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Oral Anticoagulants: Elective Interruption & Emergency Reversal

DRAFT FOR EXTERNAL REVIEW

SURVEY LINK : https://surveymoh.health.gov.bc.ca/public/survey/bc-guidelines-external-review-oral-anticoagulant-drug-guidelines-3?destination=/home

Effective Date: TBD

Scope

This guideline provides recommendations for the management of oral anticoagulants in patients aged ≥ 19 years requiring elective or urgent procedures (including surgery) and in patients who are actively bleeding and require emergency reversal.

Key Recommendations

- Periprocedural management of oral anticoagulant therapy requires a fine balance between the risk of bleeding if a procedure is performed while on anticoagulation and the risk of thrombosis if anticoagulation is interrupted.
- Whenever possible, procedures in a chronically anticoagulated patient should be undertaken on an elective basis to allow for planned periprocedural anticoagulation.
- If uncertain, discuss appropriate periprocedural management with the practitioner performing the procedure.
- Temporary interruption of an oral anticoagulant **is not** indicated for procedures with minimal risk of bleeding.
- Temporary interruption of an oral anticoagulant **is** indicated for procedures with low/moderate/high risk of bleeding.
    - Warfarin should be withheld 5-6 days prior to these procedures.
        - Bridging with a fast-acting anticoagulant (e.g., low molecular weight heparin [LMWH]) during the periprocedural period may be indicated for patients on warfarin with a high risk of thrombosis when their international normalized ratio (INR) is subtherapeutic.
    - Direct oral anticoagulants (DOACs) should be withheld for 2-5 days prior to these procedures.
        - Bridging is not indicated for the periprocedural management of DOACs.
- Rapid reversal of anticoagulants is indicated for life-threatening bleeding or patients who require an urgent/emergent procedure.
    - Warfarin is most effectively reversed with prothrombin complex concentrate (PCC).
    - Dabigatran can be rapidly reserved with Idarucizumab.

    - Factor Xa (FXa) inhibitors (apixaban, edoxaban, and rivaroxaban) can be revered with Andexanet alfa but it is not yet available in Canada.
    - Plasma derived prothrombin complex (PCC) has been used off-label for rapid reversal of DOACs for life-threatening bleeding. This use is based on very weak evidence.
- In patients undergoing major joint replacement or other procedures where prophylactic doses of DOAC is used post-operatively, the therapeutic dose of a DOAC for non-valvular atrial fibrillation (NVAF) or venous thromboembolism (VTE) should be reintroduced when the surgeon clears the patient for full dose DOAC.

Therapeutic Considerations

Periprocedural management of oral anticoagulant therapy requires a fine balance between the risk of hemorrhage if the procedure is performed while on anticoagulation, and the risk of thrombosis if anticoagulation is discontinued. Risk of hemorrhage is influenced by patient age, relevant medical conditions, type of procedure, approach, site, type of incision and closure, and post-operative anesthesia (e.g., epidural). The risk of thrombosis depends on pre-existing conditions, time since the last episode of thrombosis, and the thrombotic effect of the procedure. There are no validated risk scores to accurately predict or measure the net outcome and periprocedural anticoagulation recommendations are largely based on protocols evaluated in clinical trials, clinical experience, and expert consensus.[1]

Whenever possible, procedures in a chronically anticoagulated patient should be undertaken on an elective basis to allow for planned anticoagulant reversal. Consider delaying elective procedures for patients with a recent thromboembolic event (e.g., within previous 3 months).

Rapid reversal of an anticoagulant is necessary for patients presenting with life-threatening bleeding or those requiring an urgent/emergent procedure. Specific reversal agents are available to expedite normal hemostasis.

Procedural Bleeding Risk

The risk of bleeding with a particular procedure is based on the nature of the procedure itself and the urgency at which it must be performed.[2] Patient comorbidities and medications also influence their risk of bleeding during a particular procedure.[2] Thrombosis Canada categorizes procedural bleeding risks as minimal, low/moderate, or high.[1] However, recommended bleed risk categories do not replace one's clinical judgement and the importance of consultation with the practitioner performing the procedure, if unsure. Refer to Table 1: Procedure bleeding risks and Appendix A: When to Withhold Antiplatelet and Anticoagulants for Medical Imaging Procedures for more information on bleeding risks for specific procedures.

