Periprocedural Anticoagulation – Adult – Inpatient and Ambulatory– Clinical Practice Guideline

Cover Sheet

Target Population: Inpatient and Ambulatory Adult Patients

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Inpatient Anticoagulation Committee
Ambulatory Anticoagulation Committee

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Clinical Practice Guideline (CPG)
Executive Summary

Guideline Title:
Periprocedural Anticoagulation – Adult – Inpatient and Ambulatory – Clinical Practice Guideline

Guideline Overview
The following guideline provides recommendations for patients receiving antithrombotic therapy and who require surgery or other invasive procedure. Evaluating thrombembolic and bleeding risks are outlined as well as considerations for continuation or discontinuation of antithrombotic therapy in the periprocedural time frame.

Risk assessment tools addressed in this guideline include:
- Table 1: Bleeding Risk for Surgery/Procedure
- Table 2: Periprocedural Risk for Thrombosis
- Table 3: Risk Factors for Venous Thrombosis
- Table 4: Anticoagulation Considerations for Endoscopic Procedures
- Table 5: Dosing of Periprocedural Anticoagulation

Antithrombotic agents addressed in this guideline include:
- Aspirin
- Apixaban
- Cilostazol
- Clopidogrel
- Dabigatran
- Dipyridamole
- Low Molecular Weight Heparin (LMWH)
- Prasugrel
- Rivaroxaban
- Ticagrelor
- Unfractionated Heparin
- Warfarin

Practice Recommendations
1. Assessment
   1.1. Weigh the short-term risk for thromboembolism and bleeding for your individual patient
   1.1.1 Not all patients will need pre-operative anticoagulation or bridging therapy.
   1.1.2 Overall risk stratification should focus on the risk of thromboembolism since the consequences of thromboembolism are more common and more often fatal compared to consequences of major bleeding. (Class IIa, Level C)

   1.2. Evaluate the bleeding risk of procedure or surgery - see table 1 (Class IIa, Level C)

   1.3. Identify the indication for anticoagulation and risk of thrombosis if these agents were discontinued - see table 2. (Class IIa, Level C)
      1.3.1. For endoscopic procedures – see table 4
2. Oral Anticoagulation Therapy Considerations For Perioperative Management

2.1. Warfarin

<table>
<thead>
<tr>
<th>Pre-procedure INR</th>
<th>Warfarin Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 – 3.0</td>
<td>Stop warfarin 5 days (hold 4 doses) before surgery or procedure</td>
</tr>
<tr>
<td>3.0 – 4.5</td>
<td>Stop warfarin 6 days (hold 5 doses) before surgery or procedure</td>
</tr>
</tbody>
</table>

2.1.1. Check INR within 24 hours of surgery or procedure to ensure that it is less than 1.5 or lower if otherwise indicated (Class IIb, Level C)

2.1.2. Restart warfarin on postoperative day 1 if hemostasis is achieved and if approved by surgeon (Class Ila, Level C)

2.1.2.1. May start on postoperative day 0 if dose given 12 hours after surgery or procedure and if approved by surgeon (Class Ila, Level C)

2.2 Dabigatran

2.2.1 Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving dabigatran. (Class IIb, Level C)

<table>
<thead>
<tr>
<th>Renal Function (CrCl)</th>
<th>Dabigatran Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 50 mL/min</td>
<td>Stop dabigatran 1 to 2 days before surgical procedure</td>
</tr>
<tr>
<td>&lt; 50 mL/min</td>
<td>Stop dabigatran 3 to 5 days before surgical procedure</td>
</tr>
</tbody>
</table>

2.2.2 Dabigatran should be resumed as soon as possible after a procedure (Class IIb, Level C)

2.2.2.1 Onset of therapeutic anticoagulation with dabigatran occurs within 2 hours.

2.2.3 Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon (Class IIb, Level C)

2.2.4 Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon (Class IIb, Level C)

