PERIOPERATIVE ANTICOAGULATION GUIDELINE/DOAC MANAGEMENT

Options for anticoagulation continue to expand with the use of direct oral anticoagulants (DOACs). While the thromboembolic risk is determined by the patient's condition, the perioperative management of DOACs is vastly different and varied. **Bridging is not recommended with DOACs.**

<table>
<thead>
<tr>
<th>DOAC Patient is Taking</th>
<th>Surgery Bleeding Risk</th>
<th>Preoperative DOAC Interruption Schedule</th>
<th>Postoperative DOAC Resumption Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day -5</td>
<td>Day -4</td>
</tr>
<tr>
<td>Apixaban (Eliquis)</td>
<td>Mod/High</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran (CrCl&gt;50ml/min)</td>
<td>Mod/High</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran (CrCl&lt;50ml/min)</td>
<td>Mod/High</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban (Xarelto)</td>
<td>Mod/High</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- For patients undergoing neuraxial anesthesia, hold DOAC 72 hours prior to procedure.
- X denotes patient to Hold DOAC
- Open arrow segment refers to flexibility in the timing of DOAC resumption post-surgery procedure to account for surgical hemostasis.
- For patients at low bleeding risk, DOAC was resumed within 24 hours post procedure and for patients at high bleeding risk DOAC was resumed 48-72 hours post procedure.
- See Appendix A for bleeding risk
PERIOPERATIVE ANTICOAGULATION GUIDELINE/ WARFARIN MANAGEMENT

Management of anticoagulation before and after invasive procedures requires careful, patient-specific evaluation of the risk of bleeding weighed against the patient’s risk of thromboembolism. The patient’s underlying disease process determines the thromboembolic risk. This patient specific risk determines the need for bridging anticoagulation therapy. Coordination between primary care, anticoagulation clinic, surgeon, anesthesiologist and when indicated, a specialist, is recommended. This updated guideline is based on extensive literature review and examination of clinical practice guidelines including American College of Chest Physicians 2012 Clinical Practice Guidelines, 2017 ACC Expert Consensus Decision Pathway for Perioprocudural Management of Anticoagulation in patients with Nonvalvular Atrial Fibrillation (see reference). Section 1 addresses patients on warfarin and we suggest a 3 step process as outlined below. Steps 1-2 are preoperative. Step 3 is postoperative.

**Step 1: Determine if anticoagulation is indicated (review reason for ongoing antithrombotic therapy).**

**Determine if anticoagulation can be continued without interruption (warfarin or DOACs)**

Consider bleeding risk of the procedure. For low bleeding risk procedures anticoagulation can be continued without interruption.

**Procedures that can be performed on anticoagulants***

<table>
<thead>
<tr>
<th>Ophthalmic</th>
<th>Dental</th>
<th>Dermatologic</th>
<th>Gastrointestinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract surgery</td>
<td>Restorations</td>
<td>Mohs surgery</td>
<td>Diagnostic</td>
</tr>
<tr>
<td>Trabeculectomy</td>
<td>Uncomplicated extractions</td>
<td>Simple excisions</td>
<td>esophagastroduodenoscopy</td>
</tr>
<tr>
<td></td>
<td>Endodontics</td>
<td></td>
<td>Colonoscopy without biopsy</td>
</tr>
<tr>
<td></td>
<td>Prosthetics</td>
<td></td>
<td>Diagnostic endoscopic retrograde</td>
</tr>
<tr>
<td></td>
<td>Periodontal therapy</td>
<td></td>
<td>cholangiopancreatography</td>
</tr>
<tr>
<td></td>
<td>Dental hygiene</td>
<td></td>
<td>Biliary stent without sphincterotomy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Endoscopic ultrasonography</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>without biopsy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Push enteroscopy</td>
</tr>
</tbody>
</table>

Jaffer AK, Perioperative Management of Warfarin and Antiplatelet Therapy, Cleveland Clinic Journal of Medicine, Vol 76, Suppl 4, Nov 2009.

*refer to Appendix A for more extensive list
Step 2: When chronic anticoagulation will be interrupted, determine preoperative thromboembolic risk to decide if preoperative bridging is indicated. Consider the bleeding risk of the procedure when making the decision to implement bridging. If the procedure is a high bleeding risk procedure such as select neurosurgical and urologic procedures seek expert consultation (see Appendix A and B).

