Peri-Procedure Management of Anticoagulants

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THROMBOTIC RISK4

- High4 bleeding risk
- Low4 bleeding risk

BLOODING RISK5

- High5 bleeding risk
- Low5 bleeding risk

MANAGEMENT PRE-PROCEDURE

- Hold anticoagulants per Appendix C
- If patient on warfarin, bridge and hold anticoagulation per Appendix D
- Consult IMPAC (if outpatient)

POST-PROCEDURE RE-INITIATION TIME

- Neurosurgery procedures:
  - Anticoagulation restarted no sooner than 96 hours post-procedure
- Other procedures:
  - Patients within 30 days of acute pulmonary embolism without overt bleeding or bleeding risk, restart anticoagulation within 4-6 hours post-procedure
  - All other patients, restart warfarin or heparin within 24 hours or DOACs within at least 48 hours post-procedure

DOAC = direct oral anticoagulants

1 For questions, call appropriate service depending on procedure (Anesthesia, Cardiology, Internal Medicine Perioperative Assessment Center [IMPAC])
2 See internal Coagulation Reversal Recommendations (click here)
3 For patients on antiplatelet therapy, see Management of Antiplatelet Therapy in Patients with Cardiac Stents Undergoing Procedures Algorithm
4 See Appendix A for Indications of Thrombotic Risk
5 See Appendix B for Procedural Bleeding Risks based on type of procedure
## APPENDIX A: Thrombotic Risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mechanical Heart Valve</th>
<th>Atrial Fibrillation</th>
<th>Venous Thromboembolism (VTE)</th>
</tr>
</thead>
</table>
| High (require bridging if on warfarin) | - Any mitral valve prosthesis  
- Any caged-ball or tilting disc aortic valve prosthesis  
- Stroke or transient ischemic attack (TIA) within 6 months | - CHA$_2$DS$_2$-VASc$^1$ score of greater than or equal to 7  
- Stroke or TIA within 3 months  
- Rheumatic valvular heart disease | - VTE within 3 months  
- VTE of any duration with severe thrombophilia (e.g., deficiency of protein C, protein S, or antithrombin, antiphospholipid antibodies, homozgyous factor V Leiden or prothrombin G20210A, or multiple abnormalities) |
| Low | - Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or TIA, hypertension, diabetes, congestive heart failure, age over 75 years  
- Bileaflet aortic valve prosthesis without risk factors for stroke | - CHA$_2$DS$_2$-VASc$^1$ score less than 7 | - VTE within the past 3-12 months  
- VTE with non-severe thrombophilia (e.g., heterozygous factor V Leiden or prothrombin gene mutation)  
- Recurrent idiopathic VTE  
- Active cancer (treated within 6 months or palliative)  
- VTE greater than 12 months previous and no other risk factors |

$^1$ CHA$_2$DS$_2$-VASc Score

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>Congestive heart failure history</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes mellitus history</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension history</td>
<td>1</td>
</tr>
<tr>
<td>Vascular disease history</td>
<td>1</td>
</tr>
<tr>
<td>Age 65-74 years</td>
<td>1</td>
</tr>
<tr>
<td>Age greater than or equal to 75 years</td>
<td>2</td>
</tr>
<tr>
<td>Stroke/TIA/thromboembolism history</td>
<td>2</td>
</tr>
</tbody>
</table>
APPENDIX B: Procedure Bleeding Risks

Note: Clinical or laboratory suspicion (i.e., elevated PT/aPTT or INR) of an underlying coagulopathy unrelated to anticoagulation therapy should be evaluated prior to the procedure. Please contact Benign Hematology or General Internal Medicine for advice on management.

### Interventional Radiology

#### High Bleeding Risk
- Transjugular intrahepatic porto-systemic shunt
- Lung interventions: biopsy, drainage (parenchymal)
- Solid organ biopsies
- Solid organ drainage: nephrostomy, biliary, cholecystostomy
- Ablations: solid organs, bone, soft tissues, lung
- Transjugular liver biopsy
- Tunneled central venous catheter placement
- Angiography, arterial intervention with access size up to 6 French
- Trans-arterial embolotherapy
- Venous interventions
- Portal vein embolization and stenting
- Non-organ biopsy (e.g., retroperitoneal, vertebral, intra-abdominal)
- Non-organ drainage (e.g., abdominal or retroperitoneal abscess)
- Drainage catheter exchange less than 6 weeks (biliary, nephrostomy, abscess)
- Gastrostomy tube placement
- Spine procedures: vertebroplasty, kyphoplasty
- Tunneled drainage catheter placement (e.g., Denver catheter)
- Central line removal (tunneled)
- All interventional procedures where heparin and bivalirudin are used