2.3 Rivaroxaban

2.3.1 Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving rivaroxaban. (Class IIb, Level C)

<table>
<thead>
<tr>
<th>Renal Function (CrCl)</th>
<th>Rivaroxaban Discontinuation Plan</th>
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</thead>
<tbody>
<tr>
<td>&gt; 30 mL/min</td>
<td>Stop rivaroxaban 24 hours before surgical procedure</td>
</tr>
<tr>
<td>≤ 30 mL/min</td>
<td>Stop rivaroxaban 48 hours before surgical procedure</td>
</tr>
</tbody>
</table>

2.3.2 Rivaroxaban should be resumed as soon as possible after a procedure (Class IIb, Level C)

2.3.2.1 Onset of therapeutic anticoagulation with rivaroxaban occurs within 2-4 hours.

2.3.3 Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon (Class IIb, Level C)

2.3.4 Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon (Class IIb, Level C)
2.4 Apixaban

2.4.1 Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving apixaban. (Class IIB, Level C)

<table>
<thead>
<tr>
<th>Renal Function (Scr)</th>
<th>Apixaban Discontinuation Plan</th>
<th>High Bleeding Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1.5 mg/dL</td>
<td>Stop apixaban 24 hours before surgical procedure</td>
<td>Stop apixaban 48 hours before surgical procedure</td>
</tr>
<tr>
<td>≥ 1.5 mg/dL</td>
<td>Stop apixaban 48 hours before surgical procedure</td>
<td>Stop apixaban 72 hours before surgical procedure</td>
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</table>

2.4.2 Apixaban should be resumed as soon as possible after a procedure (Class IIb, Level C)

2.3.2.1 Onset of therapeutic anticoagulation with apixaban occurs within 3-4 hours

2.4.3 Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon (Class IIb, Level C)

2.4.4 Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon (Class IIb, Level C)

3. Parenteral Anticoagulation for Perioperative Management

3.1. Consider therapeutic doses for risk of arterial thromboembolism (Class IIb, Level C) - See table 5

3.2. Therapeutic or prophylactic doses may be considered for venous thrombosis risks (Class IIb, Level C) - See table 5

3.3. Start a low molecular weight heparin (LMWH) or unfractionated heparin (UFH) when INR < 2.0, usually 48 hours after stopping warfarin. (Class Ia, Level C)

3.4 Prior to procedure

3.4.1 Stop therapeutic LMWH 24 hours before surgery or procedure (Class Ia, Level C)

3.4.2 Stop prophylactic LMWH or SQ UFH 12 hours before surgery or procedure (Class Ia, Level C)

3.4.3 Stop IV therapeutic UFH 4 - 6 hours before surgery or procedure (Class Ia, Level C)

3.5 After procedure

3.5.1 Minor surgery or procedure with low bleeding risk: Start LMWH or UFH 12 to 24 hours if approved by surgeon (Class Ia, Level C)

3.5.2 Major surgery or high bleed risk surgery or procedure: Start LMWH or UFH 48 to 72 hours if approved by surgeon (Class Ia, Level C)

3.5.3 If therapeutic doses of LMWH or UFH were used pre-operatively may consider starting prophylactic dosing in 24 hours (Class Ia, Level C)

4. Antiplatelet Therapy Considerations for Perioperative Management

4.1 Aspirin

4.1.1 Non-cardiac Surgery

<table>
<thead>
<tr>
<th>Cardiovascular Event Risk</th>
<th>Aspirin Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate to High Risk</td>
<td>Continue aspirin around the time of surgery</td>
</tr>
<tr>
<td>Low Risk</td>
<td>Stop 7-10 days before surgery</td>
</tr>
</tbody>
</table>

