

Bridging Protocol for Surgical Patients: One Clinic's Experience Facilitating a Safe Anticoagulation Intervention

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Surgical candidates often present with complex medical histories that necessitate an individualized approach to care to minimize surgical and anesthetic risk. Patients on warfarin require exceptionally careful clinical assessment, consideration, and consistency to reduce the risk of perioperative thromboembolism and bleeding complications. In response to this need, Victoria General Hospital in Winnipeg, Manitoba, Canada developed a bridging protocol based on evidence-based guidelines and a checklist tool to incorporate and communicate the necessary tasks among the interprofessional team. The purpose of this initiative was to create a patient-focused process to assist those at risk for a thromboembolic event to navigate through a clear, consistent, and collaborative surgical experience whenever cessation and resumption of warfarin administration was required.

Keywords: anticoagulation, thromboembolism, perioperative, best practice, warfarin, low-molecular-weight heparin.

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PATIENTS ON WARFARIN can be clinically challenging and resource intensive. In preoperative preparation for surgical procedures, these patients are often at an increased risk of thromboembolic events with the cessation of warfarin and subsequently require a short-acting agent, low-molecular-weight heparin (LMWH), to minimize their risk. "Bridging" is the process of transitioning a

patient from warfarin to a short-acting antithrombotic agent before surgery, and then postoperatively returning them to a short-acting agent with warfarin and progressing solely to warfarin. As patients transition from the preoperative to the postoperative period, the management of warfarin and LMWH requires careful consideration, timely monitoring, and postoperative follow-up to ensure that therapeutic levels are resumed. Considering all the aspects of care and monitoring required for patients being bridged, there are many opportunities for error, and constant vigilance is imperative.

Essential components to a comprehensive approach to bridging include the use of an evidence-based protocol (Figures 1 and 2), a detailed checklist to follow to ensure that everything is included for each patient, and teaching combined with multidisciplinary communication. The perioperative nurse clinician (PNC) has proven to be an excellent resource to guide these patients through the perioperative

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**Physician Information Re:
ANTICOAGULATION MANAGEMENT BEFORE AND AFTER INVASIVE PROCEDURES**

Management of anticoagulation before & after invasive procedures requires careful, patient-specific evaluation of procedural & patient bleeding risk, as well as thromboembolic risk associated with the underlying disease for which anticoagulation is prescribed.

Patient specific management plans must be made in consultation with the physician performing the procedure.

1. Determine patient's thromboembolic and bleeding risk.
2. Determine the bleeding risk of the procedure.
3. Choose pre-op and post-op management accordingly.

