

**Peri-operative management of antithrombotics is a complex process that preferably involves expert-level review.** This protocol is intended as guidance only and should not supercede clinical judgment. While protocols are intended to apply to the majority of patients, we acknowledge there will be patients who require management approaches other than those suggested in this document. In those instances, a multidisciplinary discussion between the patient's PCP, anesthesiologist, surgeon, interventionalist, anticoagulation clinic provider and any other relevant party is strongly encouraged to ensure selection and implementation of the most appropriate approach.

**Outpatient Anithrombosis Clinic 505-272-6202**  
**Antithrombosis Stewardship Pharmacist 505-306-8987**  
**Inpatient anticoagulation service 505-264-6970**

**THIS GUIDELINE DOES NOT COVER MANAGEMENT OF ANTITHROMBOTICS AROUND NEURAXIAL PROCEDURES. FOR THAT INFORMATION, CLICK [HERE](#).**

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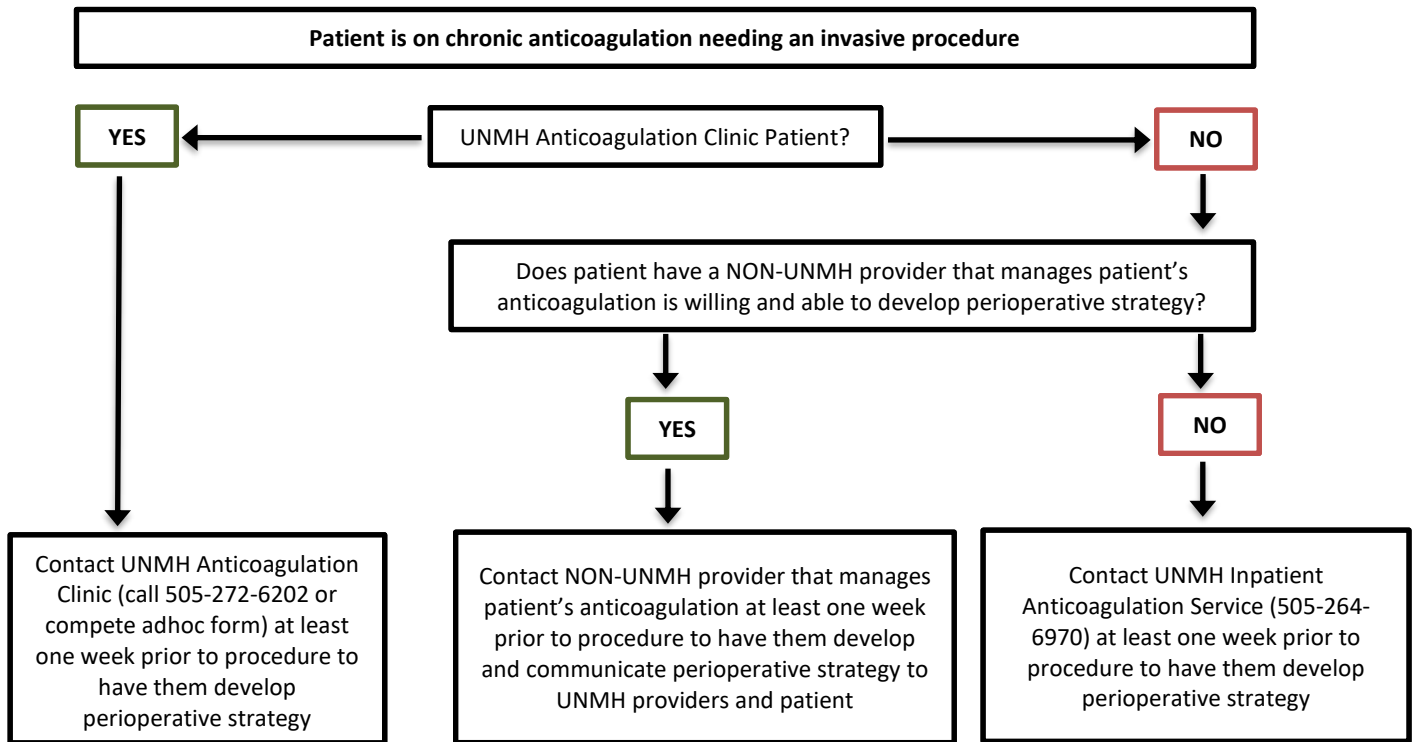
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### **What is peri-operative bridging?**