4.1.2 Cardiac surgery (ex. CABG): continue aspirin around the time of surgery (Class Ia Level C)

4.1.3 Restart aspirin 24 hours after surgery or procedure if approved by surgeon (Class Ia, Level C)

4.2 Thienopyridine Platelet Aggregation Inhibitors: Clopidogrel/ Ticagrelor/ Prasugrel

4.2.1 Patients with a coronary stent on P2Y12 therapy who require surgery

<table>
<thead>
<tr>
<th>Coronary Artery Stent Requiring Surgery</th>
<th>Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Metal Stent (BMS)</td>
<td>Defer surgery at least 6 weeks after placement</td>
</tr>
<tr>
<td>Drug Eluding Stent (DES)</td>
<td>Defer surgery at least 6 months after placement</td>
</tr>
<tr>
<td>BMS or DES unable to defer surgery</td>
<td>Continue antiplatelet therapy around the time of surgery</td>
</tr>
</tbody>
</table>
4.2.2 Patients who require coronary bypass surgery on P2Y12 therapy:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clopidogrel</td>
<td>Hold 5 days before surgery</td>
</tr>
<tr>
<td>Ticagrelor</td>
<td>Hold 5 days before surgery</td>
</tr>
<tr>
<td>Prasugrel</td>
<td>Hold 5 to 7 days before surgery</td>
</tr>
</tbody>
</table>

4.2.3 Restart within 24 to 48 hours after surgery if approved by surgeon

4.3 Dipyridamole and Cilostazol

4.3.1 Dipyridamole and cilostazol reversibly inhibit platelet function so the activity is dependant on the half life. *(Class IIb, Level C)*

<table>
<thead>
<tr>
<th>Drug and Half Life</th>
<th>Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dipyridamole (10 hours)</td>
<td>Stop 1-2 days before surgery</td>
</tr>
<tr>
<td>Cilostazol (11-13 hours)</td>
<td>Stop 1-2 days before surgery</td>
</tr>
</tbody>
</table>

4.3.2 Restart 24 hours after surgery or procedure if approved by surgeon *(Class IIb, Level C)*
## B. Scope (disease/condition, treatment, clinical specialty)
1. Adult patients undergoing a procedure or surgery who are also receiving therapeutic antithrombotic therapy

## C. Methodology
1. A modified Grading of Recommendations Assessment, Development and Evaluation (GRADE) developed by the American Heart Association and American College of Cardiology (Figure 1.) has been used to assess the Quality and Strength of the Evidence in this Clinical Practice Guideline.¹

## D. Definitions (optional)
1. Periprocedural or Bridging Anticoagulation – administration of a short acting anticoagulant during the interruption of long-term antithrombotic therapy for major/minor surgery or procedures. Usually administered for a 10-12 day period.²
2. Antithrombotic therapy: Any anticoagulant or antiplatelet medication
3. Anticoagulation therapy may include but is not limited to: warfarin, dabigatran, rivaroxaban, heparin, enoxaparin
4. Antiplatelet therapy may include but is not limited to: aspirin, clopidogrel, ticagrelor, prasugrel

## E. Introduction
1. Patients receiving long term antithrombotic therapy who require surgery or an invasive procedure present a difficult therapeutic dilemma for clinicians. Continuation of antithrombotic therapy until the day of the surgery or procedure can increase the risk of bleeding, while discontinuation several days before can place the patient at an increased risk for a thromboembolic episode. In this periprocedural interval when antithrombotic therapy is halted, periprocedural anticoagulation (bridging therapy) with a heparin product may be recommended for some patients.²³
2. These are guidelines to provide clinicians with some guidance on an area of medicine where data from randomized controlled trials are lacking and considerable controversy exists. Deviation from these guidelines may be necessary and appropriate when caring for an individual patient.

