Anticoagulation Forum is the largest organization of its kind helping practitioners improve patient care by providing current and relevant information on best practices. The membership includes more than 13,000 physicians, nurses, and pharmacists.

The forum released the Advancing Anticoagulation Stewardship: A Playbook which centers on the Anticoagulation Forum's Core Elements of Anticoagulation Stewardship and offers concrete strategies and implementation examples for healthcare organizations and clinicians who wish to create, promote, and sustain an Anticoagulation Stewardship program.

### 2.2 The Anticoagulation Forum: Core Elements of Anticoagulation and Stewardship Program Guide (2019)

[The Core Elements of Anticoagulation Stewardship Program Guide \(2019\)](#)

The Core Elements of Anticoagulation Stewardship Programs Guide outlines systemic protocols designed to improve the safety and quality of patient care and reduce adverse drug events associated with anticoagulants. The Anticoagulation Stewardship Programs guide is intended to be applicable to all care settings and all anticoagulation patient populations. By implementing effective, evidence-based system improvements to address high-priority concerns, all care settings can optimize the quality and safety of anticoagulant use and overall patient management.

The 7 Core Elements of Anticoagulation Stewardship Programs include:

1. Secure Administrative Leadership Commitment: Dedicating necessary human, financial, and technology resources
2. Establish Professional Accountability and Expertise: Appointing a single leader responsible for program outcomes, supported by at least one clinician with expertise in anticoagulation management
3. Engage Multidisciplinary Support: Involving key specialists and disciplines to obtain perspective from all domains of the care delivery system
4. Perform Data Collection, Tracking, and Analysis: Defining the population, objectively evaluating performance, and guiding decision-making

5. Implement Systematic Care: Implementing sustainable, efficient, evidence-based action(s) at the system level to assure the safety and quality of anticoagulation management
6. Facilitate Transitions of Care: Creating systems to optimize communication and ensure safe transitions between care settings
7. Advance Education, Comprehension, and Competency: Assuring that clinicians, patients, and others have the knowledge and skills necessary to optimize outcomes

### **2.3 The Joint Commission National Patient Safety Goal 03.05.01: Reduce the Likelihood of Patient Harm Associated with the Use of Anticoagulant Therapy (2021). Effective January 2022 for Hospital Program**

[The Joint Commission. \(2021, October 25\). National Patient Safety Goal for anticoagulant therapy. Effective for January 2022 for Hospital Program.](#)

The Joint Commission has identified the National Patient Safety Goal 03.05.01 to “Reduce the likelihood of patient harm associated with the use of anticoagulant therapy (Joint Commission, 2021) (Table 23).” This National Patient Safety Goal has great potential to positively impact the safety of patients on this class of medications, including improving patient outcomes. The standards were developed with resources compiled from key stakeholders including national organizations, federal and state agencies, professional associations, relevant academic institutions, peer reviewed publications and private entities.

**Table 23: Joint Commission National Patient Safety Goal 03.05.01: Requirements and Rationale**

NPSG.03.05.01: Reduce the likelihood of patient harm associated with the use of anticoagulant therapy		
	Requirement	Rationale
1	<b>EP 1:</b> The hospital uses approved protocols and evidence-based practice guidelines for the initiation and maintenance of anticoagulant therapy that address medication selection; dosing, including adjustments for age and renal or liver function; drug–drug and drug–food interactions; and other risk factors as applicable.	Anticoagulation medications are high-risk medications due to complex dosing, insufficient monitoring, and inconsistent patient compliance. The introduction of direct oral anticoagulants, as an alternative to heparin and warfarin, requires organizations to modify existing protocols and use evidence-based practice guidelines to address the initiation and maintenance of all anticoagulation medications and their associated risk factors.
2	<b>EP 2:</b> The hospital uses approved protocols and evidence-based practice guidelines for reversal of anticoagulation and management of bleeding events related to each anticoagulant medication.	Bleeding is the most common complication of all anticoagulants. In addition to heparin and warfarin, each of the direct oral anticoagulants have different reversal mechanisms. It is important for organizations to use evidence-based practice guidelines when developing protocols to manage bleeding events. For timely and appropriate management, providers need to be aware of the variations in presentation severity (e.g., location and severity of bleeding, indication for reversal) and appropriate reversal agents (e.g., drug discontinuation, use of concentrated clotting therapy) for each anticoagulation medication used by patients coming to their organization.
3	<b>EP 3:</b> The hospital uses approved protocols and evidence-based practice guidelines for perioperative management of all patients on oral anticoagulants. <i>Note: Perioperative management may address the use of bridging medications, timing for stopping an anticoagulant, and timing and dosing for restarting an anticoagulant.</i>	Patients taking oral anticoagulation medications need to be managed appropriately during the perioperative period to minimize bleeding risks during surgery. The decision to stop an anticoagulant, use a bridging medication, or to restart an anticoagulant should be based on organization-approved protocols and evidence-based practice guidelines that address the patient’s bleeding risk and renal function, as well as the half-life of the medication.