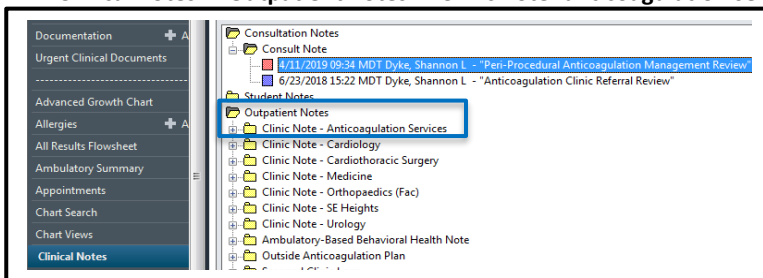
- Patients who are chronically anticoagulated with **warfarin** and require an invasive procedure may need to have their warfarin temporarily interrupted to minimize bleeding risk around the procedure.
- Peri-operative bridging refers to the use of a rapid-acting parenteral anticoagulant (unfractionated heparin, low molecular weight heparin) in the pre- and/or post-operative period(s) while the patient's INR is subtherapeutic to prevent thromboembolic events. This practice is largely based on biological plausibility, pharmacokinetics and expert opinion.
- Emerging evidence suggests that, in many patient populations, bridging does not reduce thromboembolic events but does increase bleeding.<sup>1</sup>
- As such, bridging therapy should be reserved for those **warfarin** patients at highest risk of a thrombotic event as they are most likely, though not guaranteed, to derive benefit.
- Additionally, evidence suggests that prophylactic dose bridging may be equally effective, but much safer than therapeutic dose bridging, in some patient populations.
- **It is important to note that bridging therapy only pertains to warfarin patients. Patients on direct oral anticoagulants (DOACs) such as apixaban, dabigatran, edoxaban and rivaroxaban do not require bridging therapy, and this practice should be avoided in those patients.<sup>2</sup>**

## I. Outpatient to inpatient management

- All surgical patients on chronic anticoagulant therapy being seen pre-operatively in clinic need to have a clearly delineated perioperative anticoagulant management strategy.
- Surgical providers should refer to algorithm below to identify appropriate resources for assistance:



- For peri-operative management of DOACs, see Table 3 below. Additionally, pharmacy antithrombosis services are available for assistance at the phone numbers listed at top of this protocol.
- For peri-operative management of warfarin patients, see Table 2 below and section VI. for a general bridging template **IF** your **warfarin** patient warrants bridging
  - It is strongly recommended that a dosing template with specific instructions be filled out and given to patient at pre-operative clinic visit, along with any needed prescriptions, such as LMWH, etc.
- For UNMH antithrombosis clinic patients, peri-operative management consult information will be posted in one/both of the following locations:**
  - 'Clinical notes' > 'Consultation notes' > 'Anticoagulation peri-operative consult'
  - 'Clinical notes' > 'Outpatient notes' > 'Clinic note- anticoagulation services'



## II. How to notify the UNMH Antithrombosis Clinic that your patient is undergoing a procedure:

- Click on the AdHoc button from the task bar
- Select the folder titled "Provider Outpatient Consult Form"
- Double click on "Antithrombosis Clinic Consult Request"
- Select **\*\*Existing UNMH Anticoag Clinic Patient\*\***
- Complete section entitled "Notification of Procedures"

The screenshot shows the 'Notification of Procedures' form with the following sections:

- Step 1-3:** Includes a list of forms on the left and a 'Referral Type (select one below):' dropdown menu. The 'Existing UNMH Anticoag Clinic Patient' option is selected.
- Step 4:** Includes a 'Notification of Procedures' section with checkboxes for 'Medication changes', 'Changes to anticoagulation therapy', and 'Discontinue therapy'.
- Notification of Procedures:** Includes fields for 'Type of Procedure (if known)', 'Date of Procedure', 'Surgeon performing the procedure (if known)', 'Does the procedure/surgery require a normalized INR (0.8 to 1.2)?', 'Is the procedure/surgery planned as an outpatient?', and 'If no, what is expected duration of admission?'.
- Step 5:** A blue button labeled 'Step 5'.