#### Low Bleeding Risk
- Non-tunneled venous access
- Central line removal (non-tunneled)
- Drainage catheter exchange greater than 6 weeks (biliary, nephrostomy, abscess)
- Thoracentesis
- Non-tunneled chest tube placement (pleural space)
- Paracentesis
- Intraperitoneal catheter placement
- Superficial (e.g., lymph nodes) or palpable mass biopsies
- Superficial abscess drainage
- Inferior vena cava (IVC) filter placement
- IVC filter retrieval
- Left and right cardiac catheterization

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1 For patients on antplatelet therapy, see Management of Antiplatelet Therapy in Patients with Cardiac Stents Undergoing Procedures Algorithm.
APPENDIX B: Procedural Bleeding Risks

General Procedures

**High Bleeding Risk:**
- Lumbar puncture
- Peripherally inserted central catheter (PICC) line placement
- All operating room procedures

**Low Bleeding Risk:**
- Bone marrow aspiration and biopsy
- Ommaya reservoir puncture
- Subclavian or femoral vein catheter placement

Pulmonary Procedures

**High Bleeding Risk:**
- Diagnostic bronchoscopy with transbronchial biopsy
- Diagnostic bronchoscopy with endobronchial biopsy
- Therapeutic bronchoscopy with endobronchial tumor destruction, stenosis relief, or management of hemoptysis
- Pleuroscopy, pleural biopsy
- Diagnostic bronchoscopy with endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)

- Tunneled pleural catheter placement
- Tunneled pleural catheter removal

**Low Bleeding Risk:**
- Diagnostic bronchoscopy airway exam
- Diagnostic bronchoscopy with bronchoalveolar lavage (BAL)
- Thoracentesis

Gastroenterology Procedures

**High Bleeding Risk:**
- Biliary or pancreatic sphincterotomy
- Polypectomy
- Cystogastrostomy
- Endoscopic hemostasis
- Endoscopic ultrasound (EUS) with FNA
- Tumor ablation by any technique
- Pneumatic or bougie dilation percutaneous endoscopic gastrostomy (PEG) placement
- Therapeutic balloon-aided enteroscopy
- Treatment of varices

**Low Bleeding Risk:**
- Capsule endoscopy
- Diagnostic (esophagogastroduodenoscopy (EGD), colonoscopy, flexible sigmoidoscopy) including biopsy
- Enteral stent deployment (without dilation)
- Enteroscopy and diagnostic balloon-assisted enteroscopy
- Endoscopic retrograde cholangiopancreatogram (ERCP) without sphincterotomy
- EUS without FNA

Cardiology Procedures

**High Bleeding Risk**
- Pacemaker or defibrillator placement
- Coronary intervention
- Endomyocardial biopsy

**Low Bleeding Risk**
- Electrophysiology testing and/or ablation
- Diagnostic coronary angiography

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1 For patients on antiplatelet therapy, see Management of Antiplatelet Therapy in Patients with Cardiac Stents Undergoing Procedures Algorithm.
APPENDIX C: Recommended Holding Time Prior to Procedure

- These dates are approximate based on ½ (hour) of specific new oral anticoagulant in various degree of renal impairment. Note: Renal function should be considered when determining appropriate hold times for anticoagulants
- Normal risk of bleeding needs 2-3 drug half-lives between the last dose and surgery; aim for mild to moderate residual anticoagulant effect at surgery less than 12% to 25%
- High risk of bleeding needs 4-5 drug half-lives between the last dose and surgery; aim for minimal residual anticoagulant effect at surgery less than 3% to 6%
- Attention: Expert panels DO NOT RECOMMEND use of DOACs in patients with cancer. A multidisciplinary consultation is strongly recommended with Benign Hematology, Cardiology, and/or General Internal Medicine. Each case needs to be individually assessed prior to use of DOACs. The following recommendations for hold strategy are based on estimated half-life of each anticoagulation and data for hold strategy in cancer patients is very limited. Clinicians should always consider risk of bleeding versus risk of thrombosis in cancer patients in determining the hold strategy.

