GUIDELINE FOR THE MANAGEMENT OF ORAL ANTICOAGULATION BEFORE AND AFTER ELECTIVE SURGERY OR PROCEDURES

OBJECTIVE

The objective of this guideline is to optimize the quality of care for patients who require interruption of chronic oral anticoagulation for elective surgery or procedures. Please note that not all patients may require interruption of oral anticoagulation therapy (for example, patients undergoing pacemaker or internal cardioverter defibrillator implants or cataract surgery).

STATEMENT OF THE PROBLEM

The management of patients whose oral anticoagulation is withdrawn prior to surgery represents a difficult dilemma. Interruption of oral anticoagulation increases the risk of thromboembolism, whereas aggressive peri-operative anticoagulation with heparin to bridge this period of thromboembolic vulnerability increases the risk of bleeding, particularly post-operatively. This guideline provides recommendations on when and how to use bridging anticoagulation.

LIMITATIONS OF THIS GUIDELINE

The perioperative management of anticoagulation is a controversial area because of the lack of data from randomized trials and prospective studies. It is recognized that other interpretations of the relevant literature and other clinical policies may be reasonable and appropriate.

Good judgment remains the cornerstone of clinical decision-making for individual patients. This guideline is intended to assist the clinician in decision-making, but cannot replace or impart good judgment. This guideline cannot and does not anticipate all of the individual clinical circumstances and special situations that arise in practice. For this reason, no clinician and no one evaluating the actions of a clinician should attempt to apply this guideline in a rote or blanket fashion.

GUIDELINE

The decision to use bridging anticoagulation (ie. therapeutic dose IV unfractionated heparin or subcutaneous low molecular weight heparin before and after surgery) should be based on the approach outlined in Figure 1. Please note that the newer oral anticoagulants (dabigatran, rivaroxaban, apixaban) have shorter half-lives and faster onset of action compared to warfarin and bridging is generally not required.

RECOMMENDATIONS FOR PATIENTS TAKING WARFARIN:

- **Holding warfarin before surgery:**
  - For patients whose INR is between 2.0 and 3.0, discontinue warfarin 5 days prior to surgery (last dose given 6 days before surgery) and allow the INR to spontaneously fall. Warfarin should be withheld for a longer period of time if the INR is normally maintained above 3.0.
  - The INR should be measured the day prior to surgery. Vitamin K may be administered if the INR is deemed excessive.

- **Bridging with IV unfractionated heparin before surgery:**
  - After discontinuation of warfarin, patients should be admitted to hospital and started on IV unfractionated heparin in therapeutic doses. Since therapeutic oral anticoagulation will remain therapeutic for at least a day after the last warfarin dose, patients can be admitted on the second day after their last dose of warfarin.
  - IV heparin should be discontinued 4 to 6 hours prior to surgery.

- **Bridging with therapeutic dose subcutaneous low molecular weight heparin (LMWH) before surgery**
  - For some patients, an acceptable alternative to IV unfractionated heparin is outpatient subcutaneous administration of LMWH in therapeutic doses. LMWH should be avoided in patients with renal failure. Weight-adjusted dosing without monitoring anti-factor Xa levels may be inappropriate for patients who weigh less than 50 kg or greater than 90 kg.
  - The physician responsible for outpatient administration of LMWH will make the appropriate outpatient nursing arrangements for LMWH administration if the patient is unable to self-inject and monitoring for bleeding.
  - Subcutaneous LMWH in a therapeutic dose should be started the second day after the last dose of warfarin.
  - The last pre-operative dose should be administered no less than 24 hours prior to surgery. Some clinicians recommend that half of the total daily dose be given 24 hours prior to surgery. At the discretion of the treating physician, patients may be admitted for IV heparin infusion after the last LMWH dose to provide therapeutic anticoagulation coverage until a few hours prior to surgery. In such patients, IV unfractionated heparin should be discontinued 4 to 6 hours prior to surgery.

- **Restarting warfarin after surgery:**
  - Post-operatively, warfarin should be resumed when the patient is able to take medications by mouth and after the epidural catheter has been removed (if neuraxial analgesia has been used).