Table 1. Procedure bleeding risks (adapted from Thrombosis Canada, 2021).[1]

Procedure Bleed Risk		
Minimal	**Low/Moderate**	**High**
• Cataract surgery • Dermatologic procedures (e.g., biopsy)	• Gastroscopy or colonoscopy *with or without* biopsy • Non-cancer abdominal	• Select procedures involving vascular organs (e.g., kidney, liver or prostate biopsy)

• Dental extractions (i.e., 1 or 2 teeth) • Endodontic procedure (i.e., root canal) • Subgingival scaling or other cleaning • Permanent pacemaker insertion or internal defibrillator placement (if bridging anticoagulation is not being used) • Coronary angiography (using radial arterial approach) • Selected procedures with small-bore needs (e.g., thoracentesis, paracentesis, arthrocentesis)	surgery (e.g., cholecystectomy, hernia repair, colon resection) • Non-cancer gynecological surgery[3] • Other general surgery (e.g., breast) • Complex dental procedure (e.g., multiple tooth extractions) • Other intrathoracic surgery • Other orthopedic surgery • Other vascular surgery • Other ophthalmologic surgery • Coronary angiography (using femoral artery approach) • Selected procedures with large-bore needles (e.g., bone marrow biopsy, lymph node biopsy)	• High bleed risk interventions (e.g., pericardiocentesis, spinal injection, polypectomy, endoscopic retrograde cholangiopancreatography) • Any surgery or procedure with neuraxial anesthesia (i.e., spinal or epidural) • Neurosurgery (i.e., intracranial or spinal) • Cardiac surgery (e.g., coronary artery bypass grafting, heart valve replacement) • Extensive cancer surgery (e.g., gynecological,[3] pancreas, debulking) • Major vascular surgery (e.g., aortic aneurysm repair, aortofemoral bypass) • Major orthopedic surgery (e.g., hip/knee joint replacement) • Lung or other organ resection/transplantation • Urological surgery (e.g., prostatectomy, bladder tumour resection) • Intestinal anastomosis • Orbital surgery • Reconstructive plastic surgery

Periprocedural Management for Warfarin

1. **Assess the risk of bleeding to determine target INR**
   - Refer to Table 1: Procedure bleeding risks and Appendix A: When to Withhold Antiplatelet and Anticoagulants for Medical Imaging Procedures for more information on bleeding risks for specific procedures.
   - Warfarin interruption is not required for procedures with minimal risk of bleeding.
   - An INR $\leq$ 1.5 is generally acceptable for procedures with low/moderate risk of bleeding.
   - An INR of $\leq$ 1.2 is generally acceptable for procedures with high risk of bleeding that might be life-threatening or cause permanent disability.
   - Discuss target INR with the practitioner performing the procedure if uncertain or if the INR is borderline.
2. **Assess the risk of thrombosis to determine if bridging is required**
   - Temporary interruption of warfarin results in a period of subtherapeutic anticoagulation in the periprocedural period. This can be dangerous for patients at high risk of thrombosis.

- Bridging with a fast-acting anticoagulant (e.g., LMWH) can provide temporary anticoagulation when warfarin is interrupted. However, while bridging may be indicated for patients at very high risk of thrombosis, evidence to support a net benefit for all patients is lacking.[4–6]
- Bridging should be considered for the following conditions due to their high risk of thrombosis:
    - Mechanical mitral valve and old model aortic prosthesis (e.g., ball, Bjork-Shiley, Lillehei-Kaster);
    - Atrial fibrillation plus history of ischemic/embolic stroke/TIA;
    - Atrial fibrillation with $CHADS_2$ score of 5 or 6 (Congestive heart failure, Hypertension, Age, Diabetes, previous Stroke/transient ischemic attack);
    - Venous thromboembolism (e.g., deep vein thrombosis, pulmonary embolism) occurring within past 3 months; and,
    - Triple positive anti-phospholipid syndrome (i.e., positive for lupus anticoagulant, anticardiolipin, and anti-β2-glycoprotein I antibodies).[7]