F. Recommendations

1. Assessment
   1.1. Weigh the consequences of short-term risk for thromboembolism and bleeding for your individual patient.²
   1.1.3 Not all patients will need periprocedural anticoagulation or bridging therapy.
   1.1.4 Overall risk stratification should focus on the patient’s risk of thromboembolism since the consequences of thromboembolism are more common and more often fatal compared to consequences of major bleeding. (Class IIa, Level C)

1.2. Evaluate the bleeding risk of procedure or surgery² - see table 1 (Class IIa, Level C)

1.3. Warfarin and aspirin may be continued during some procedures where bleed risk is low.², ⁴
   1.3.1 Simple dental procedures (including extractions) if there is coadministration of an oral prohemostatic agent. (If no oral prohemostatic agent is coadministered, then warfarin should be held for 2-3 days before the procedure) (Class IIa, Level B)
   1.3.1.1 Pro-hemostatic agents used in dental procedures may include but are not limited to: oxycellulose, absorbable gelatin, collagen, fibrin glue
   1.3.2 Cataract surgery (Class IIa, Level C)
   1.3.3 Diagnostic or screening colonoscopies (Class IIa, Level C)
   1.3.4 Some cutaneous surgeries (Class IIa, Level C)
   1.3.5 For endoscopic procedures – see table 4

1.4. Identify the indication for anticoagulation and risk of thrombosis if these agents were discontinued² - see table 2. (Class IIa, Level C)
   1.4.1. For endoscopic procedures – see table 4

1.5. Consider other risk factors for thromboembolism⁵-⁷ (Class IIa, Level C)
   1.5.1 Type of surgery or procedure
   1.5.2 Other patient specific risk factors – see table 3.
   1.5.3 Duration off antithrombotic therapy
Evaluate the Risk of Bleeding

Table 1. Bleeding Risk for Surgery/Procedure\textsuperscript{2,5,8}

<table>
<thead>
<tr>
<th>High Risk</th>
<th>Moderate Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic aneurysm repair</td>
<td>Renal biopsy</td>
<td>Cataract surgery</td>
</tr>
<tr>
<td>Bladder surgery</td>
<td>Resection of colon polyps</td>
<td>Dental procedures</td>
</tr>
<tr>
<td>Bowel polypectomy</td>
<td>Prostate biopsy</td>
<td>Dental hygiene</td>
</tr>
<tr>
<td>Coronary artery bypass grafting (CABG)</td>
<td>Pacemaker or defibrillator implantation</td>
<td>Simple extractions</td>
</tr>
<tr>
<td>Heart valve replacement</td>
<td>Major intraabdominal surgery</td>
<td>Restorations</td>
</tr>
<tr>
<td>Intracranial surgery</td>
<td>Major intrathoracic surgery</td>
<td>Endodontics</td>
</tr>
<tr>
<td>Major cancer surgery</td>
<td>More invasive dental or ophthalmic procedures</td>
<td>Prosthetics</td>
</tr>
<tr>
<td>Major orthopedic surgery (hip or knee replacement)</td>
<td></td>
<td>Cutaneous surgeries (most)</td>
</tr>
<tr>
<td>Peripheral artery bypass and other major vascular surgery</td>
<td></td>
<td>Laparoscopic cholecystectomy or hernia repair</td>
</tr>
<tr>
<td>Prostate surgery</td>
<td></td>
<td>Coronary angiography</td>
</tr>
<tr>
<td>Reconstructive plastic surgery</td>
<td></td>
<td>Endoscopy with or without biopsy</td>
</tr>
<tr>
<td>Spinal surgery/Epidural procedure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluate the Risk of Thrombosis - Identify the indication for anticoagulation and risk of thrombosis if these agents were discontinued