- **Bridging with IV unfractionated heparin after surgery:**
  - Full dose (therapeutic dose) IV unfractionated heparin should be started no sooner than 24 hours after major surgery when there is adequate post-op hemostasis. If there is evidence of surgical bleeding or if the patient is at high risk of bleeding, it should be delayed further. It should also be delayed while the epidural catheter is insitu (if neuraxial analgesia has been used). In situations where therapeutic dose IV unfractionated heparin is deferred beyond 24 hours, the administration of prophylactic dose LMWH can be considered sooner (as early as the evening of the day of surgery). IV heparin may be started sooner if the surgery or procedure is of a minor nature and the risk of bleeding is low.
  - Heparin should be started without a bolus, at no more than the expected maintenance

infusion rate. To further minimize the risk of post-operative bleeding associated with persistently supratherapeutic PTT values that sometimes occur initially, a lower target PTT range can be considered with the use of the Reduced Dose Unfractionated Heparin Pre Printed Order.

- Heparin should be continued until the INR is therapeutic.

- **Bridging with therapeutic dose subcutaneous LMWH after surgery:**
  - Therapeutic dose subcutaneous LMWH should be started no sooner than 24 hours after major surgery. If there is evidence of surgical bleeding or if the patient is at high risk of bleeding, it should be delayed further. It should also be delayed while the epidural catheter is insitu (if neuraxial analgesia has been used). In situations where therapeutic dose LMWH is deferred beyond 24 hours, the administration of prophylactic dose LMWH can be considered sooner (as early as the evening of the day of surgery). Therapeutic dose LMWH may be started prior to 24 hours after surgery if the surgery or procedure is of a minor nature and the risk of bleeding is low.
  - LMWH should be continued until the INR is therapeutic.