**NPSG.03.05.01: Reduce the likelihood of patient harm associated with the use of anticoagulant therapy**

4	<p><b>EP 4:</b> The hospital has a written policy addressing the need for baseline and ongoing laboratory tests to monitor and adjust anticoagulant therapy. Note: For all patients receiving warfarin therapy, use a current international normalized ratio (INR) to monitor and adjust dosage. For patients on a direct oral anticoagulant (DOAC), follow evidence-based practice guidelines regarding the need for laboratory testing.</p>	<p>Baseline and ongoing laboratory tests ensure that patients on anticoagulation medications are monitored and dosed appropriately. For patients receiving heparin and warfarin, routine laboratory testing includes partial thromboplastin time (PTT) and international normalized ratio (INR). Although direct oral anticoagulants (DOACs) were designed to be given at fixed doses and do not require routine coagulation monitoring, in selected instances, the interpretation of coagulation laboratory results is important for optimal management of DOAC toxicity or reversal. Regular monitoring of renal function and liver function should also be considered.</p>
5	<p><b>EP 5:</b> The hospital addresses anticoagulation safety practices through the following:</p> <ul style="list-style-type: none"> <li>- Establishing a process to identify, respond to, and report adverse drug events, including adverse drug event outcomes</li> <li>- Evaluating anticoagulation safety practices, taking actions to improve safety practices, and measuring the effectiveness of those actions in a time frame determined by the hospital.</li> </ul>	<p>The prevention of adverse drug events (ADEs) is an important patient safety priority. Anticoagulant medications, which include warfarin, heparin, low-molecular weight heparin, and direct oral anticoagulants, are one of four medication classes commonly identified as a cause of ADEs. Identification of common, preventable, and measurable healthcare associated anticoagulant ADEs is a key component of quality improvement efforts to drive prevention, benchmark progress, and promote a culture of anticoagulation safety.</p>
6	<p><b>EP 6:</b> The hospital provides education to patients and families specific to the anticoagulant medication prescribed, including the following:</p> <ul style="list-style-type: none"> <li>- Adherence to medication dose and schedule</li> <li>- Importance of follow-up appointments and laboratory testing (if applicable)</li> <li>- Potential drug–drug and drug–food interactions</li> <li>- The potential for adverse drug reactions.</li> </ul>	<p>Nonadherence to anticoagulation therapy places patients at risk for bleeding and/or clotting that can lead to severe adverse drug events. It is important that patient and family education emphasizes medication adherence, dose and schedule compliance, drug and food interactions, and the need for follow-up appointments and ongoing laboratory tests. It is important to educate patients taking anticoagulants that some foods and medicines can cause adverse interactions that can lead to an increase risk of bleeding while others can lead to an increase risk of developing blood clots.</p>
7	<p><b>EP 7:</b> The [hospital/organization] uses only oral unit-dose products, prefilled syringes, or premixed infusion bags when these types of products are available.</p> <p>Note: <i>For pediatric patients, prefilled syringe products should only be used if specifically designed for children.</i></p>	<p>Use of oral unit-dose products, prefilled syringes and premixed infusion bags reduces the risk of dosing and medication errors, while increasing patient safety because of their high level of accuracy in delivering medications.</p> <p><i>This is an existing Joint Commission requirement that has been renumbered.</i></p>
8	<p><b>EP 8:</b> When heparin is administered intravenously and continuously, the [hospital/organization] uses programmable pumps to provide consistent and accurate dosing.</p>	<p>Use of programmable pumps ensures consistent and accurate administration of heparin.</p> <p><i>This is an existing Joint Commission requirement that has been renumbered.</i></p>

## **2.4 National Quality Forum (NQF). (2010, April). Safe Practices for Better Healthcare – 2010 Update: A Consensus Report. Washington, D.C.**

National Quality Forum (NQF). (2010, April). Safe Practices for Better Healthcare – 2010 Update: A consensus Report. Washington, D.C.