3. Determine the timing of drug interruption

- Refer to Table 1: Procedure bleeding risks and Appendix A: When to Withhold Antiplatelet and Anticoagulants for Medical Imaging Procedures for more information on bleeding risks for specific procedures.
- Warfarin must be discontinued for several days to allow normalization of the anticoagulant effect. INR normalization may take longer in older patients and those treated at a higher target INR (i.e., INR 2.5-3.5).
- INR should be checked to confirm anticoagulation effect prior to the procedure.
- In patients with epidural catheters:
    - Do not start warfarin until epidural catheter is removed.
    - Prophylactic dosing of LMWH is okay with an epidural in place.
    - Do not give a therapeutic level dosing of LMWH with an epidural catheter in place.
    - Epidural catheter should not be removed within 12 hours after a dose of LMWH.
    - Do not give LMWH until after 2 hours of epidural catheter removal.
    - Always discuss timing of epidural removal with anesthesiologist.
- Refer to Figure 1: Periprocedural warfarin management without bridging for warfarin interruption in patients for whom bridging **is not indicated**.
- Refer to Figure 2: Periprocedural warfarin management with bridging. for warfarin interruption in patients for whom bridging **is indicated**.

Figure 1. Periprocedural warfarin management *without* bridging.

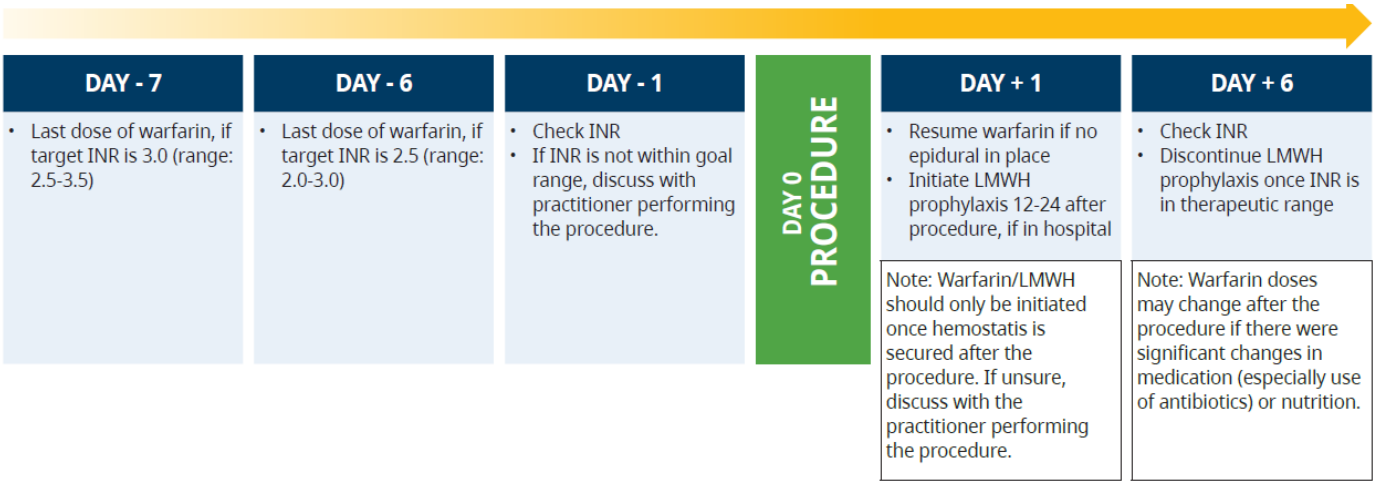
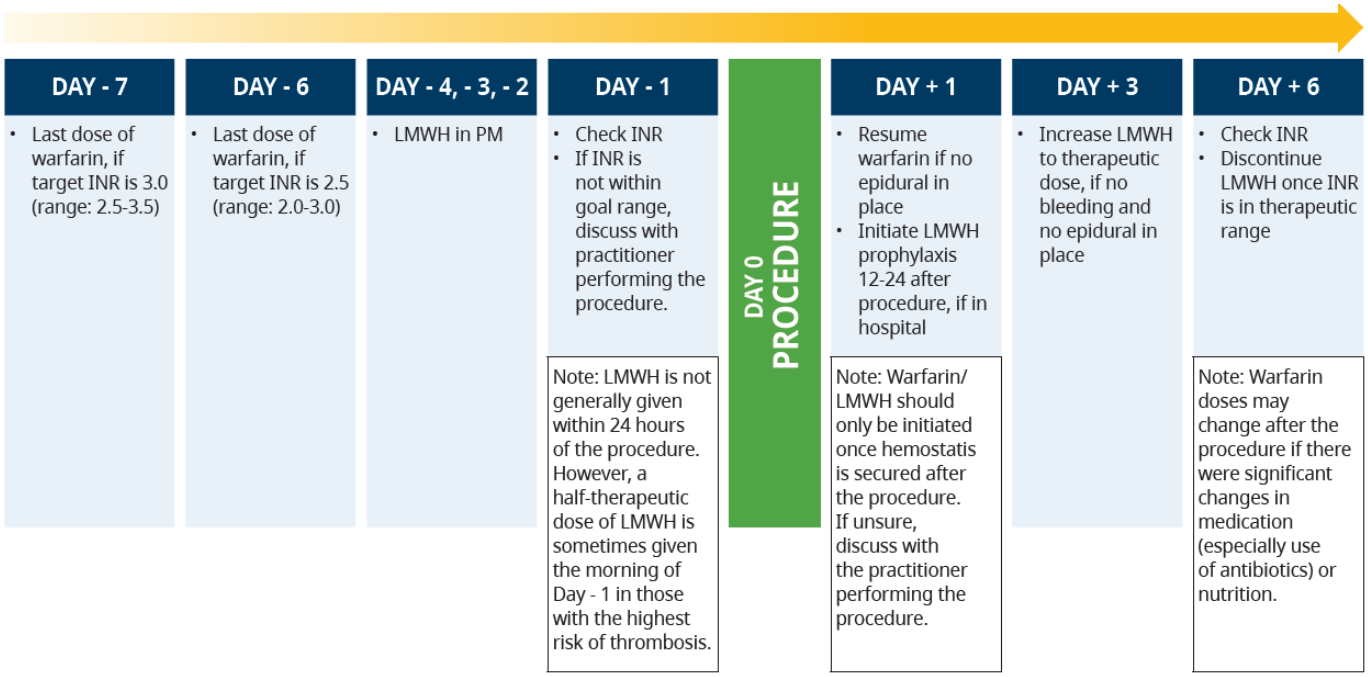


