Winnipeg Regional Health Authority / Office régional de la santé de Winnipeg Caring for Health / À l'écoute de notre santé **CLINICAL PRACTICE GUIDELINE**	**Practice Guideline:** *Antithrombotic Guideline for Radiology Procedures*	
	Approval Date: *July 15, 2022*	**Pages:** *1 of 8*
		Supersedes: *N/A*

PURPOSE AND INTENT

To provide a standardized framework for patient risk stratification and corresponding management of antithrombotic medication for radiology procedures.

1. BACKGROUND

The risk of hemorrhage and of thrombosis must be minimized for patients undergoing radiology procedures. It is important to identify and establish a uniform practice in the management of anticoagulation and risk of hemorrhage (i.e. patient's intrinsic risk vs risk due to medication).

This clinical practice guideline is meant to address elective and inpatient procedures. Urgent and emergent procedures often require more dynamic correction and management of hemorrhage risk. Moreover, this document does not intend to replace clinical judgment regarding anticoagulation. Guidance in this document can be modified by a clinician as necessitated by the individual patient, practice setting or available resources.

2. DEFINITIONS

2.1. Antithrombotic: Medication to prevent or reduce the formation of blood clots. This can be further divided into antiplatelet (reduction of platelet migration or aggregation), and anticoagulant (prevent or limit the coagulation of blood) medications.

2.2. Procedure risk level: Due to the lack of large randomized controlled trials or other high-level evidence, the Society of Interventional Radiology (SIR) developed guidelines based on risk categories (examples of each provided in **Appendix 1**).

- 2.2.1. Low – procedures expected to rarely have hemorrhagic complication (i.e. <1.5% risk of major bleeding) and/or are occurring in areas where bleeding is easy to diagnose and control
- 2.2.2. High risk – procedures that may have a high risk of bleeding (i.e. >1.5% risk of major bleeding) and/or are occurring in areas where bleeding is difficult to diagnose or treat, or where even minor bleeding may have devastating consequences (i.e. eye, spinal cord, brain).

2.3. Bridging anticoagulation: An approach to limit the amount of time a patient is not on an antithrombotic medication by use of another, short acting, agent prior to a procedure.

3. WORKFLOW

3.1 In all cases, communication with the clinical care team is needed. This guideline will provide a starting framework for developing individualized patient care.

3.2 The consulting radiologist will classify the procedure to be performed into a risk category which will provide a care plan regarding preprocedural screening, the use of anticoagulants prior to, and after, the procedure.

- 3.2.1 There is significant variability of risk procedure to procedure, and within each risk category. Specific assessment of bleeding risk must therefore be individualized, and it is the discretion of the performing physician to modify the risk category and/or associated care plan based upon clinical parameters.

3.3 The risk category and recommendations for preprocedural screening, patient preparation and antithrombotic management will be conveyed to the clinician. It is the responsibility of the clinical service, in consultation with radiology, to determine if altering or holding anticoagulants and antiplatelets is possible and safe. In some cases, consultation with specialists in cardiology, hematology and internal medicine may be required. Template documents for radiologist communication are attached in the appendices.

3.4 Emergency or highly urgent procedures may not afford time to adequately correct and modify risk of hemorrhage. In these cases, the risk of delay must be balanced with the risk of hemorrhage/thrombosis.

4. PREPROCEDURAL SCREENING CATEGORIES, RECOMMENDED TESTS AND TARGET VALUES

4.1 Low risk
- 4.1.1 No screening coagulation tests are routinely recommended
- 4.1.2 Thresholds
  - 4.1.2.1 International normalized ratio (INR): (correct to ≤2-3)
  - 4.1.2.2 Platelets: not routinely recommended (≤20, 000 /μL recommend transfusion)

4.2 High risk
- 4.2.1 INR: recommended
- 4.2.2 Platelets: recommended
- 4.2.3 Threshold:
  - 4.2.3.1 INR: Correct to within range of ≤1.5-1.8
  - 4.2.3.2 Platelets: ≤50, 000 /μL recommend transfusion

4.3 Special cases
- 4.3.1 Patient factors
  - 4.3.1.1 For patients with higher bleeding risk (i.e. hematologic disorders, receiving certain chemotherapies, receiving anticoagulant therapy) may require preprocedural laboratory testing, even if the procedure is low risk.
- 4.3.2 Chronic liver disease
  - 4.3.2.1 Consider measuring fibrinogen levels in all cases, with correction of levels <100 mg/dL
  - 4.3.2.2 Low risk: NA
  - 4.3.2.3 High risk
    - 4.3.2.3.1 INR: Correct to <2.5
    - 4.3.2.3.2 Platelets: ≤30, 000 /μL recommend transfusion