### III. Assessment of patient and surgical risk factors for thromboembolism/bleeding

- A. Risk stratification with consideration for patient and procedure-related bleed and thromboembolic event risk as well as consequences of these events is essential for the creation of an appropriate perioperative antithrombotic management plan.

| TABLE 1. PERIOPERATIVE ANTICOAGULANT MANAGEMENT RECOMMENDATIONS BASED ON RISK ASSESSMENT <sup>1,3,4,5,7,14,18,23,24</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| INSTRUCTIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         | THROMBOEMBOLIC RISK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         | HIGH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | LOW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <p>1. Perform patient anticoagulation assessment 7+ days prior to procedures.</p> <p>2. Categorize underlying thromboembolic risk using the columns to the right and procedure-related bleeding risk using the rows below.</p> <p>3. View suggestions for anticoagulant interruption and bridging in cell where rows and column interact.</p> <p>4. View specific guidance for warfarin users in Table 1 and DOACs in Table 2.</p> <p><b>Disclaimer:</b> Anticoagulation prescribing is highly complex and should be conducted with the greatest care on a case-by-case basis, considering the complete patient medical profile. The information presented is for general guidance only and is not all-inclusive. Prescribers are encouraged to consult the current medical evidence and organizational policies and procedures.</p> <p><b>Decisions to interrupt, bridge, and resume anticoagulants MUST be clearly communicated among providers and to patient.</b></p> |         | <p><b>Mechanical heart valve patients:</b></p> <ul style="list-style-type: none"><li>Any <b><u>mechanical mitral</u></b> valve</li><li>Older caged ball or tilting disk valve in <b><u>any</u></b> (mitral/aortic) position</li><li><b><u>Aortic</u></b> mechanical valve <b><u>only IF patient has additional stroke risk factors</u></b>, such as Afib, MI, LA enlargement, hypercoagulable condition, EF&lt;40%</li><li>Stroke or TIA in the past 6 months</li></ul> <p><b>Atrial fibrillation patients:</b></p> <ul style="list-style-type: none"><li>Valvular atrial fibrillation (rheumatic heart disease, severe mitral stenosis)</li><li>With mechanical heart valve</li><li>Any cardioembolic event, including stroke or TIA, in the past 3 months</li></ul> <p><b>Venous thromboembolism patients:</b></p> <ul style="list-style-type: none"><li>VTE (DVT or PE) in the past 1-3 months</li><li>History of VTE associated with a confirmed <b>severe</b> thrombophilia (antiphospholipid syndrome, Protein C or S deficiency, or AT deficiency)</li></ul> <p><b>Other:</b></p> <ul style="list-style-type: none"><li>Mural thrombus or left atrial appendage clot within the past 1 month</li><li>History of venous or arterial thromboembolism while on therapeutic anticoagulation or during temporary interruptions of anticoagulation</li></ul> | <p>Most other patients not listed in the high-risk category including, but not limited to, all atrial fibrillation patients without any of the concomitant thrombotic risk factors listed to the left.</p> <p><i>Bridging in atrial fibrillation patients with a higher risk for stroke (e.g. CHADS2 &gt;4) may be considered on a case-by-case basis.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| PROCEDURE BLEEDING RISK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | HIGH    | <p><b>Major surgery with extensive tissue injury</b></p> <ul style="list-style-type: none"><li>Head/neck/abdominal/breast cancer surgery</li><li>General/vascular/thoracic/lung surgery</li><li>Reconstructive plastic surgery</li><li>Cardiac, intracranial, or spinal surgery</li><li>Bilateral hip or knee arthroplasty</li></ul> <p><b>Urologic or Gastrointestinal surgery</b></p> <ul style="list-style-type: none"><li>Transurethral prostate resection, bladder resection, or tumor ablation</li><li>Abdominal hysterectomy</li><li>Nephrectomy, kidney biopsy</li><li>Colonic polyp resection</li><li>Bowel resection</li><li>PEG placement, ERCP</li></ul> <p><b>Other</b></p> <ul style="list-style-type: none"><li>Surgery in highly vascular organs</li><li>Multiple tooth extractions</li><li>Any procedure duration &gt;45 minutes</li><li>Epidural injections with INR &gt;1.2</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>1. <b>INTERRUPTION:</b> Recommend interruption of anticoagulation for warfarin and DOAC patients.</p> <p>2. <b>BRIDGING:</b> <u>Suggest bridging</u> with warfarin patients only. Bridging is not necessary in DOAC patients due to the rapid onset and offset.