Figure 2. Periprocedural warfarin management *with* bridging.



Periprocedural Management for DOACs

Protocols for periprocedural DOAC management have been evaluated in clinical trials and are well described in consensus recommendations and manufacturer instructions. Timing of the last dose of a DOAC depends on: the bleeding risk associated with the procedure, patient renal function, and the drug half-life.[1]

1. **Assess the risk of bleeding**
   - .
   - Discontinuation of DOAC is not necessary for procedures with a minimal risk of bleeding.
   - Bridging with a fast-acting anticoagulant (e.g., LMWH) is not required for DOACs due to their rapid onset and offset of action.[1,2]

2. **Assess patient renal function**
   - Use the Cockcroft-Gault equation to calculate creatinine clearance (CrCl).
   - Do not use the estimated glomerular filtration rate (eGFR) provided by laboratory reports to estimate the CrCl because it does not account for age or body weight and will give an over-estimation of renal function in those at highest risk of bleeding.
3. **Determine the timing of drug interruption**
   - Unlike INR for warfarin, there is no reliable laboratory test to measure the anticoagulant effect of DOACs.
   - Refer to Table 2: Periprocedural DOAC Management for interruption protocols based on drug pharmacokinetics, procedural bleed risk and renal function. Consult with the practitioner performing the procedure if individual protocol modifications are being considered.
   - Timing of the last dose of DOAC is unclear for patients with severe renal dysfunction (CrCl < 30mL/min).[1] Because clearance of the DOAC will be delayed in these patients, a longer duration off DOAC than what is recommended in Table 2: Periprocedural DOAC Management is necessary. Consult a specialist to determine when to stop DOAC prior to procedure (e.g., RACE consult line).
   - For patients having neuraxial anesthesia or postoperative analgesia (i.e., epidural), some anesthesiologists prefer a longer duration of DOAC interruption than recommended below. Discuss further with an anesthesiologist.

Table 2. Periprocedural DOAC Management (adapted from Thrombosis Canada, 2021)[1]

DOAC	Renal Function, CrCl (mL/min)	Procedure Bleed Risk		
		Minimal	Low/Moderate	High
Apixaban	≥ 30	Regular dosing	Last Dose Day - 2	Last Dose Day - 3
Dabigatran	≥ 50	Regular dosing	Last Dose Day - 2	Last Dose Day - 3
	30-49	Regular dosing	Last Dose Day - 3	Last Dose Day - 5
Edoxaban	≥ 30	Regular dosing	Last Dose Day - 2	Last Dose Day - 3
Rivaroxaban	≥ 30	Regular dosing	Last Dose Day - 2	Last Dose Day - 3

Abbreviations: CrCl = creatinine clearance; hr = hour(s); mL/min = milliliter per minute; DOAC = direct acting oral anticoagulants. **Footnote:** Day 0 = day of procedure.