5. PERIPROCEDURAL MANAGEMENT OF ANTITHROMBOTIC MEDICATIONS

5.1 In some cases, procedural risk will require holding antiplatelet and anticoagulant medication. The effect of some medications can be monitored with blood work. Others can be held based on knowledge of their pharmacokinetics and the patient's renal function. These are outlined in **Appendices 2, 3** but can be addressed in detail using Thrombosis Canada's Perioperative Anticoagulant Management Algorithm.
https://thrombosiscanada.ca/tools/?calc=perioperativeAnticoagulantAlgorithm

5.2 Management of antiplatelet medications in patients with coronary stents may require delaying elective procedures. The management recommendations are summarized in **Appendix 4**.

5.3 The use of reversal agents and blood products is at the discretion of the performing physician.

5.4 The resumption of antithrombotic medications depends on the procedural risk, as outlined in **Appendices 2-4**.

6. BRIDGING ANTICOAGULATION

6.1 Bridging anticoagulation should be considered in patients at high risk of a thrombotic event, such as: prosthetic heart valve, recent venous thromboembolism, high risk atrial fibrillation, or atrial fibrillation with stroke, severe thrombophilia, recent cardiac or cerebrovascular stenting.

6.2 Bridging anticoagulation should be done in conjunction with the referring service and anticoagulation specialist.

7. REFERENCES:

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(2) Taslakian B, Georges Sebaaly M, Al-Kutoubi A. Patient Evaluation and Preparation in Vascular and Interventional Radiology: What Every Interventional Radiologist Should Know (Part 1: Patient Assessment and Laboratory Tests). (2016) Cardiovascular and interventional radiology. 39 (3): 325-33.

(3) Tracy A. Jaffe, Doug Raiff, Lisa M. Ho, and Charles Y. Kim. Management of Anticoagulant and Antiplatelet Medications in Adults Undergoing Percutaneous Interventions. (2015) American Journal of Roentgenology: 205:2, 421-428

(4) Spyropoulos AC, Al-Badri A, Sherwood MW, Douketis JD. Periprocedural management of patients receiving a vitamin K antagonist or a direct oral anticoagulant requiring an elective procedure or surgery. J Thromb Haemost. 2016;14:875-85.

(5) Thrombosis Canada, (2020) NOACs / DOACs: Perioperative Management https://thrombosiscanada.ca/wp-content/uploads/2020/05/NOACs-DOACs-Perioperative-Management-17May2020.pdf

(6) Thrombosis Canada, (2019) Unfractionated Heparin, Low Molecular Weight Heparin and Fondaparinux https://thrombosiscanada.ca/wp-content/uploads/2019/09/UFH-LMWH-Fonda-4Sep19.pdf

(7) Thrombosis Canada (2020) Perioperative Management of Antiplatelet Therapy https://thrombosiscanada.ca/wp-uploads/uploads/2021/01/36.-Perioperative-Management-of-Antiplatelet-Therapy_24June2020.pdf

8. PRIMARY AUTHOR (S)

S Dyck, MD Interventional Radiology
S Ying, MD Director of Adult CT and MRI HSC

Appendix 1: Suggested procedural risk stratification (adapted from Patel IJ, et al)
Note: These are guidelines only and are not meant for a replacement for clinical judgment or proceduralist preference