</p> <p><i>Consider a “step-up” approach in which prophylactic dosing of an injectable anticoagulants is initiated ≥6-24 hours post-procedure then, if well-tolerated, transition to treatment dose anticoagulation at 48 – 72 hours post-procedure. It should be noted that this only applies to the inpatient setting.</i></p> <p>MEDICATION CESSATION GUIDANCE: See Table 2 (for warfarin) and Table 3 (for DOACs) for guidance regarding cessation.</p>                                                                    | <p>1. <b>INTERRUPTION:</b> Recommend interruption of anticoagulation in warfarin and DOAC patients.</p> <p>2. <b>BRIDGING:</b> <u>Suggest NO bridging.</u></p> <p><i>Consider use of appropriate post-op VTE prophylaxis based on patient risk factors (see VTE prophylaxis guidelines for determination).</i></p> <p>MEDICATION CESSATION GUIDANCE: See Table 2 (for warfarin) and Table 3 (for DOACs) for guidance regarding cessation.</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | LOW     | <ul style="list-style-type: none"><li>Cutaneous/lymph node biopsies</li><li>Shoulder/foot/hand/knee surgery</li><li>Joint arthroplasty with use of tranexamic acid</li><li>Coronary angiography or catheterization via femoral access</li><li>Heart biopsy</li><li>Gastrointestinal endoscopy +/- biopsy</li><li>Colonoscopy +/- biopsy</li><li>Laparoscopic cholecystectomy</li><li>Abdominal hernia repair</li><li>Hemorrhoidal surgery</li><li>Bronchoscopy +/- biopsy</li><li>Arthroscopy</li><li>Chest tube insertion</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>1. <b>INTERRUPTION:</b> <u>Recommend</u> interruption of anticoagulation for DOAC patients and <u>suggest</u> interruption of anticoagulation for warfarin patients.</p> <p>2. <b>BRIDGING:</b> <u>Suggest bridging</u> with warfarin patients only. Bridging is not necessary in DOAC patients due to the rapid onset and offset.</p> <p><i>Consider a “step-up” approach in which prophylactic dosing of an injectable anticoagulants is initiated ≥6-24 hours post-procedure then, if well-tolerated, transition to treatment dose anticoagulation at 48 – 72 hours post-procedure. It should be noted that this only applies to the inpatient setting.</i></p> <p>MEDICATION CESSATION GUIDANCE: See Table 2 (for warfarin) and Table 3 (for DOACs) for guidance regarding cessation.</p> | <p>1. <b>INTERRUPTION:</b> Recommend interruption of anticoagulation in warfarin and DOAC patients.</p> <p>3. <b>BRIDGING:</b> <u>Suggest NO bridging.</u></p> <p><i>Consider use of appropriate post-op VTE prophylaxis based on patient risk factors (see VTE prophylaxis guidelines for determination).</i></p> <p>MEDICATION CESSATION GUIDANCE: See Table 2 (for warfarin) and Table 3 (for DOACs) for guidance regarding cessation.</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | MINIMAL | <ul style="list-style-type: none"><li>IVC filter or CVC removal</li><li>Cataract or glaucoma surgery</li><li>Minor dental procedures</li><li>Minor dermatologic procedures</li><li>Cardiac catheterization via radial access</li><li>Chest tube removal</li><li>Fistulogram by IR</li><li>Pacemaker battery change</li><li>Pacemaker or ICD implantation</li><li>Afib /flutter catheter ablation</li><li>AV node catheter ablation</li><li>Catheter ablation (e.g. VT, SVT )</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>Do <u>not</u> interrupt anticoagulation.</b></p> <p>Consider use of oral pro-hemostatic agent with simple dental procedures.</p> <p><b>Cardiac catheterization via radial access:</b></p> <ul style="list-style-type: none"><li><b>Elective procedure*</b> – no warfarin interruption; hold DOAC per Table 3 recommendations for low-bleed risk procedure</li><li><b>NSTEMI</b> – no warfarin interruption; hold DOAC 24 hours in advance regardless of DOAC</li><li><b>STEMI</b> – no warfarin or DOAC interruption</li></ul>                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <p>*May consider holding warfarin in cardiac catheterization in procedures at higher risk of perforation (e.g. recanalization of chronic total occlusion or rotation atherectomy) or when percutaneous coronary intervention with stent placement via the femoral approach is scheduled.</p> <p>Abbreviations: VTE = venous thromboembolism; PEG = percutaneous endoscopic gastrostomy; ERCP = endoscopic retrograde cholangiopancreatography; ICD = implantable cardioverter defibrillator; Afib = atrial fibrillation; MI = myocardial infarction; LA = left atrial; EF = ejection fraction; AT = antithrombin; VT= ventricular tachycardia; SVT= supraventricular tachycardia; AV= atrioventricular</p>                                                                                                                                                                                                                                                                |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**B. Assessment of patient bleeding risk factors**