<table>
<thead>
<tr>
<th>MODERATE TO HIGH Preop Thrombotic Risk: Consider Bridging</th>
<th>LOW Preop Thrombotic Risk: Bridging Not Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical Heart Valves</strong></td>
<td></td>
</tr>
<tr>
<td>• All mitral valve prosthesis</td>
<td>• Bi-leaflet aortic valve prosthesis <strong>without</strong> stroke</td>
</tr>
<tr>
<td>• Older mechanical aortic valve prosthesis (caged ball/tilting disk)</td>
<td>• On-X Valve <strong>without</strong> history of stroke</td>
</tr>
<tr>
<td>• Stroke/TIA</td>
<td></td>
</tr>
<tr>
<td>• Bi-leaflet aortic valve prosthesis and history of stroke</td>
<td></td>
</tr>
<tr>
<td>• Two or more mechanical valves</td>
<td></td>
</tr>
</tbody>
</table>

| **Atrial Fibrillation (A fib)**                             |                                                  |
| • Prior embolic stroke                                     | • no prior stroke or TIA >1 year ago            |
| • confirmed TIA within 1 year                              | • no moderate to high thrombotic risk conditions |
| • Moderate to severe mitral stenosis                       |                                                  |
| • Cardiac thrombus within 3 months                         |                                                  |
| • Hypertrophic cardiomyopathy                              |                                                  |

| **Venous Thromboembolism (VTE)**                           |                                                  |
| • Recent VTE within 3 months                               | • VTE more than 3 months ago no other risk factors |
| • Prior VTE with highly prothrombotic state²              | • Nonsevere thrombophilic conditions, including hereditary disorders |

**Bridging**
- Check INR 7 days prior to surgery
- Last dose of warfarin 6 days prior to procedure (for INR 2-3, if INR 3-4.5, last dose warfarin 7 days prior)
- If CrCl>30, initiate enoxaparin* 1 mg/kg SQ 36 hrs after last warfarin dose and continue q12 hrs If CrCl<30, initiate enoxaparin* 1 mg/kg SQ 36 hrs after last warfarin dose and continue q24hr. Last dose SQ LMWH 1mg/kg 24 hours prior to procedure
- Alternate dose: 1.5mg/kg SQ q24 hrs, last dose give half the total dose 24 hours prior to surgery
- Check INR in the morning on the day of surgery

**No Bridging**
- Check INR 5-7 days prior to surgery
- Last dose of warfarin 6 days prior to procedure for INR<3. If INR 3-4.5: Last dose of warfarin 7 days prior to procedure
- Check INR the morning of the procedure

---

*Refer to page 4 for alternative drugs for bridging and contraindications to enoxaparin

1 Delay elective surgery until 3 months post VTE event if possible

2 Triple positive antiphospholipid syndrome, myeloproliferative neoplasm, paroxysmal nocturnal hemoglobinuria, active cancer
# Post-Operative Anticoagulation Guideline

**Step 3: Resume Anticoagulation**
See appendix A for extensive list of procedures

<table>
<thead>
<tr>
<th>Low risk of post op thrombosis</th>
<th>Moderate bleeding risk procedure</th>
<th>High bleeding risk procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bileaflet Aortic Valve without stroke</td>
<td>Resume warfarin 12-24 hours post procedure at usual dose (no bridging therapy) once hemostasis achieved</td>
<td>Resume warfarin 3-7 days post procedure at usual dose (No bridging therapy)</td>
</tr>
<tr>
<td>On-X valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial fibrillation and no risks factors³</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moderate risk of post op thrombosis</th>
<th>Moderate bleeding risk procedure</th>
<th>High bleeding risk procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTE greater than 3 months ago</td>
<td>Start prophylactic dose LMWH, post-op day one Resume warfarin 12-24 hours post procedure at usual dose Stop LMWH when reach target INR⁵</td>
<td>Consider starting prophylactic dose LMWH post-op when hemostasis achieved Resume Warfarin at usual dose once hemostasis achieved Stop LMWH when reach target INR</td>
</tr>
<tr>
<td>Atrial fibrillation with additional risks factors⁴</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High risk of post op thrombosis</th>
<th>Moderate bleeding risk procedure</th>
<th>High bleeding risk procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical mitral valve</td>
<td>Resume full dose LMWH 24 hours post procedure (Can consider prophylactic dose LMWH for 1-3 days before initiating full dose) Resume warfarin 12-24 hours post procedure at usual dose Stop LMWH when reach target INR</td>
<td>Consider starting prophylactic dose LMWH post-op when hemostasis achieved and increase to full dose at surgeon’s discretion (goal 48-72hrs postop) Resume Warfarin at usual dose once hemostasis achieved Stop LMWH when reach target INR</td>
</tr>
<tr>
<td>Older mechanical aortic valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bileaflet aortic valve, with h/o stroke Recent VTE within 3 months⁶</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior VTE with highly prothrombotic state⁷ &gt;1 unprovoked VTE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