Low bleeding risk	▪ Catheter exchanges (gastrostomy biliary, nephrostomy, abscess, including gastrostomy/gastrojejunostomy conversions) ▪ Diagnostic arteriography and arterial interventions: peripheral sheath <6F*, embolotherapy ▪ Diagnostic venography and select venous interventions: pelvic and extremities ▪ Dialysis access interventions ▪ Facet joint injections and medial branch nerve blocks (thoracic and lumbar spine) ▪ IVC filter placement and removal ▪ Lumbar puncture** ▪ Nontunneled chest tube placement for pleural effusion ▪ Nontunneled venous access and removal ▪ Paracentesis ▪ Peripheral nerve blocks, joint and sacral lateral branch blocks ▪ Sacroiliac joint injections and sacral lateral branch blocks ▪ Superficial abscess drainage or biopsy (palpable lesion, lymph node, soft tissue, breast, thyroid, superficial bone, eg, extremities and bone marrow aspiration) ▪ Thoracentesis ▪ Transjugular liver biopsy ▪ Trigger point injections including piriformis ▪ Tunneled drainage catheter placement ▪ Tunneled venous catheter placement/removal (including ports)
High bleeding risk	▪ Ablations: Solid organs, bone soft tissue, lung ▪ Arterial interventions: >7F* sheath, aortic, pelvic, mesenteric, CNS ▪ Biliary interventions (including cholecystostomy tube placement) ▪ Catheter directed thrombolysis (DVT, PE, portal vein) ▪ Deep abscess drainage (eg lung parenchyma, abdominal, pelvic, retroperitoneal) ▪ Deep nonorgan biopsies (eg spine, intraabdominal, retroperitoneal, pelvic compartments) ▪ Gastrostomy/gastrojejunostomy placement ▪ IVC filter removal (complex) ▪ Portal vein interventions ▪ Solid organ biopsies ▪ Spine procedures with risk pf spinal or epidural hematoma (eg kyphoplasty, vertebroplasty, epidural injections, facet blocks cervical spine) ▪ Transjugular intrahepatic portosystemic shunt ▪ Urinary tract interventions (including nephrostomy tube placement, ureteral dilation, stone removal) ▪ Venous interventions: intrathoracic and CNS interventions

*Anticipated maximum sheath size for any given procedure, given patient and procedural factors, i.e. if it is anticipated a procedure may have to upsize from <6F to >7F, the procedure may be overall considered of high bleeding risk

**Although a low risk procedure, the consequences of hemorrhage after lumbar puncture can be devastating. Some guidelines recommend a platelet count >50, 000 /µL for this procedure.

Appendix 2: Agent specific recommendations for anticoagulant and antiplatelet agents (1)

		Interval between last dose and procedure		Resumption after procedure		
	Medication	Low bleeding risk	High bleeding risk	Low bleeding risk	High bleeding risk	Comment
Anticoagulants	UFH (IV)	None	4 h	N/A	6-8 hr	
	Heparin (sub cut)	None	6 h	N/A	6-8 hr	
	Enoxaparin	None	Withhold 1 dose if prophylactic dose is used; withhold 2 doses or 24 h before procedure if therapeutic dose is used	N/A	12h	Check anti-Xa level if renal function impaired
	Dalteparin	None	24 hours before procedure (1 dose if once daily)	N/A	12 h	
	Fondaparinux	None	48 h; 72 h if CrCl ≤50	N/A	24 h	
	Argatroban	None	2-4 h	N/A	4-6 h	
	Bivalirudin	None	4 h	N/A	4-6 h	Half-life varies from a normal 25 mins to 3.5 hours in ESRD – thus waiting for offset of effects will be longer
	Warfarin	Target INR ≤ 3	5 d; target INR ≤ 1.8	N/A; Same day for bridged patients	12-24 h	Consider bridging for high thrombosis risk cases; if STAT or emergent, use reversal agent
	DOAC	Refer to Thrombosis Canada Perioperative Anticoagulant Management Algorithm https://thrombosiscanada.ca/				
Antiplatelet: NSAID	ASA	None	3-5 d	N/A	24 h	Patients with coronary stents require special consideration
	ASA and dipyridamole	None	3-5 d	N/A	24 h	
	NSAIDs	None	No recommendation; see comment	N/A	N/A	If held, 5 half lives is recommended. E.g. naproxen 3d, meloxicam 4d
	Cilostazol	None	24 h	N/A	Immediate	
Antiplatelet: Thienopyridines	Clopidogrel	None	5 d	N/A	6 h	24 h after procedure if using a loading dose (300–600 mg)
	Prasugrel	None	7 d	N/A	24 h	
	Ticagrelor	None	5 d	N/A	24 h	
Antiplatelet: GpIIb/IIIa inhibitors	Tirofiban	Multidisciplinary discussion -	-	-	-	Recent surgery is a contraindication (within 4wks)
	Eptifibatide	Multidisciplinary discussion -	-	-	-	Recent surgery is a contraindication (within 6wks)

Note: Resumption of anticoagulation is a clinical decision primarily, requiring assessment for adequate hemostasis

Appendix 3a: Pre-procedure recommendations for perioperative DOAC use (from Thrombosis Canada
Guidelines)