1.1 Patient Thromboembolic Risk [^]		[^] Risk stratification according to patient indication for antithrombotic therapy	
Risk ^A	Mechanical Heart Valve	Atrial Fibrillation	VTE
<input type="checkbox"/> HIGH	<ul style="list-style-type: none"> o Any mitral valve prosthesis o Older (caged ball or tilting disk) aortic valves o Recent (within 6 months) stroke or transient ischemic attack (TIA) 	<ul style="list-style-type: none"> o CHADS₂ score of 5 or 6 o Recent (within 3 months) stroke, or transient ischemic attack o Rheumatic valvular heart disease 	<ul style="list-style-type: none"> o Recent (within 3 months) VTE (DVT/PE) o Severe thrombophilia (e.g. deficiency of protein C, protein S or antithrombin, antiphospholipid antibodies or multiple abnormalities)
<input type="checkbox"/> MODERATE	<ul style="list-style-type: none"> o Bileaflet aortic valve prosthesis and one of the following: atrial fibrillation, prior stroke or TIA, hypertension, diabetes, congestive heart failure, age > 75 yrs 	<ul style="list-style-type: none"> o CHADS₂ score of 3 or 4 <div style="border: 1px dashed black; padding: 2px; width: fit-content; margin: 5px auto;"> CHADS₂ = Congestive heart failure+Hypertension- Age+Diabetes+Stroke </div>	<ul style="list-style-type: none"> o VTE within past 3-12 months o Non-severe thrombophilic conditions (e.g. heterozygous factor V Leiden mutation, heterozygous factor II mutation) o Recurrent VTE o Active cancer (treated within 6 months or palliative)
<input type="checkbox"/> LOW	<ul style="list-style-type: none"> o Bileaflet aortic valve without atrial fibrillation and no other stroke risk factors 	<ul style="list-style-type: none"> o CHADS₂ score of 0 to 2 (and no prior stroke or transient ischemic attack) 	<ul style="list-style-type: none"> o Single VTE occurred more than 12 months ago and no other risk factors
1.2 Patient Bleeding Risk			
<input type="checkbox"/> High (2 or more of the following)			
<ul style="list-style-type: none"> o >65 years old o GI Bleed in past 12 months o Stroke in past 12 months o Warfarin started in last month o Severe anemia 		<ul style="list-style-type: none"> o Severe liver dysfunction o Uncontrolled hypertension (BP >160/90) o Acute MI in past 3 months o Renal insufficiency (SCr >130 µmol/L) o Thrombocytopenia or coagulation Factor Deficiency 	
2.0 Procedure Bleeding Risk			
<input type="checkbox"/> Minimal		<input type="checkbox"/> Low	
<ul style="list-style-type: none"> o Cutaneous biopsy/most other cutaneous (minor dermatologic) surgeries o Simple dental procedures/ extractions o Cataract surgery o Coronary angiography o Joint & soft tissue injections, arthrocentesis o Upper GI endoscopy with or without mucosal biopsy o TURP with laser surgery o Diagnostic endoscopic retrograde cholangiopancreatography o Biliary stent implantation (without sphincterotomy) 		<ul style="list-style-type: none"> o Colonoscopy o Bronchoscopy o Biopsy (bladder, thyroid, breast, pancreas) o Lap cholecystectomy o Hernia repair o Upper endoscopy with endosphincterotomy 	
		<input type="checkbox"/> Moderate	
		<ul style="list-style-type: none"> o Abdominal surgery o Hemorrhoidal surgery o Dilatation and curettage o Hydrocele repair o Other orthopedic surgery 	
		<input type="checkbox"/> High	
<ul style="list-style-type: none"> o Aortic aneurysm repair o Major vascular surgery o Major cancer surgery o TURP o Most solid organ biopsies o Hip/knee replacement o Neurosurgery 		<ul style="list-style-type: none"> o Prostatectomy o Bladder surgery o Cardiac surgery o Cervical cone biopsy o Bowel polypectomy o Pacemaker insertion o Extensive dental surgery (multiple tooth extractions) 	
Thromboembolic Risk	Recommendation	3.0 Strategy	
Low	Bridging Therapy <i>Optional</i> *	<ul style="list-style-type: none"> • No change in warfarin dose (<i>minimal bleeding risk</i>), or hold warfarin 2-5 days pre-op depending on target INR range & desired INR at time of surgery (e.g. INR ≤ 1.5) • Restart usual therapeutic warfarin dose evening after surgery • Recheck INR 5 days after warfarin restarted <p>* May start subcut unfractionated heparin (UFH) or dalteparin (LMWH) at prophylactic doses 12 - 24 hours post-op if clinically indicated</p>	
Moderate	Consider Bridging Therapy	<ul style="list-style-type: none"> • Consider use of prophylactic (low dose) or full dose LMWH / UFH (once hemostasis is secured) <p>For procedures associated with a high bleeding risk, consider a prophylactic dose LMWH / UFH for first 24-48 hours post-op, then commence full dose LMWH</p>	
High	Strongly Recommend Bridging Therapy	<ul style="list-style-type: none"> • Use of full dose LMWH / UFH recommended (once hemostasis is secured) <p>For procedures associated with a high bleeding risk, consider prophylactic dose LMWH / UFH for first 24-48 hours post-op, then commence full dose LMWH / UFH</p>	
		Treatment ("Full") Dose	Prophylactic ("Low") Dose
Low Molecular Weight Heparin (LMWH)			
Dalteparin (Fragmin®) rounded to nearest syringe size: 5000, 7500, 10000, 12500, 15000, 18000 Units		200 Units/ kg subcut q24h (or 100 Units/ kg subcut q12h)	5000 Units subcut q24h
UNFRACTIONATED HEPARIN (UFH)			
5000 Unit PFS; solution 1000 Units/mL		Refer to IV Heparin nomogram: 80 Units/Kg bolus (max: 8800Units), then 18Units/Kg/hr (max: 2000 Units/hr) IV,	5000 Units subcut q12h or q8h

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Figure 1. Risk Stratification Tool.

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