Table 2. Periprocedural Risk for Thromboembolism\textsuperscript{2,7}

<table>
<thead>
<tr>
<th>Risk</th>
<th>High:</th>
<th>Moderate: Anticoagulation considered on a case by case basis</th>
<th>Low: Anticoagulation is generally not advised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Heart Valve</td>
<td>Any mechanical mitral valve</td>
<td>Bileaflet aortic valve and 1 of the following: atrial fibrillation, prior stroke or TIA, hypertension, diabetes, heart failure, age &gt;75 years</td>
<td>Bileaflet aortic valve without atrial fibrillation and no other risk factors for stroke</td>
</tr>
<tr>
<td></td>
<td>Older mechanical valve model (caged ball or tilting disc) aortic valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recently placed mechanical valve (&lt; 3 months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>With mechanical heart valve (any position)</td>
<td>CHADS2* Score of 3 or 4</td>
<td>CHADS2* Score of 0 or 2 (no prior stroke or TIA)</td>
</tr>
<tr>
<td>*CHADS2 score Table 3</td>
<td>With rheumatic valvular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With recent stroke or TIA (within 3 months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHADS2* Score of 5 or 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>VTE within previous 3 months</td>
<td>VTE 3-12 months ago</td>
<td>Single VTE &gt; 12 months ago and no other risk factors</td>
</tr>
<tr>
<td></td>
<td>With severe thrombophilia (eg. Protein C, S or Antithrombin III deficiency, Antiphospholipid syndrome, Homozygous factor V Leiden mutation)</td>
<td>Recurrent VTE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With non-severe thrombophilia (eg, heterozygous factor V Leiden mutation, heterozygous factor II mutation)</td>
<td>With active cancer (treated within 6 months or palliative)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With active cancer (treated within 6 months or palliative)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\*CHADS2 has not been validated for VTE risk in atrial fibrillation. It is used for risk stratification to reduce stroke risk with aspirin vs warfarin.
Calculating a CHADS2 Score

| C | Congestive Heart Failure   | 1 point |
| H | Hypertension               | 1 point |
| A | Age ≥ 75                   | 1 point |
| D | Diabetes                   | 1 point |
| S | Secondary prevention in patients with prior ischemic stroke, TIA, or systemic thromboembolic event | 2 points |

0 points – Low Risk  
1-2 points – Intermediate Risk  
≥ 3 points – High Risk

Table 3. Risk Factors for Developing Venous Thromboembolism

| Age > 40 years | Personal or Family History of SVT, DVT/PE |
| BMI > 25       | History of malignancy |
| Swollen legs (current) | Central venous access |
| Oral contraceptive or hormone replacement therapy | Present cancer or treatment with chemotherapy |
| Acute myocardial infarction (<1 month) | Heart failure exacerbation (<1 month) |
| History of inflammatory bowel disease | Serious lung dx ex. Pneumonia (<1 month) |
| Leg plaster cast or brace | Type of surgery/procedure |

Table 4. Anticoagulation Considerations for Endoscopic Procedures

<table>
<thead>
<tr>
<th>Endoscopic Procedure</th>
<th>High or Moderate Thromboembolic Risk</th>
<th>Low Thromboembolic Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic or Screening</td>
<td>Continue warfarin management</td>
<td>Consider holding warfarin and proceeding when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Low biopsy risk</td>
<td>Continue warfarin management</td>
<td>Consider holding warfarin and proceeding when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Removal of &lt; 10 mm polyps with cold snare/forceps</td>
<td>Hold warfarin and bridge peri-procedural anticoagulation</td>
<td>Hold warfarin and proceed when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Large polyp removal (&gt; 10 mm)</td>
<td>Hold warfarin and bridge peri-procedural anticoagulation</td>
<td>Hold warfarin and proceed when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Sphincterotomy</td>
<td>Hold warfarin and bridge peri-procedural anticoagulation</td>
<td>Hold warfarin and proceed when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Esophageal Dilation</td>
<td>Hold warfarin and bridge peri-procedural anticoagulation</td>
<td>Hold warfarin and proceed when INR &lt; 1.5*</td>
</tr>
<tr>
<td>Fine Needle Aspiration</td>
<td>Hold warfarin and bridge peri-procedural anticoagulation</td>
<td>Hold warfarin and proceed when INR &lt; 1.5*</td>
</tr>
</tbody>
</table>