1. Assessment of individual patient bleeding risk must be considered in tandem with procedural bleeding risk
2. Higher bleeding risk may necessitate more conservative peri-operative management (e.g., no bridging, longer hold times, use of prophylactic vs. therapeutic bridging)

| HAS-BLED parameters (each bullet is 1 point; score ≥3 highly predictive of bleeding) |                                                                                           |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| •                                                                                    | Hypertension (systolic >160 mm Hg)                                                        |
| •                                                                                    | Abnormal renal function (chronic dialysis, renal transplant, SCr > 2 mg /dL)              |
| •                                                                                    | Abnormal liver function ( cirrhosis, bilirubin >2x ULN, AST or ALT >3x ULN)               |
| •                                                                                    | Prior stroke                                                                              |
| •                                                                                    | History of or prone to anemia or major bleeding                                           |
| •                                                                                    | Labile INR in warfarin patients (TTR <60%)                                                |
| •                                                                                    | Age > 65 years                                                                            |
| •                                                                                    | Concomitant antiplatelet or NSAID                                                         |
| •                                                                                    | Alcohol or drug use (≥8 drinks/week)                                                      |
| Other bleed risk factors to consider                                                 |                                                                                           |
| •                                                                                    | Prior bleed event within 3 months, including intracranial hemorrhage                      |
| •                                                                                    | Quantitative or qualitative platelet abnormality (e.g., uremia in advanced renal disease) |
| •                                                                                    | Elevated INR at time of procedure in warfarin patients                                    |
| •                                                                                    | History of bleeding during bridging                                                       |
| •                                                                                    | History of bleeding with similar procedure                                                |

**IV. Timing of antithrombotic therapy cessation and re-initiation perioperatively**

- A. These guidelines pertain to elective procedures or those in which there is adequate time to implement recommended cessation periods. For all other situations (e.g. urgent or emergent surgery), providers are encouraged to collaborate with the inpatient anticoagulation service and refer to the “Antithrombotic Reversal Guideline” on the pharmacy webpage to develop a safe, effective urgent or emergent perioperative plan.

| TABLE 2. CONVENTIONAL ANTICOAGULANT CESSATION/RE-INITIATION GUIDANCE <sup>3,4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |                                                                              |                              |                                                                 |                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------|------------------------|
| Conventional Anticoagulant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | TREATMENT DOSING |                                                                              |                              | PROPHYLACTIC DOSING                                             |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CESSATION        | RE-INITIATION POST-OP*                                                       |                              | CESSATION                                                       | RE-INITIATION POST-OP* |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  | Low Bleed Risk <sup>#</sup>                                                  | High Bleed Risk <sup>#</sup> |                                                                 |                        |
| <b>WARFARIN</b><br>(t <sub>1/2</sub> ≈ 40 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5 – 6 days       | 12 – 24 hours                                                                |                              | Not applicable                                                  |                        |
| <b>UFH</b><br>(t <sub>1/2</sub> = 1 – 2 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4 – 6 hours      | 12 – 24 hours <sup>Δ</sup>                                                   | 48 – 72 hours                | 4 – 6 hours                                                     | ≥ 6-12 hours           |
| <b>LMWH</b> <sup>∇</sup><br>(t <sub>1/2</sub> = 4 – 7 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 24 hours**       | 24 hours                                                                     | 48 – 72 hours                | <u>30 mg BID</u> : 12 hours<br><u>40 mg daily</u> : 12-24 hours |                        |
| <b>FONDAPARINUX</b><br>(t <sub>1/2</sub> = 17 – 21 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 – 4 days       | Consider a shorter acting agent until patient is tolerant to anticoagulation |                              | ≥ 48 hours                                                      |                        |
| <sup>*</sup> Depending on surgical hemostasis. For all injectable anticoagulants, a “step-up” approach may be considered where prophylactic dosing is initiated ≥6-24 hours post-procedure then, if well-tolerated, transition to treatment dose anticoagulation at 48 – 72 hours post-procedure.<br><sup>**</sup> If using 1.5 mg/kg LMWH once daily, consider hold for 36 hours prior to procedure or giving ½ of dose at 24 hours prior to procedure.<br><sup>Δ</sup> For cardiac catheterizations, may start IV UFH low intensity protocol without a bolus 6 hours after sheath or TR band removal<br><sup>#</sup> Refer to Table 1 for procedure bleeding risk<br><sup>∇</sup> BID (1 mg/kg BID) dosing may be preferred over once daily treatment dosing (1.5 mg/kg daily) to mitigate bleed risk |                  |                                                                              |                              |                                                                 |                        |