DRUG (DOSE REGIMEN)	RENAL FUNCTION	MODERATE BLEED RISK SURGERY* *12-25% RESIDUAL ANTICOAGULANT EFFECT AT TIME OF SURGERY ACCEPTABLE/PROCEDURE*	MAJOR SURGERY/PROCEDURE INCLUDING NEURAXIAL PROCEDURES*† (HIGH BLEEDING RISK) <10% RESIDUAL ANTICOAGULANT EFFECT AT TIME OF SURGERY ACCEPTABLE
Dabigatran (twice daily)	Normal renal function or mild impairment (CrCl ≥50 mL/min) $t_{1/2}$ 7-17 hours	Give last dose 2 days before surgery/ procedure (i.e. skip 2 doses)	Give last dose 3 days before surgery/procedure (i.e. skip 4 doses)
	Moderate renal impairment (CrCl 30-49 mL/min) $t_{1/2}$ 17-20 hours	Give last dose 3 days before surgery/ procedure (i.e. skip 4 doses)	Give last dose 5 days before surgery/procedure (i.e. skip 8 doses)
Rivaroxaban (once daily)	Normal renal function, mild or moderate impairment (CrCl ≥30 mL/min) $t_{1/2}$ 7-11 hours	Give last dose 2 days before surgery/procedure (i.e. skip 1 dose)	Give last dose 3 days before surgery/procedure (i.e. skip 2 doses)
Apixaban (twice daily)	Normal renal function, mild or moderate impairment (CrCl ≥30 mL/min) $t_{1/2}$ 8-12 hours	Give last dose 2 days before surgery/procedure (i.e. skip 2 doses)	Give last dose 3 days before surgery/procedure (i.e. skip 4 doses)
Edoxaban (once daily)	Normal renal function or mild impairment (CrCl ≥30 mL/min) $t_{1/2}$ 10-14 hours	Give last dose 2 days before surgery/procedure (i.e. skip 1 dose)	Give last dose 3 days before surgery/procedure (i.e. skip 2 doses)

Appendix 3b: Post-procedure recommendations for perioperative DOAC use (from Thrombosis Canada Guidelines)

DRUG	MODERATE BLEEDING RISK SURGERY/PROCEDURE (MODERATE BLEEDING RISK)	MAJOR SURGERY/PROCEDURE (HIGH BLEEDING RISK)
Dabigatran	Resume on day after surgery (~24 hours post-operative)	Resume therapeutic doses 2-3 days after surgery (~48-72 hours post-operative); prophylactic dose anticoagulants can be considered in the interim
Rivaroxaban	Resume on day after surgery (~24 hours post-operative)	Resume therapeutic doses 2-3 days after surgery (~48-72 hours post-operative); prophylactic dose anticoagulants can be considered in the interim
Apixaban	Resume on day after surgery (~24 hours post-operative)	Resume therapeutic doses 2-3 days after surgery (~48-72 hours post-operative); prophylactic dose anticoagulants can be considered in the interim
Edoxaban	Resume on day after surgery (~24 hours post-operative)	Resume therapeutic doses 2-3 days after surgery (~48-72 hours post-operative); prophylactic dose anticoagulants can be considered in the interim

Appendix 4: Management of antiplatelet medications in patients with coronary stents (from Thrombosis Canada Guidelines)

	Timing of Non-cardiac Surgery	**Perioperative Antiplatelet Management**
PCI Patients with a Bare Metal Stent	Recommended to delay surgery for at least 1 month after PCI	ASA should be continued perioperatively. Clopidogrel and ticagrelor should be withheld 5-7 days preoperatively, and prasugrel 7-10 days preoperatively
		P2Y12 inhibitor should be restarted as soon as it is deemed safe by the surgeon
PCI Patients with a Drug Eluting Stent*	Recommended to delay surgery for at least 3 months after PCI. If semi-urgent surgery is required, surgery should be delayed at least 1 month after PCI with a DES.	ASA should be continued perioperatively. Clopidogrel and ticagrelor should be withheld 5-7 days preoperatively, and prasugrel 7-10 days preoperatively
		P2Y12 inhibitor should be restarted as soon as it is deemed safe by the surgeon

*The risk of stent thrombosis could still be significantly increased in certain patient subsets e.g. multiple stents, bifurcation stenting, long small diameter stents, left main stenting. Discussion with Interventional Cardiology is strongly recommended.