* May consider using peri-procedural anticoagulation
2. Oral Anticoagulation Therapy Considerations For Perioperative Management

2.1. Warfarin

2.1.1. Assess INR at least 7 days before surgery or procedure to allow for planning of perioperative management. If bridge therapy is needed see section: 3.0 (Class Ila Level C)

<table>
<thead>
<tr>
<th>Pre-procedure INR</th>
<th>Warfarin Discontinuation Plan</th>
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<tr>
<td>2.0 – 3.0</td>
<td>Stop warfarin 5 days (hold 4 doses) before surgery or procedure</td>
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<td>Stop warfarin 6 days (hold 5 doses) before surgery or procedure</td>
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</table>

2.1.2. Check INR within 24 hours of surgery or procedure to ensure that it is less than 1.5 or lower if otherwise indicated (Class Ib, Level C)

2.1.3. If timing of surgery does not allow for gradual reduction of INR from withholding warfarin alone, administration of phytonadione (vitamin K) or fresh frozen plasma may be necessary. (Class Ib, Level C)

2.1.4. Restart warfarin on postoperative day 1 if hemostasis is achieved and if approved by surgeon (Class Ila, Level C)

2.1.4.1. May start on postoperative day 0 if dose given 12 hours after surgery or procedure and if approved by surgeon (Class Ila, Level C)

2.2. Dabigatran

2.2.1. Assess renal function at least 7 days before surgery or procedure to allow for planning of perioperative management. Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving dabigatran. (Class Ib, Level C)

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<tr>
<th>Renal Function (CrCl)</th>
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<td>≥ 50 mL/min</td>
<td>Stop dabigatran 1 to 2 days before surgical procedure</td>
</tr>
<tr>
<td>&lt; 50 mL/min</td>
<td>Stop dabigatran 3 to 5 days before surgical procedure</td>
</tr>
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2.2.2. Consider stopping dabigatran for > 5 days for patients undergoing major surgery, spinal puncture, or placement of a spinal or epidural catheter or port in whom complete hemostasis may be required (Class Ib, Level C)

2.2.3. Dabigatran should be resumed as soon as possible after a procedure (Class Ib, Level C)

2.2.3.1. Onset of therapeutic anticoagulation with dabigatran occurs within 2 hours.

2.2.4. Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon (Class Ib, Level C)

2.2.5. Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon (Class Ib, Level C)

2.2.5.1. Use caution when restarting dabigatran within 48 to 72 hours postoperatively especially in procedures associated with high bleeding risks

2.2.6. Dabigatran therapy should not be changed to warfarin post-operatively if being used for the same indication (Class Ib, Level C)

2.2.7. Monitor serum creatinine and creatinine clearance post-operatively to determine if a dose adjustment is needed
2.3 Rivaroxaban

2.3.1 Assess renal function at least 7 days before surgery or procedure to allow for planning of perioperative management. Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving rivaroxaban. *(Class IIb, Level C)*

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<tr>
<td>≤ 30 mL/min</td>
<td>Stop rivaroxaban 48 hours before surgical procedure</td>
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2.3.2 Rivaroxaban should be resumed as soon as possible after a procedure *(Class IIb, Level C)*

2.3.2.1 Onset of therapeutic anticoagulation with rivaroxaban occurs within 2-4 hours

2.3.3 Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon *(Class IIb, Level C)*

2.3.4 Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon *(Class IIb, Level C)*

2.3.5 Rivaroxaban therapy should not be changed to warfarin if being used for the same indication *(Class IIb, Level C)*

2.4 Apixaban

2.4.1 Assess renal function at least 7 days before surgery or procedure to allow for planning of perioperative management. Pre-operative parenteral anticoagulation is not needed in the majority of patients receiving apixaban. *(Class IIb, Level C)*

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<td>≥ 1.5 mg/dL</td>
<td>Stop apixaban 48 hours before surgical procedure</td>
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2.4.2 Apixaban should be resumed as soon as possible after a procedure *(Class IIb, Level C)*