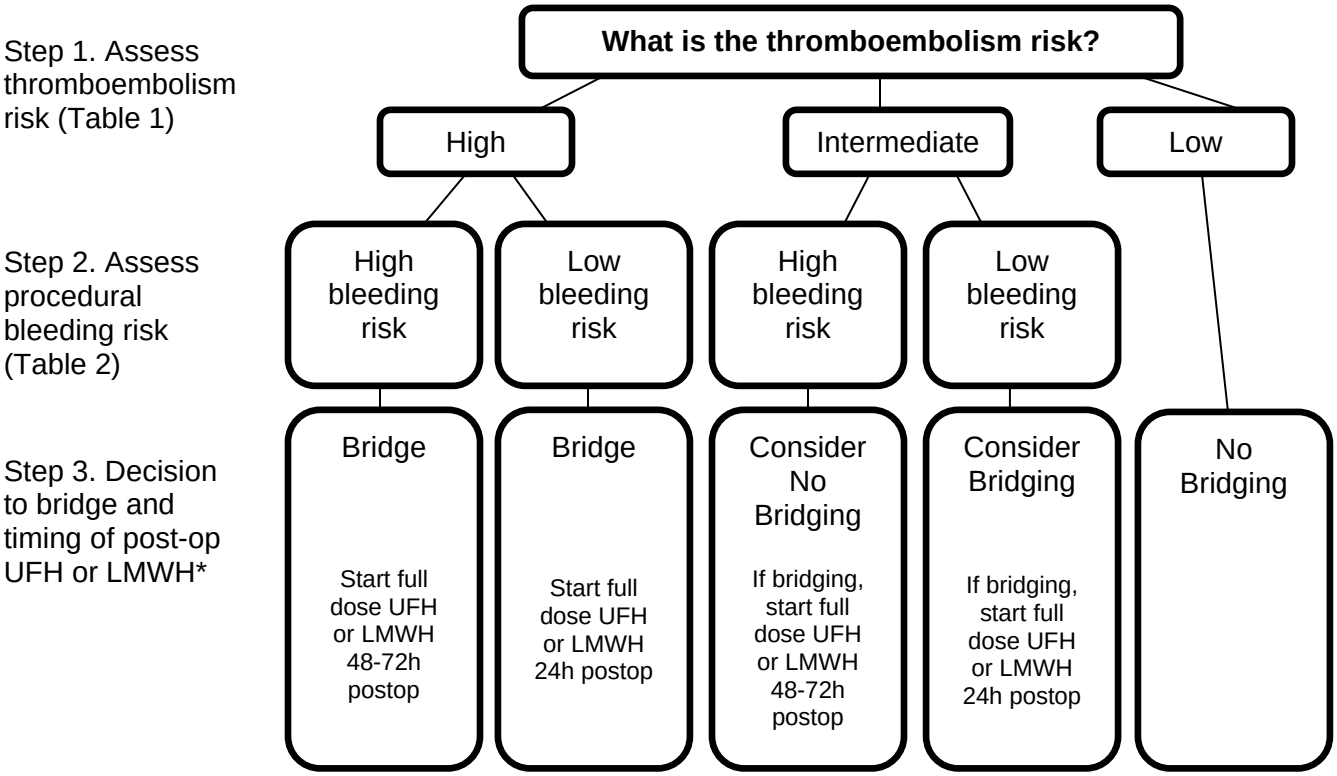
RECOMMENDATIONS FOR PATIENTS TAKING DABIGATRAN, RIVAROXABAN OR APIXABAN

- **Holding dabigatran, rivaroxaban and apixaban before surgery:**
  - Refer to "*Guidelines for the Preoperative Management of Medications*" (located in KGH Drug Formulary) for time frame to hold these medications before surgery.

- **Restarting dabigatran, rivaroxaban and apixaban after surgery:**
  - Post-operatively, these drugs should be resumed after hemostasis has been achieved, after epidural catheter has been removed (if neuraxial analgesia has been used) and the patient is able to take medications by mouth.
  - Post-operatively, peak plasma concentrations of these agents are achieved quickly (see table below) following administration thus bridging is not normally required.

Drug	**Time to Peak Plasma Concentrations post dose**
Dabigatran (Pradaxa®)	6 hours (post-operative patients)
Rivaroxaban (Xarelto®)	2 to 4 hours
Apixaban (Eliquis®)	3 to 4 hours

Figure 1. Approach for Decision Making for Bridging



*Start low dose LMWH or UFH 24 to 48 hours post-op if pharmacologic VTE prophylaxis is indicated.
UFH - unfractionated heparin, LMWH - low molecular weight heparin, VTE - venous thromboembolism

Table 1. Thromboembolism risk

		Indication for Anticoagulation		
		Mechanical heart valve	**Atrial fibrillation**	**Venous thromboembolism**

Thromboembolism Risk	**High**
	Greater than 10%/year ATE risk or
	greater than 10%/month VTE risk
		• Any mechanical mitral valve
		• Caged-ball or tilting disc AVR
		• Recent (less than 6 months) stroke or TIA
			• Non-valvular AF with $CHADS_2$ score of 5 or 6
			• Recent (within last 6 months) stroke or TIA
			• Rheumatic valvular heart disease
				• Recent (less than 3 months) VTE
				• Severe thrombophilia:
				  • Protein C,S or AT deficiency
				  • APLA
				  • Multiple thrombophilias

	Intermediate
	4 to 10%/year ATE risk or
	4 to 10%/month VTE risk
		• Bileaflet AVR and more than 1 additional risk factor for stroke:
		  • Atrial fibrillation
		  • Prior stroke or TIA
		  • Hypertension
		  • Diabetes
		  • CHF
		  • Age over 75
			• Non-valvular AF with $CHADS_2$ score of 3 or 4	• VTE within past 3 to 12 months
				• Recurrent VTE
				• Non severe thrombophilia
				• Active or recently (within last 6 months) treated cancer

	Low Less than 4%/year ATE risk or less than 4%/month VTE risk	• Bileaflet AVR without additional risk factors for stroke	• Non-valvular AF with $CHADS_2$ score of 0 to 2 and no prior stroke or TIA	• VTE more than 12 months ago

ATE = arterial thromboembolism, VTE = venous thromboembolism, AF = atrial fibrillation, AVR = aortic valve replacement, TIA = transient ischemic attack, CHF = congestive heart failure