- Full dose DOACs should not be restarted within 24-48 hours[1] of the procedure because therapeutic levels are reached within 3-4 hours of the first dose. Timing of the first post-procedure dose may be discussed with the practitioner performing the procedure.
- In patients who require VTE prophylaxis while in hospital, LMWH prophylaxis may be given within the first 24-48 hours after the procedure and prior to restarting a DOAC at full dose.[1]
- In patients undergoing major joint replacement or other surgery where prophylactic doses of DOAC is used post-operatively, the therapeutic dose of a DOAC for NVAF or VTE should be re-introduced when the surgeon clears the patient for full dose DOAC.

Management – Rapid Reversal for Bleeding or Urgent Procedures

Bleeding is a common adverse event of all anticoagulant drugs.[8,9] Consequently, complete and rapid reversal of an oral anticoagulant is sometimes necessary when a patient presents with serious bleeding or requires an urgent or emergent procedure (e.g., after major trauma).

Plasma-derived prothrombin complex concentrate (PCC) is the most effective agent for rapid reversal of warfarin.[10] Effects are realized within minutes and last up to 6 hours. Vitamin K **must** also be used to provide sustained reversal because the effects of PCC and plasma only last for a few hours.[10] If PCC is unavailable, frozen plasma can be used.

DOACS do not often require reversal agents because their anticoagulant effect is quickly eliminated by withholding doses due to the drug's short half-life.[11] However, rapid reversal may be indicated for life-threatening bleeding situations or when an urgent procedure is required.[11] Currently, only dabigatran has an approved reversal agent available (i.e., idarucizumb). Andexanet alfa is effective for rapid reversal of apixaban, edoxaban, and rivaroxaban, **but is not yet available in Canada**. PCC has been used off-label for the rapid reversal of DOACs, though this is based on low quality evidence.

Individual reversal agents for warfarin and DOACs are outlined below. Selection of the appropriate reversal agent is determined by the clinical situation.

Therapeutic Agents for Warfarin Reversal

Refer to Appendix B: Warfarin Reversal Flow Chart for information on how to rapidly reverse warfarin with vitamin K and PCC.

Vitamin K

- Intravenous (IV) delivery is the fastest and most reliable way to obtain the anticoagulation reversal effect of vitamin K. Avoid intramuscular and subcutaneous administration.
- If the procedure is >24 hours away, there is no difference between using IV and oral.
- The effect of vitamin K on INR is observed after 8-12 hours, depending on the route of administration.
- An excessive dose of vitamin K (i.e., > 2 mg) can lead to difficulty with re-anticoagulation.
- Rarely, patients will experience anaphylactoid reactions with IV vitamin K, which can be mitigated by giving a slow infusion.
- Recommended dosing for full reversal (urgent scenario): 5-10 mg in 50 mL normal saline infused over 30 minutes.
- Recommended dosing for partial reversal (supratherapeutic INR): 1-2 mg orally

Plasma-Derived Prothrombin Complex Concentrate (PCC)

- PCC is the product of choice for rapid reversal of warfarin and is indicated for immediate INR reversal in patients with active, serious bleeding, and/or who require urgent, unplanned procedures within 6 hours.[10]
- PCC contains factors II, VII, IX, X, Protein C and Protein S.[10]
- PCC has a short duration of action of approximately 6 hours so must be used in conjunction with IV vitamin K (10 mg).
- PCC contains heparin and is contraindicated in patients with heparin-induced thrombocytopenia, liver coagulopathy and disseminated intravascular coagulation.
- PCC use may be associated with clinically important thrombosis.
- Caution should be observed if PCC is administered to a pregnant patient as there is a lack of published evidence for PCC use in this population.[10] This is especially true during the

peripartum and early postpartum periods due to the elevated risk of thrombosis during this time.[10]

- Available at most hospitals and can be ordered through the blood bank.
- The following dosing is recommended:[12]

	INR 1.6 to 1.9	INR 2.0 to 2.9	INR 3.0 to 5.0	INR > 5.0
Weight < 100 kg	500 Units	1000 Units	2000 Units	3000 Units (max)
Weight ≥ 100 kg	1000 Units	1500 Units	2500 Units	3000 Units (max)

Footnote: To accommodate vial size, the dose should be rounded to the nearest 500 units.
Source: Vancouver Coastal Prescriber Order.[12]