| TABLE 3. DIRECT ORAL ANTICOAGULANT (DOAC) CESSATION/RE-INITIATION GUIDANCE <sup>2,8,9,10,11,16</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                               |                                        |                             |                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|-----------------------------|--------------------|
| Direct Oral Anticoagulant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | NUMBER OF DOSES TO HOLD PRIOR TO PROCEDURE                    |                                        | RE-INITIATION TIME POST-OP* |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low Bleed Risk Procedure <sup>#</sup>                         | High Bleed Risk Procedure <sup>#</sup> | Low Bleeding Risk           | High Bleeding Risk |
| DABIGATRAN (Pradaxa) – Twice daily dosing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                               |                                        | ~24 hours                   | ~48 – 72 hours     |
| CrCl > 80 mL/min<br>(t <sub>1/2</sub> ~ 14 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2 doses                                                       | 5 – 6 doses                            |                             |                    |
| CrCl 50 – 80 mL/min<br>(t <sub>1/2</sub> ~ 17 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3 – 4 doses                                                   | 6 – 7 doses                            |                             |                    |
| CrCl 30 – 49 mL/min<br>(t <sub>1/2</sub> ~ 19 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4 – 5 doses                                                   | 7 – 8 doses                            |                             |                    |
| CrCl 15 – 29 mL/min<br>(t <sub>1/2</sub> ~ 28 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5 – 7 doses                                                   | 9 – 12 doses                           |                             |                    |
| CrCl < 15 mL/min<br>(t <sub>1/2</sub> unknown)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hold until resolved or consider transition to warfarin or UFH |                                        |                             |                    |
| RIVAROXABAN (Xarelto) – Once daily dosing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                               |                                        |                             |                    |
| CrCl ≥ 30 mL/min<br>(t <sub>1/2</sub> ~ 8 – 9 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 dose                                                        | 2 doses                                |                             |                    |
| CrCl 15 – 29 mL/min<br>(t <sub>1/2</sub> ~ 10 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 – 2 doses                                                   | 2 – 3 doses                            |                             |                    |
| CrCl < 15 mL/min<br>(t <sub>1/2</sub> unknown)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hold until resolved or consider transition to warfarin or UFH |                                        |                             |                    |
| APIXABAN (Eliquis®) – Twice daily dosing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                               |                                        |                             |                    |
| CrCl > 50 mL/min<br>(t <sub>1/2</sub> ~ 7 – 8 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2 doses                                                       | 4 doses                                |                             |                    |
| CrCl 15 – 49 mL/min<br>(t <sub>1/2</sub> ~ 17 – 18 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3 – 4 doses                                                   | 6 – 7 doses                            |                             |                    |
| CrCl < 15 mL/min<br>(t <sub>1/2</sub> unknown)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hold until resolved or consider transition to warfarin or UFH |                                        |                             |                    |
| EDOXABAN (Savaysa®) – Once daily dosing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                               |                                        |                             |                    |
| CrCl > 30 mL/min<br>(t <sub>1/2</sub> ~ 8 – 10 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 dose                                                        | 2 doses                                |                             |                    |
| CrCl 15 – 29 mL/min<br>(t <sub>1/2</sub> ~17 hrs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 doses                                                       | 3 – 4 doses                            |                             |                    |
| CrCl < 15 mL/min<br>(t <sub>1/2</sub> unknown)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hold until resolved or consider transition to warfarin or UFH |                                        |                             |                    |
| *Depending on surgical hemostasis.<br>#Refer to Table 1 for procedure bleeding risk. For low bleeding risk procedures, aiming for mild-moderate residual anticoagulant effect (<12-25%) at surgery. For high bleeding risk procedures, aiming for no or minimal residual anticoagulant effect (<3-6%) at surgery. In the patient with decreased renal clearance, allowance should be made for lower dosing and/or increased hold time prior to procedure to minimize bleeding risk. For patients at high risk for both thromboembolism and bleeding after surgery, consider a step-up approach of administering prophylactic dose dabigatran (75 mg twice daily), rivaroxaban (10 mg once daily), or apixaban (2.5 mg twice daily) at around 24 hours post-op, then increasing back to therapeutic dosing at 48-72 hours if tolerated. |                                                               |                                        |                             |                    |