Table 2. Procedural Bleeding Risk

Procedure	Low Risk Bleeding (less than 1.5%)	High Risk Bleeding (greater than 1.5% or in vulnerable areas)
Anesthesiology	Endotrachial intubation	Spinal and epidural anesthesia*
Cardiac surgery	None	All
Cardiovascular	Diagnostic coronary angiography (controversial)	Pacemaker or defibrillator placement* (3.5% on warfarin therapy, 16% with bridging anticoagulation) Coronary intervention Electrophysiology testing and/or ablation
Dental	Tooth extraction Endodontic procedures (root canal)	Reconstructive procedures
Dermatology	Minor skin procedures (excision of basal and squamous cell cancers, nevi, actinic keratosis, premalignant lesions)	Major procedures (wide excision of melanoma)
Gastroenterology	Diagnostic endoscopy (including balloon enteroscopy) +/- mucosal biopsy Endoscopic retrograde cholangiopancreatography without sphincterotomy Endoscopic ultrasound without fine-needle aspiration Nonthermal (cold) snare removal of small polyps Luminal self-expanding metal stent placement (controversial)	Large polypectomy (greater than 1 cm) Endoscopic mucosal and submucosal dissection Biliary or pancreatic sphincterotomy Percutaneous endoscopic gastrostomy Endoscopic ultrasound with fine-needle aspiration or needle biopsy Coagulation or ablation of tumours, vascular lesions Percutaneous liver biopsy Variceal band ligation (controversial)
General surgery	Suture of superficial wounds	Major tissue injury Vascular organs (spleen, liver, kidney) Bowel resection Laparoscopy
Gynecologic surgery	Diagnostic colposcopy, hysteroscopy Dilation and curettage Endometrial biopsy Insertion of interauterine device	Laparoscopic surgery Bilateral tubal ligation Hysterectomy
Interventional radiology	Simple catheter exchange in well-formed, nonvascular tracts (e.g. gastrostomy, nephrostomy, cholecystostomy tubes) Thoracentesis Paracentesis Inferior vena cava filter placement Peripheral catheter placement, non-tunneled catheter (PICC) Aspiration of abdominal or pelvic abcesses, placement of small-caliber drains Temporary dialysis catheter placement	Percutaneous transhepatic cholangiography Percutaneous nephrostomy Percutaneous drainage of liver abcess or gallbladder Aggressive manipulation of drains or dilation of tracts Chest tube placement Hickman and tunneled dialysis catheter placement Biopsy of organs
Intravascular procedures	Venous access	Arterial puncture Transvenous ablation
Neurology	None	Lumbar puncture* Myelography Needle electromyography (controversial)
Neurosurgery	None	Intracranial, spinal surgery*
Ophthalmology	Cataract surgery Intraocular injections (Avoid retrobulbar anesthesia – controversial)	Periorbital surgery Vitreoretinal surgery
Orthopedic surgery	Arthrocentesis	Joint replacement Arthroscopy

Procedure	Low Risk Bleeding (less than 1.5%)	High Risk Bleeding (greater than 1.5% or in vulnerable areas)
Otolaryngologic surgery	Diagnostic fiberoptic laryngoscopy, nasopharyngoscopy, sinus endoscopy Fine-needle aspiration Vocal cord injection	Any sinus surgery Biopsy or removal of nasal polyps Thyroidectomy Parotidectomy Septoplasty Terbinate cautery
Plastic Surgery	Injection therapy	Reconstruction
Pulmonary	Diagnostic bronchoscopy +/- bronchioalveolar lavage Endobronchial fine-needle aspirate (controversial) Airway stent placement (controversial)	Tumor ablation (laser) Transbronchial biopsy Stricture dilation
Rheumatology	Arthrocentesis	None
Urology	Circumcision Cystoscopy without biopsy	Extracorporeal shock-wave lithotripsy Transurethral prostatectomy Bladder resection, bladder tumor resection Tumor ablation Kidney biopsy
Vascular surgery	None	Carotid endarterectomy Open or endovascular aneurysm repair Vascular bypass grafting

* potential for profound neurological consequences

Reference: NEJM 2013;368: 2113-24.

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