- Additional prescriber considerations:[12]
    - Maintain platelet count > 50 X 10^9/L (consider > 100 X 10^9/L for intracranial hemorrhage)
    - Consider platelet transfusion if patient on antiplatelet therapy (excluding ASA)
    - Consider tranexamic acid
    - Recommend fibrinogen replacement if fibrinogen < 1.5 g/L

Frozen Plasma (FP)

- FP is only indicated for rapid reversal of warfarin when PCC is not available.
- FP has a short duration of action of approximately 6 hours so should be used in conjunction with IV vitamin K (10 mg).
- The risk of infectious agent transmission is minimal but still present.
- A much larger volume is required than with PCC.
- Recommended dosing is 3-4 units (10-15 mL/kg).

Therapeutic Agents for DOAC Reversal

Idarucizumab (for dabigatran only)

- Idarucizumab is a monoclonal antibody that completely reverses the anticoagulant effect of dabigatran within minutes. The duration of action is 24 hours in most patients.[13]
- Caution should be observed for patients with hereditary fructose intolerance as the drug contains 4 g sorbitol per dose.[13]
- Adverse reactions: urinary tract infection, constipation, hypersensitivity reactions (e.g., bronchospasm, rash, pyrexia, pruritis).[13]
- Recommended dosing is 5 g IV bolus (administered as two consecutive 2.5 g doses no more than 15 minutes apart).[14]

Andexanet alfa (for apixaban, edoxaban and rivaroxaban)

- A reversal agent for direct FXa inhibitors (i.e., apixaban, edoxaban, and rivaroxaban) that is not yet commercially available in Canada.

Plasma-Derived Prothrombin Complex Concentrate (PCC)

- Has been used off-label for rapid reversal of DOACs for life-threatening bleeding, based on very weak evidence. No randomized trials have been published on the use of PCC as a rapid reversal agent for direct FXa inhibitors (i.e., apixaban, edoxaban, and rivaroxaban).[10]

- PCC contains factors II, VII, IX, X, Protein C and Protein S.
- The duration of action for PCC with DOAC reversal is unclear. Concurrent administration of IV vitamin K is therefore not required, unlike for warfarin reversal with PCC.
- Contains heparin and is contraindicated in patients with heparin-induced thrombocytopenia, liver coagulopathy and disseminated intravascular coagulation.
- May be associated with clinically important thrombosis.
- Available at most hospitals, though generally requires hemopathy and/or clinical path approval. Automatic approval for DOAC reversal for intracranial bleed and/or critical bleed may be available, depending on health authority.
- Off-label recommended one time dose for patients with intracranial bleeding: 2000 Units (weight-based dosage: 25 units per kg – max 3000 units).

Resources

References

1. *DOACs: Perioperative Management*. Thrombosis Canada; 2021. https://thrombosiscanada.ca/clinicalguides/
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12. Prescriber Order: Prothrombin Complex Concentrate (PCC). Published online 2021.
13. Product Monograph Including Patient Medication Information Praxbind®. Published online April 18, 2019.
14. *DOACs: Management of Bleeding*. Thrombosis Canada; 2021. https://thrombosiscanada.ca/clinicalguides/

Resources

- Thrombosis Canada
- Thrombosis Canada periprocedural algorithm tool
- HealthLink BC
- BC Guidelines: Warfarin
- BC Guidelines: Direct Acting Oral Anticoagulants
- BC Guidelines: Stroke and Transient Ischemic Attack
- BC Guidelines: Atrial Fibrillation
- BC Guidelines: Venous Thromboembolism [link when published]