The National Quality Forum (NQF) created the following patient-safety goal for reducing anticoagulant-associated harms, Safe Practice #29 (Anticoagulation Therapy): Organizations should implement practices to prevent patient harm due to anticoagulant therapy (National Quality Forum, 2010). The safety practice was established based on feedback from healthcare organizations, subject matter experts, and the NQF Safe Practices Consensus Committee.

## **2.5 Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions—Part II: Recommendations. Management of Anticoagulation and/or Antiplatelet Agents Before and after A Procedure (2019)**

Patel, I. J., Rahim, S., Davidson, J. C., Hanks, S. E., Tam, A. L., Walker, T. G., Wilkins, L. R., Sarode, R., & Weinberg, I. (2019). Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions-Part II: Recommendations: Endorsed by the Canadian Association for Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe. *Journal of vascular and interventional radiology : JVIR*, 30(8), 1168–1184.e1.

<https://doi.org/10.1016/j.jvir.2019.04.017>

The goal of anticoagulation and/or antiplatelet agents before a procedure is to minimize medication-related bleeding complications, but also carries a theoretical risk for thrombosis as a result of undertreatment. Therefore, the timing of withholding of medications is a balance between patient thrombosis risk and procedural bleeding risk. Patient comorbidities (e.g., renal function) should be taken into account, and, for patients who present with complex medical comorbidities, multidisciplinary shared decision-making with the patient’s cardiovascular specialist or hematologist is recommended for the management of antithrombotic agents, including bridging options, in the periprocedural period. Table 24 is adapted from the “Management of Anticoagulation and/or Antiplatelet Agents Before and after A Procedure”, Table 6 in the consensus guidelines (Patel et al, 2019), which summarizes agent-specific recommendations for periprocedural medication interruption and reinitiation, including recommendations for patients with renal impairment.



**Table 24: Society of Interventional Radiology Consensus Guidelines Society of Interventional Radiology Consensus Guidelines: Management of Anticoagulation and/or Antiplatelet Agents Before and after A Procedure**

Medication	Low risk for Bleeding	High Risk for Bleeding
<b>Anticoagulants</b>		
<b>UFH</b>		
Withholding	Do not withhold	Withhold IV heparin for 4-6 hours before procedure; check aPTT or anti-Xa level; for BID or TID dosing of SC heparin, procedure may be performed 6 hours after last dose
Reinitiation	NA	6-8 hours
<b>LMWH: enoxaparin (Lovenox), dalteparin (Fragmin)</b>		
Withholding	Do not withhold	Enoxaparin, withhold 1 dose if prophylactic dose is used; withhold 2 doses or 24 hours before procedure if therapeutic dose is used; check anti-Xa level if renal function impaired; dalteparin, withhold 1 dose before procedure
Reinitiation	NA	12 hours
<b>Fondaparinux (Arixtra)</b>		
Withholding	Do not withhold	Withhold 2/3 days (CrCl ≥50 mL/min) or 3-5 days (CrCl ≤50 mL/min)
Reinitiation	NA	24 hours
<b>Argatroban (Acova)</b>		
Withholding	Do not withhold	Withhold 2-4 hours before procedure; check aPTT
Reinitiation	NA	4-6 hours
<b>Bivalirudin (Angiomax)</b>		
Withholding	Do not withhold	Withhold 2-4 hours before procedure; check aPTT
Reinitiation	NA	4-6 hours
<b>Warfarin (Coumadin)</b>		
Withholding	Target INR ≤3.0; consider bridging for high thrombosis risk cases	Withhold 5 days until target INR ≤1.8; consider bridging for high thrombosis risk cases; if STAT or emergent, use reversal agent
Reinitiation	NA or same day reinitiation for bridged patients	Resume day after procedure; high thrombosis risk cases may benefit from bridging with LMWH and multidisciplinary management especially if reversal agent used along with vitamin K
<b>Apixaban (Eliquis)</b>		
Withholding	Do not withhold	Withhold 4 doses (CrCl ≥50 mL/min) or 6 doses (CrCl <30-50 mL/min); if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity or apixaban level especially with impaired renal function