2.4.2.1 Onset of therapeutic anticoagulation with apixaban occurs within 3-4 hours

2.4.3 Minor surgery or procedure with low bleeding risk: Start 12 to 24 hours if approved by surgeon *(Class IIb, Level C)*

2.4.4 Major surgery or high bleed risk surgery or procedure: Start 48 to 72 hours if approved by surgeon *(Class IIb, Level C)*

2.4.5 Apixaban therapy should not be changed to warfarin if being used for the same indication *(Class IIb, Level C)*

3. Parenteral Anticoagulation for Perioperative Management

3.1 Consider therapeutic doses for patients who are at risk for arterial thromboembolism *(Class IIb, Level C)* - See table 5

3.2 Therapeutic or prophylactic doses may be considered for patients with venous thrombosis risks *(Class IIb, Level C)* - See table 5

3.3 Start a low molecular weight heparin (LMWH) or unfractionated heparin (UFH) when INR < 2.0, usually 48 hours after stopping warfarin. *(Class Ila, Level C)*
Table 5. Dosing of Periprocedural Anticoagulation

<table>
<thead>
<tr>
<th>Drug</th>
<th>Therapeutic Dose</th>
<th>Prophylactic Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoxaparin</td>
<td>1 mg/kg SQ every 12 hours (Round to nearest prefilled syringe size)</td>
<td>40 mg SQ every 24 hours</td>
</tr>
<tr>
<td>(Formulary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dalteparin*</td>
<td>100 units/kg SQ every 12 hours OR 200 units/kg SQ every 24 hours (Round to nearest prefilled syringe size)</td>
<td>5000 units SQ every 24 hours</td>
</tr>
<tr>
<td>(Non-Formulary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UFH</td>
<td>Refer to UWHC Guidelines for therapeutic dosing of IV heparin</td>
<td>5000 units SQ every 12 hours OR 5000 units SQ every 8 hours</td>
</tr>
</tbody>
</table>

* Patients will be therapeutically interchanged to the formulary product enoxaparin during admission

3.4 Prior to procedure

3.4.1 Stop therapeutic LMWH 24 hours before surgery or procedure (Class IIa, Level C)

3.4.2 Stop prophylactic LMWH or SQ UFH 12 hours before surgery or procedure (Class IIa, Level C)

3.4.3 Stop IV therapeutic UFH 4 - 6 hours before surgery or procedure (Class IIa, Level C)

3.5 After procedure

3.5.1 Minor surgery or procedure with low bleeding risk: Start LMWH or UFH 12 to 24 hours if approved by surgeon (Class IIa, Level C)

3.5.2 Major surgery or high bleed risk surgery or procedure: Start LMWH or UFH 48 to 72 hours if approved by surgeon (Class IIa, Level C)

3.5.3 If therapeutic doses of LMWH or UFH were used pre-operatively may consider starting prophylactic dosing in 24 hours (Class IIa, Level C)

4. Antiplatelet Therapy Considerations for Perioperative Management

4.1 Aspirin

4.1.1 Non-cardiac Surgery

Cardiovascular Event Risk | Aspirin Discontinuation Plan
--------------------------|---------------------------------|
Moderate to High Risk     | Continue aspirin around the time of surgery |
Low Risk                  | Stop 7-10 days before surgery       |

4.1.2 Cardiac surgery (ex. CABG): continue aspirin around the time of surgery (Class IIa Level C)

4.1.3 Restart aspirin 24 hours after surgery or procedure if approved by surgeon (Class IIa, Level C)

4.2 Thienopyridine Platelet Aggregation Inhibitors: Clopidogrel/ Ticagrelor/ Prasugrel

4.2.1 Patients with a coronary stent on P2Y12 therapy who require surgery

Coronary Artery Stent Requiring Surgery | Discontinuation Plan
----------------------------------------|---------------------------|
Bare Metal Stent (BMS)                   | Defer surgery at least 6 weeks after placement |
Drug Eluding Stent (DES)                  | Defer surgery at least 6 months after placement |
BMS or DES unable to defer surgery       | Continue antiplatelet therapy around the time of surgery |