## V. Perioperative Management of Warfarin in Dialysis Patients

- A. In patients with end-stage renal disease on hemodialysis, outpatient bridging with low molecular weight heparin (i.e., enoxaparin) is contraindicated. While therapeutic-dose unfractionated heparin may be employed, challenges associated with retail availability and insurance coverage essentially preclude its use. Thus, perioperative bridging in dialysis patients is discouraged except in clinical situations that pose the highest thromboembolic risk (see Table 1 above).
  - i. In instances in which perioperative bridging is indicated, providers have two options:
    - a. Hold warfarin for a shorter duration of just 2-3 days (rather than a full 5 days) in order to provide a low level of residual anticoagulant effect.
    - b. Admit the patient to the hospital for bridging therapy with IV unfractionated heparin.
- B. A multidisciplinary discussion between the patient's PCP, surgeon, and anticoagulation clinic provider is strongly encouraged to ensure selection and successful implementation of the most appropriate approach.

## VI. Example Warfarin Bridging Template

| TABLE 4. WARFARIN BRIDGING TEMPLATE EXAMPLE <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                 |                                                                                                                                            |                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Day                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Warfarin Dose                                                                   | Bridging with LMWH                                                                                                                         | INR Monitoring                                                                                                                 |
| -7 to -10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Maintenance dose (MD)                                                           | Assess for perioperative bridging anticoagulation; classify patients as undergoing high or low bleeding risk procedures                    | Check baseline labs (hemoglobin, platelet count, serum creatinine, INR)                                                        |
| -6- or -5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Begin to hold warfarin day -5 or day -6                                         | No LMWH                                                                                                                                    | None                                                                                                                           |
| -4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No Warfarin                                                                     | No LMWH                                                                                                                                    | None                                                                                                                           |
| -3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No Warfarin                                                                     | Start LMWH at therapeutic dose**                                                                                                           | None                                                                                                                           |
| -2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No Warfarin                                                                     | LMWH at therapeutic dose**                                                                                                                 | None                                                                                                                           |
| -1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No Warfarin                                                                     | Last preoperative dose of LMWH administered ≥ 24 hours before start of surgery**                                                           | Assess INR before the procedure; proceed with surgery if INR <1.5; If INR > 1.5 and <1.8, consider FFP or oral vit K (1-2.5mg) |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Resume MD (or slightly higher booster dose) of warfarin on evening of procedure | None                                                                                                                                       | INR if FFP or oral vit K administration was necessary                                                                          |
| +1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MD (or slightly higher booster dose)                                            | Low-bleeding risk: restart LMWH at previous treatment dose; High-bleeding risk: no LMWH administration or prophylactic LMWH administration | Per clinician judgment                                                                                                         |
| +2 or +3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MD                                                                              | Low-bleeding risk: LMWH administration continued<br>High-bleeding risk: restart LMWH at previous dose                                      | Per clinician judgment                                                                                                         |
| +4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MD                                                                              | Continue LMWH administration until INR is >2                                                                                               | INR                                                                                                                            |
| +7 to +10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MD                                                                              |                                                                                                                                            | INR                                                                                                                            |
| NOTE: This template addresses patients with a target INR of 2 – 3 and who are in the therapeutic range at the initial check prior to starting the bridging plan. If the patient has a higher target INR or has a supratherapeutic INR, longer warfarin hold times may be necessary. If the patient has a subtherapeutic INR, the duration of enoxaparin bridging may need to be altered. In these instances, consultation with a clinician more experienced with perioperative antithrombotic management is strongly recommended. |                                                                                 |                                                                                                                                            |                                                                                                                                |
| **Therapeutic LMWH regimens include enoxaparin 1.5 mg/kg once daily or 1 mg/kg twice daily subcutaneously. If using 1.5 mg/kg LMWH once daily, consider hold for 36 hours prior to procedure or giving ½ of dose at 24 hours prior to procedure.                                                                                                                                                                                                                                                                                  |                                                                                 |                                                                                                                                            |                                                                                                                                |