Reinitiation	NA	24 hours
<b>Betrixaban (Bevyxxa)</b>		
Withholding	Do not withhold	Withhold for 3 doses; if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity especially with impaired renal function
Reinitiation	NA	24 hours
<b>Dabigatran (Pradaxa)</b>		
Withholding	Do not withhold	Withhold 4 doses (CrCl $\geq$ 50 mL/min) or 6-8 doses (CrCl <30-50 mL/min); if procedure is STAT or emergent, use reversal agent (idarucizumab); consider checking thrombin time or dabigatran level with impaired renal function
Reinitiation	NA	24 hours
<b>Edoxaban (Savaysa)</b>		
Withholding	Do not withhold	Withhold for 2 doses; if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity especially with impaired renal function
Reinitiation	NA	24 hours
<b>Rivaroxaban (Xarelto)</b>		
Withholding	Do not withhold	Defer procedure until off medication for 2 doses (CrCl $\geq$ 50 mL/min), 2 doses (CrCl <30-50 mL/min), or 3 doses (CrCl <15-30 mL/min); if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity or rivaroxaban level especially with impaired renal function
Reinitiation	NA	24 hours
<b>Antiplatelet agents: thienopyridines</b>		
<b>Clopidogrel (Plavix)</b>		
Withholding	Do not withhold	Withhold for 5 days before procedure
Reinitiation	NA	Reinitiation can occur 6 hours after procedure if using 75 mg dose but should occur 24 hours after procedure if using a loading dose (300-600 mg)
<b>Ticagrelor (Brilinta)</b>		
Withholding	Do not withhold	Withhold for 5 days before procedure
Reinitiation	NA	Resume the day after procedure
<b>Prasugrel (Effient)</b>		
Withholding	Do not withhold	Withhold for 7 days before procedure
Reinitiation	NA	Resume the day after procedure
<b>Cangrelor (Kengreal)</b>		
Withholding	Defer procedure until off medication; if procedure is emergent, withhold 1 hour before procedure; multidisciplinary discussion with cardiology suggested	

Reinitiation	Patients receiving cangrelor are undergoing PCI or are within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended	
Antiplatelet agents: NSAIDs		
Aspirin		
Withholding	Do not withhold	Withhold 3-5 days before procedure
Reinitiation	NA	Resume the day after procedure
Aspirin/dipyridamole (Aggrenox)		
Withholding	Do not withhold	Withhold 3-5 days before procedure
Reinitiation	NA	Resume the day after procedure
Short-acting NSAIDs (half-life 2-6 hours): ibuprofen, diclofenac, ketoprofen, indomethacin, ketorolac		
Withholding	Do not withhold	No recommendation
Reinitiation	NA	NA
Intermediate-acting NSAIDs (half-life 7-15 hours): naproxen, sulindac, diflunisal, celecoxib		
Withholding	Do not withhold	No recommendation
Reinitiation	NA	NA
Long-acting NSAIDs (half-life >20 hours): meloxicam, nabumetone, piroxicam		
Withholding	Do not withhold	No recommendation
Reinitiation	NA	NA
Antiplatelet agents: glycoprotein IIb/IIIa inhibitors		
Long-acting: abciximab (ReoPro)		
Withholding	Withhold 24 hours before procedure	
Reinitiation	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended	
Short-acting: eptifibatide (Integrilin), tirofiban (Aggrastat)		
Withholding	Withhold 4-8 hours before procedure	
Reinitiation	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended	
Other		
Cilostazol (Pletal)		
Withholding	Do not withhold	Do not withhold
Reinitiation	NA	NA

Note: Adapted from Table 6 in Consensus Guidelines for Thrombotic and Bleeding Risk: Part II; please see citation in Patel et. Al (2019), Table 6, for a list of footnotes for the adapted table.