4.2.2 Patients who require coronary bypass surgery on P2Y12 therapy:

Drug                | Discontinuation Plan
---------------------|-----------------------|
Clopidogrel          | Hold 5 days before surgery |
Ticagrelor           | Hold 5 days before surgery |
Prasugrel            | Hold 5 to 7 days before surgery |

4.2.3 Restart within 24 to 48 hours after surgery if approved by surgeon
4.3 Dipyridamole and Cilostazol\textsuperscript{2,16}

4.3.1 Dipyridamole and cilostazol reversibly inhibit platelet function so the activity is dependant on the half life. \textit{(Class IIb, Level C)}

<table>
<thead>
<tr>
<th>Drug and Half Life</th>
<th>Discontinuation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dipyridamole (10 hours)</td>
<td>Stop 1-2 days before surgery</td>
</tr>
<tr>
<td>Cilostazol (11-13 hours)</td>
<td>Stop 1-2 days before surgery</td>
</tr>
</tbody>
</table>

4.3.2 Restart 24 hours after surgery or procedure if approved by surgeon \textit{(Class IIb, Level C)}

5. \textbf{Endoscopic procedures} \textsuperscript{2,4,8}

5.1 Screening or diagnostic endoscopic procedure: anticoagulation may be resumed the same day \textit{(Class IIb, Level C)}

5.2 Biopsy obtained: anticoagulation may be resumed the same day \textit{(Class Ila, Level C)}

5.3 Snare polypectomy, sphincterotomy, esophageal dilation or fine needle aspiration performed: anticoagulation may be resumed the next day \textit{(Class Ila, Level C)}

6. \textbf{Communication} \textit{(Class IIb, Level C)}

6.1 Surgeons or proceduralist should contact to the clinician managing antithrombotic therapy at least 7 days before surgery to develop a perioperative plan

6.2 Surgeons or proceduralist should communicate to the clinician managing antithrombotic therapy if the needs are different then what has been outlined in this guideline

6.3 Patients should be given written instructions (ex. Calendar) outlining the perioperative plan for holding antithrombotic therapy, the use of bridging therapy (if needed), laboratory needs, and when to restart antithrombotic therapy

6.4 Surgeons or proceduralists should communicate to the clinician managing warfarin when anticoagulation may be restarted either through telephone conversation or documentation within electronic medical record.

G. \textbf{External References}


H. Benefits/Harms of Implementation
1. Benefit: Provides a standardized approach for management and monitoring of peri-procedural anticoagulation
2. Harms:
   2.1. Choosing to continue anticoagulation therapy may result in bleeding intra or post procedure or surgery.
   2.2. Discontinuing anticoagulation therapy may result in a thromboembolic event while the patient is not anticoagulated.

I. Qualifying Statements (optional)
These are guidelines to provide clinicians with some guidance on an area of medicine where data from randomized controlled trials are lacking and considerable controversy exists. Deviation from these guidelines may be necessary and appropriate when caring for an individual patient

J. Implementation Strategy –
1. Recommendations provided by this guideline will be disseminated to clinical staff through a series of clinical inservices and through the use of implementation tools outlined below.

K. Implementation Tools/Plan –
1. UW Health Ambulatory Anticoagulation Newsletter
2. UW Health Anticoagulation Website: [www.uwhealth.org/anticoagulation](http://www.uwhealth.org/anticoagulation)
3. Creation of smart text for documenting periprocedural plan in the electronic medical record.

L. Disclaimer
It is understood that occasionally patients will not match the conditions considered in the guideline and clinical judgment should be used when developing a treatment plan.