## VII. Antiplatelet Management

- A. Assess use of anti-platelets at least 7 days prior to procedure to allow for adequate hold time, if necessary. Collaboration with additional specialty services, such as cardiology, cardiothoracic surgery, neurology, or anesthesia, is strongly encouraged when deciding cessation options for antiplatelet therapy.

| TABLE 5. PERIOPERATIVE MANAGEMENT OF ANTI-PLATELET MEDICATIONS <sup>4,12,16,17</sup> |               |              |                                    |
|--------------------------------------------------------------------------------------|---------------|--------------|------------------------------------|
| ANTIPLATELET                                                                         |               | CESSATION    | RE-INITIATION POST-OP <sup>A</sup> |
| Aspirin                                                                              | Low CV risk   | 7 – 10 days  | 24 hours                           |
|                                                                                      | High CV risk* | May continue |                                    |
| Cilostazol                                                                           |               | 1 – 2 days   |                                    |
| Dipyridamole                                                                         |               | 1 – 2 days   | 24 – 48 hours                      |
| P2Y12 Inhibitors                                                                     | Clopidogrel   | 5 days       |                                    |
|                                                                                      | Prasugrel     | 5 – 7 days   |                                    |
|                                                                                      | Ticagrelor    | 5 days       |                                    |

<sup>A</sup>Depending on surgical hemostasis.  
Abbreviations: CV = cardiovascular

\* **Primary prevention:** most men and women ≥50 y with diabetes and with ≥1 other ASCVD risk factors; adults with diabetes, <50 y; multiple ASCVD risk factors (10-y ASCVD risk 5%-10%)

**Secondary prevention:** known coronary artery disease (CAD), cerebrovascular disease (CVD), significant peripheral vascular disease (PVD)

| TABLE 6. PERIOPERATIVE ANTI-PLATELET MANAGEMENT BASED ON RISK ASSESSMENT <sup>4,12,13,15,16,18-22</sup>                                                                 |                                                                                                         |                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| PROCEDURE TYPE                                                                                                                                                          | CARDIOVASCULAR RISK                                                                                     |                                                               |
|                                                                                                                                                                         | HIGH                                                                                                    | LOW                                                           |
| Minor (dental/dermatologic/ophthalmologic)                                                                                                                              | Continue antiplatelet therapy                                                                           | Continue antiplatelet therapy                                 |
| Non-cardiac                                                                                                                                                             | Continue antiplatelet therapy*                                                                          | Hold antiplatelet therapy                                     |
| Carotid endarterectomy                                                                                                                                                  | Continue aspirin                                                                                        | Not applicable as these procedures imply high CV risk patient |
| Coronary Artery Bypass Graft (CABG)                                                                                                                                     | Continue aspirin<br>Hold P2Y12 inhibitors                                                               |                                                               |
| Any procedure that cannot be delayed in patients in the 4-6 weeks post-BMS or minimum 6 months post-DES placement**                                                     | Consult cardiology <sup>▽</sup><br>Continue dual anti-platelet therapy                                  |                                                               |
| Any procedure that cannot be delayed in patients following 4-6 weeks post-BMS or minimum 6 months post-DES placement, but prior to 1 year of dual anti-platelet therapy | Consult cardiology <sup>▽</sup><br>Continue aspirin and hold P2Y12 inhibitor for shortest time possible |                                                               |

\*Except for intracranial, middle ear, posterior chamber of eye, intramedullary spin, and possibly transurethral prostatectomy (TURP) procedures as these confer a very high risk of hemorrhagic complications.  
\*\*Strongly recommend deferring surgery for at least 6 weeks after placement of a bare-metal stent (BMS) and for at least 6 months after placement of a drug-eluting stent (DES), if possible. Ideally, a minimum of 1 year of uninterrupted dual anti-platelet therapy in both BMS and DES is preferred.  
<sup>▽</sup> Risk for stent thrombosis is extremely high in the 4-6 weeks post-BMS and 6 months post-DES placement. Strongly recommend consultation with a cardiologist to discuss appropriateness of antiplatelet therapy as well as cessation time as some providers may be more comfortable with shorter holding periods.

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