Minimum hold days of DOAC according to Creatinine Clearance (CrCl) mL/minute and bleeding risk.

Take last dose on days listed as a count down to day of procedure which is Day 0

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>Hold Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warfarin (Coumadin®)</td>
<td>Take last dose on Day -5 Stop the dose 24 hours before surgery or on Day -1 or longer in patients with renal impairment.</td>
</tr>
<tr>
<td>LMWH [enoxaparin (Lovenox®), dalteparin (Fragmin®), tinzaparin (Innohep®)]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>Dabigatran (Pradaxa®)</th>
<th>Rivaroxaban (Xarelto®)</th>
<th>Apixaban (Eliquis®)</th>
<th>Edoxaban (Savaysa®)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl (mL/minute)</td>
<td>Normal or low risk of bleeding</td>
<td>High risk of bleeding</td>
<td>Normal or low risk of bleeding</td>
<td>High risk of bleeding</td>
</tr>
<tr>
<td>greater than 80</td>
<td>Take last dose on Days being held</td>
<td>Take last dose on Days being held</td>
<td>Take last dose on Days being held</td>
<td>Take last dose on Days being held</td>
</tr>
<tr>
<td>50 - 79</td>
<td>-2 1</td>
<td>-3 2</td>
<td>-2 1</td>
<td>-2 1</td>
</tr>
<tr>
<td>30 - 49</td>
<td>-3 2</td>
<td>-5 4</td>
<td>-2 1</td>
<td>-4 3</td>
</tr>
<tr>
<td>less than 30</td>
<td>-4 3</td>
<td>-6 5</td>
<td>-3 2</td>
<td>-4 3</td>
</tr>
</tbody>
</table>

Note: “Take last dose on” column is information for the patient and “Days being held” column is information for the provider.

1 Increased risk for death in elderly patients with renal insufficiency
2 Full dose 48 hours (low risk) and 96 hours (high risk) prior to procedure (longer-half life)

Non-formulary
**Peri-Procedure Management of Anticoagulants**

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**APPENDIX D: Bridge Strategy for Patients on Warfarin (should be discussed with primary physician)**

<table>
<thead>
<tr>
<th>Day</th>
<th>Heparin</th>
<th>Enoxaparin (Lovenox®) and Dalteparin (Fragmin®)</th>
<th>Fondaparinux (Arixtra®)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>Last dose warfarin</td>
<td>Last dose warfarin</td>
<td>Last dose warfarin</td>
</tr>
<tr>
<td>-4</td>
<td>Continuous infusion</td>
<td>No medications</td>
<td>No medications</td>
</tr>
<tr>
<td>-3</td>
<td>Continuous infusion</td>
<td>Weight based dose</td>
<td>Last dose if high risk of bleeding</td>
</tr>
<tr>
<td>-2</td>
<td>Continuous infusion</td>
<td>Weight based dose</td>
<td>Last dose if low risk of bleeding</td>
</tr>
<tr>
<td>-1</td>
<td>Continuous infusion</td>
<td>Take ½ dose at 8AM</td>
<td>No medications</td>
</tr>
<tr>
<td>0</td>
<td>Stop 4-5 hours before procedure</td>
<td>No medications</td>
<td>No medications</td>
</tr>
</tbody>
</table>

**Example for a patient on warfarin who will bridge with heparin infusion for a procedure scheduled for Wednesday (Day 0) – patient will hold warfarin on Friday (Day -5), start continuous infusion heparin on Saturday (Day -4), and continue until 4-5 hours prior to procedure on Wednesday.**

**Example for a patient on warfarin who will bridge with low molecular weight heparin (LMWH) for a procedure scheduled for Wednesday (Day 0) – patient will hold warfarin on Friday (Day -5), start full dose LMWH on Sunday (Day -3) and Monday (Day -2), and only take half dose LMWH on Tuesday morning (Day -1).**

**Bridging:** Use of a short-acting anticoagulant to assist peri-procedure management of anticoagulation and the process for resuming the patient’s appropriate therapeutic anticoagulant dosing regimen post-procedure. Consider an appointment with IMPAC prior to the procedure.

**Note:** Renal function should be considered when determining appropriate hold times for anticoagulants.
SUGGESTED READINGS


This practice consensus algorithm is based on majority expert opinion of the Peri-procedure Anticoagulant Management work group at the University of Texas MD Anderson Cancer Center. It was developed using a multidisciplinary approach that included input from the following clinical staff:

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