³ prior stroke or TIA, systemic embolization, moderate to severe mitral stenosis, cardiac thrombus within 3 months, hypertrophic cardiomyopathy

⁴ prior stroke or TIA, systemic embolization, moderate to severe mitral stenosis, cardiac thrombus within 3 months, hypertrophic cardiomyopathy

⁵ Refer to Appendix B

⁶ Delay elective surgery until at least 3 months post VTE event if possible

⁷ Triple positive antiphospholipid syndrome, myeloproliferative neoplasm, paroxysmal nocturnal hemoglobinuria, active cancer
### Alternative Drugs for Bridging

<table>
<thead>
<tr>
<th>Drug</th>
<th>Therapeutic Dose</th>
<th>Prophylaxis Dose</th>
<th>Pre-Surgery Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoxaparin (Lovenox)</td>
<td>1 mg/kg SQ BID or 1.5mg/kg SQ daily</td>
<td>30 mg SQ BID or 40 mg SQ daily</td>
<td>Last dose 24hr prior to surgery</td>
</tr>
<tr>
<td>Enoxaparin for chronic kidney disease</td>
<td>1mg/kg SQ daily when CrCl &lt; 30 ml/min</td>
<td>30mg SQ daily when CrCl &lt; 30 ml/min</td>
<td>Last dose 24hr prior to surgery</td>
</tr>
<tr>
<td>UFH</td>
<td>250 units/kg SQ BID</td>
<td>5000 units SQ BID or 5000 units SQ TID</td>
<td>Last dose 8-12hr prior to procedure (depending on regimen)</td>
</tr>
<tr>
<td>Fondaparinux (Arixtra)</td>
<td>5mg SQ daily when &lt; 50kg. 7.5mg SQ daily when 50-100kg. 10mg SQ daily when &gt;100kg.</td>
<td>2.5mg SQ daily</td>
<td>Last dose 36-48hr prior to surgery</td>
</tr>
</tbody>
</table>

**Contraindications to enoxaparin:**
- Known hypersensitivity to enoxaparin, heparin, pork products, or any component of the formulation (including benzyl alcohol)
- History of HITT or presence of circulating antibodies
- Active major bleeding
- ICH < 3 months

**Relative contraindications to bridging:**
- High risk bleeding procedure
- Platelet Abnormality
- Prior bleed during bridging
References for anticoagulation and antiplatelet therapy management guidelines:

- Doherty et al. 2017 ACC Expert Consensus Decision Pathway for Periprocedural Management of Anticoagulation in Patients With Nonvalvular Atrial Fibrillation. DOI: 10.1016/j.jacc.2016.11.024
- Douketis et al. Perioperative Anticoagulant Use for Surgery Evaluation (PAUSE); General Session ASH Annual meeting, Abstract
- Preoperative Algorithms- Antiplatelet Agents and Cardiac Stents. Legacy UHealth Preoperative Assessment Center, University of Miami. (Based on American College of Chest Physicians 2008 practice Guidelines).
### Appendix A:

**Bleeding Risk Associated with Different Procedure Types**

<table>
<thead>
<tr>
<th></th>
<th>Moderate/High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate Bleeding Risk unless noted as (usually considered as $\geq 2.0%$ risk of major bleed or in vulnerable area)</td>
<td>(usually considered as $&lt; 2.0%$ risk of major bleed)</td>
</tr>
</tbody>
</table>
| **Anesthesiology**       | • Neuraxial anesthesia (spinal and epidural, facet, stellate ganglion and selective nerve root blocks)$^{5}$ | • Peripheral nerve blocks$^{1,2}$  
• Pump refills$^{1,2}$  
• Endotracheal intubation$^{5}$ |
| **Cardiac surgery**      | • Coronary bypass surgery$^{1,2,4,5}$  
• Valve replacement surgery$^{1,2,4,5}$ | |
| **Cardiology - General** | • Cardiac catheterization$^{1,2}$  
• Electrophysiology studies$^{5}$  
• Coronary interventions$^{5}$ | |
| **Cardiology - EP**      | • Pacemaker implantation  
• Pacemaker adjustment/battery replacement  
• AICD implantation | |
| **Dentistry**            | • Extensive reconstructive procedures | • Simple dental extractions$^{4}$  
• Tooth extractions$^{5}$  
• Multiple tooth extractions$^{4}$  
• Endodontic procedures (root canal)$^{5}$ |
| **Dermatology**          | | • All dermatologic procedures are considered low risk including Mohs surgery and simple excisions$^{1,2}$ |
| **Endocrinology**        | | • Thyroid aspiration or biopsy$^{4,7}$ |
| **ENT**                  | • All head and neck surgeries$^{4}$  
• Any sinus surgery$^{5}$  
• Thyroidectomy$^{5}$  
• Parathyroidectomy$^{5}$  
• Nasal polyp biopsy$^{5}$ | • Diagnostic sinus, laryngeal or nasopharyngeal fiberoptic exam$^{5}$  
• FNA$^{5}$  
• Vocal cord injection$^{5}$  
• Excision of benign and malignant lesions of the face, scalp and neck |
| Gastroenterology | • EGD with variceal procedures<sup>1</sup>  
• Colonoscopy with polypectomy<sup>1</sup>  
• Large polypectomy (>1 cm)  
• ERCP with sphincterotomy<sup>1</sup>  
• Laser ablation<sup>1</sup>  
• Pneumatic or bougie dilation<sup>1,4,6</sup>  
• Percutaneous endoscopic gastrostomy (PEG)<sup>1,4,5,6</sup>  
• Procedures with biopsies<sup>2,4</sup>  
• Polypectomy<sup>2,4,6</sup>  
• Variceal procedures<sup>4,6</sup>  
• Variceal banding (controversial)<sup>5</sup>  
• EUS with FNA or needle biopsy<sup>5,6</sup>  
• Liver biopsy<sup>5</sup>  
• Therapeutic balloon-assisted enteroscopy<sup>6</sup>  
• Endoscopic hemostasis<sup>6</sup> | • Flex sigmoidoscopy<sup>2,6</sup>  
• EGD with or without biopsy<sup>4,6</sup>  
• Colonoscopy without biopsy<sup>5,6</sup>  
• Biliary/pancreatic stent placement<sup>4</sup>  
• EUS without biopsy<sup>4</sup>  
• ERCP without sphincterotomy<sup>5,6</sup>  
• Non-thermal snare removal of small (< 6 mm) polyp<sup>5</sup>  
• Self-expanding luminal stents without dilatation (controversial)<sup>5,6</sup>  
• Paracentesis<sup>5,7</sup>  
• Capsule endoscopy<sup>6</sup> |
| --- | --- | --- |
| General surgery | • Major thoracic, abdominal or pelvic surgery  
• Other internal procedures (e.g., hernia repair, cholecystectomy) |  |
| Gynecology | • Laparoscopic surgery  
• BTL  
• hysterectomy | • Vulvar biopsy<sup>1</sup>  
• Laser of vulva, vagina<sup>1</sup>  
• Leep of cervix<sup>1</sup>  
• D and C<sup>1,4,5</sup>  
• Hysterectomy, diagnostic<sup>1</sup>  
• Colposcopy, diagnostic<sup>5</sup>  
• IUD placement<sup>6</sup>  
• Ablation- HTA or thermachoice only (not resectoscopic)<sup>1</sup> |
| Nephrology | • Kidney biopsy<sup>1,2,4</sup> |  |
| Neurology | • Lumbar puncture<sup>5</sup> | • Needle electromyograph |
| Neurosurgery | • Any intracranial and spine surgeries<sup>1,2,4,5</sup>  
• Laminectomy<sup>4</sup> |  |
| Ophthalmology | (all posterior chamber of the eye surgeries are)  
• Trabeculectomy with/without cataract extraction<sup>1</sup>  
• Trabectome Surgery<sup>1</sup>  
• Bleb revision<sup>1</sup>  
• Glaucoma Tube Shunt Implants<sup>1</sup>  
• Ahmed Implant<sup>1</sup>  
• Baerveldt Implant<sup>1</sup>  
• All Oculoplastic/Reconstructive<sup>1</sup> | • Cataract extraction with IOL implantation<sup>1</sup>  
• Endocyclophotocoagulation<sup>1</sup>  
• Glaucoma laser / other lasers<sup>1</sup>  
• Refractive Laser Surgeries<sup>1</sup>  
• LASIK, PRK<sup>1</sup>  
• Corneal Surgeries<sup>1</sup>  
• Cornea Transplant<sup>1</sup>  
• DSEK, DLEK<sup>1</sup>  
• Cataract and non-cataract surgery<sup>4</sup> |
| Ophthalmology (continued) | • Blepharoplasty<sup>1</sup>  
  • Entropion/Ectropion Repair<sup>1</sup>  
  • All Orbital Surgery<sup>1</sup>  
  • Dacryocystorhinostomy (DCR)<sup>1</sup>  
  • Periorbital surgery<sup>5</sup>  
  • Vitreoretinal surgery<sup>5</sup> |
|--------------------------|--------------------------------------------------------------------------------------------------|
|                         | • Cataract surgery<sup>6</sup>  
  • Intraocular injections<sup>5</sup> |
| Orthopedics             | • Total joint replacement surgeries – hip, knee, or shoulder<sup>1,2</sup>  
  • Fracture repair in femur, humerus or pelvis<sup>1,2</sup>  
  • Arthroscopy<sup>5</sup>  
  • Shoulder, foot or hand surgery<sup>4</sup>  
  • Arthroscopic surgery<sup>4</sup>  
  • Carpal tunnel repair<sup>4</sup> |
|                         | • Joint, bursa, and tendon sheath aspirations and injections<sup>1</sup>  
  • Arthrocentesis<sup>5</sup> |
| Plastic Surgery         | • Major reconstructive plastic surgeries<sup>1</sup>  
  • Some small office procedures |
| Podiatry                | • Surgical osteotomies<sup>1</sup>  
  • Open reduction/internal fixation foot and ankle fractures/dislocations<sup>1</sup>  
  • Soft tissue/mass excision<sup>1</sup>  
  • Arthrodesis of the toes/foot/ankle<sup>1</sup>  
  • Arthroscopy-foot/ankle<sup>1</sup>  
  • Removal foreign body (deep)<sup>1</sup>  
  • Tendon repair<sup>1</sup>  
  • Neuroma/neurectomy<sup>1</sup>  
  • Closed reduction – in case need to convert to an open reduction; hence patients will need to be off warfarin |
|                         | • Biopsies-skin (deep), fascia, muscle bone<sup>1</sup> |
|                         | Office procedures are low risk including:  
  • Nail procedures<sup>1,2</sup>  
  • Wart removal<sup>1,2</sup>  
  • Foreign body (superficial)<sup>1,2</sup>  
  • Skin biopsy (superficial)<sup>1,2</sup>  
  • Removal external fixation<sup>1</sup> |
| Pulmonology             | • Chest tube placement<sup>5</sup>  
  • Transbronchial biopsy<sup>5</sup>  
  • Stricture dilation<sup>5</sup>  
  • Thorocentesis<sup>5,7</sup>  
  • Endobronchial FNA<sup>5</sup>  
  • Airway stent placement<sup>5</sup>  
  • Bronchoscopy with or without biopsy<sup>4,5</sup> |
|                         | • Central venous line removal<sup>4</sup> |
| Radiology               | • Epidural steroid injection<sup>1,2</sup>  
  • Disc procedures<sup>1,2</sup>  
  • Liver/kidney biopsy<sup>5,7</sup>  
  • TIPS<sup>5,7</sup>  
  • Percutaneous nephrostomy<sup>5,7</sup> |
|                         | • Trigger Point Injection<sup>1,2</sup>  
  • Peripheral injections<sup>1,2</sup>  
  • Sacroiliac joint injection<sup>1,2</sup>  
  • Pump refills<sup>1,2</sup>  
  • Joint, bursa or tendon sheath aspirations/injections<sup>1</sup>  
  • Simple catheter exchange in non-vascular tract (PEG tube, nephrostomy tube)<sup>5,7</sup>  
  • PICC<sup>5,7</sup>  
  • IVC filter<sup>5,7</sup> |
pelvic abscess
▪ Dilation of percutaneous tracts
▪ Biliary interventions (new tract)
▪ Radiofrequency ablation (complex)
▪ Angiography up to 7F
▪ Venous interventions
▪ PEG
▪ Chemoembolism
▪ Transjugular liver biopsy
▪ Tunneled central venous catheter
▪ Subcutaneous port placement
▪ Intra abdominal, chest wall or retroperitoneal drainage or biopsy
▪ Lung biopsy
▪ Percutaneous liver biopsy
▪ Percutaneous cholecystostomy
▪ Spine procedures (vertebroplasty, kyphoplasty, lumber puncture, epidural injection, facet block – moderate but high in all other guidelines)
▪ Renal cryoablation
▪ Vertebral/spine bone biopsy

| Urology | • Transurethral resection of the prostate
• Transurethral resection of the bladder for tumor
• Kidney, prostate or bladder biopsy
• Partial nephrectomy
• Ureteroscopy
• Lithotripsy
• Hydrocele repair
|• Cystoscopy with or without biopsy
• Circumcision |

| Vascular Surgery | • Aortic aneurysm repair
• Peripheral bypass surgery
• Carotid endarterectomy
• Angiogram with or without intervention |

1. Kaiser Permanente Northern California guidelines
2. Kaiser Permanente Northwest current guideline