- Rapid Access to Consultative Expertise (RACE) Program: A phone consultation line for physicians, nurse practitioners and medical residents. **If the relevant specialty area is available through your local RACE line, please contact them first**. Contact your local RACE line for the list of available specialty areas. If your local RACE line does not cover the relevant specialty service or there is no local RACE line in your area, or to access Provincial Services, please contact the Vancouver/Providence RACE line. Tip: Download the RACEapp+ to your device from the Apple or Android stores. Many specialty areas are only available for consult through the RACEapp+.
    - Vancouver Coastal Health Region/Providence Health Care RACE: 604-696-2131 (local) or 1-877-696-2131 (toll free). Available Monday to Friday, 8 am to 5 pm, excluding statutory holidays.
    - Northern RACE: 1-855-605-7223
    - Interior RACE: 1-844-365-7223
- PathwaysBC: An online resource that allows GPs and nurse practitioners and their office staff to quickly access current and accurate referral information, including wait times and areas of expertise, for specialists and specialty clinics.
- Health Data Coalition: An online, physician-led data sharing platform that can assist you in assessing your own practice in areas such as chronic disease management or medication prescribing. HDC data can graphically represent patients in your practice with chronic diseases in a clear and simple fashion, allowing for reflection on practice and tracking improvements over time.
- General Practice Services Committee:
    - Practice Support Program: offers focused, accredited training sessions for BC physicians to help improve practice efficiency and support enhanced patient care.
    - Chronic Disease Management and Complex Care Incentives: compensates GPs for the time and skill needed to work with patients with complex conditions or specific chronic diseases.
- Public Health Agency of Canada: Provides resources to help patients make wise choices about healthy living, including increasing physical activity and eating well. Visit: Food and nutrition - Canada.ca
- US Centre for Disease Control
- British Columbia Centre of Disease Control (BCCDC)
- BC Women's Hospital

Appendices

- Appendix A: When to withhold antiplatelet and anticoagulants for medical imaging procedures
- Appendix B: Flowchart for warfarin reversal with vitamin K and/or PCC

Associated Documents

The following documents accompany this guideline:

- Patient Record Sheet: Warfarin Before & After Surgery
- Patient Record Sheet: Warfarin

This guideline is based on scientific evidence current as of the Effective Date.

~~This guideline was developed by the Guidelines and Protocols Advisory Committee, approved by the British Columbia Medical Association, and adopted by the Medical Services Commission~~. [Note: Will remove strikethrough once approved by the MSC]

THE GUIDELINES AND PROTOCOLS ADVISORY COMMITTEE

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

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Disclaimer

The Clinical Practice Guidelines (the guidelines) have been developed by the guidelines and Protocols Advisory Committee on behalf of the Medical Services Commission. The guidelines are intended to give an understanding of a clinical problem, and outline one or more preferred approaches to the investigation and management of the problem. The guidelines are not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of clinical problem. **We cannot respond to patients or patient advocates requesting advice on issues related to medical conditions. If you need medical advice, please contact a health care professional.**

Appendix A: When to Withhold Antiplatelet and Anticoagulants for Medical Imaging Procedures

The following management guidelines are presented with permission from the Interventional Radiology Practice Lead, Vancouver Coastal Health Authority. BC Guidelines does not warrant that this version represents the most current information from the contributing organizations. Individual providers may observe more conservative practices than what is outlined in these guidelines.

Management Guidelines for * NON-URGENT * Invasive Procedures in Medical Imaging

HIGH RISK | **LOW RISK**

****CAUTION****
Patient at risk for THROMBOTIC EVENTS may require consultation for bridging anticoagulation therapy (eg. PROSTHETIC HEART VALVES, VENOUS THROMBOEMBOLISM, ATRIAL FIBRILLATION WITH PRIOR STROKE)
Premature discontinuation of anti-platelet drugs in patients with CORONARY STENTS may precipitate acute stent thrombosis
Do not stop anticoagulation in these patients without consultation

HIGH RISK PROCEDURES

HIGH RISK INR ≤ 1.8 or ≤ 2.5 with chronic liver disease Target INR for warfarin reversal: ≤ 1.5 Platelets > 50 x 10^9/L Testing within 2 weeks for outpatient	Anticoagulant / Antiplatelet MEDS	Discontinue Yes*/ No	Suggested Timing of LAST dose BEFORE procedure*	Timing of FIRST dose AFTER day of procedure*
VASCULAR ▪ TIPS ▪ Catheter-directed thrombolysis ▪ Arterial interventions >6Fr access	▪ aspirin (ASA), low dose (81 mg)	Yes	- 5 days	Day + 1
	▪ clopidogrel (Plavix®) ▪ aspirin, non-low dose ▪ ticagrelor (Brilinta®)	Yes	- 5 days†	Day + 1 or + 2
	▪ prasurgrel (Effient®)	Yes	- 7 days†	Day + 1 or + 2
	▪ NSAIDs	Yes	NA	NA
NON-VASCULAR **Abdominal Procedures** ▪ Solid organ, lung and deep tissue biopsies ▪ Prostate biopsy ▪ Deep abscess drainage ▪ PCNL/Nephrostomy ▪ G and GJ-tube placement ▪ Biliary drainage (PTBD) ▪ Thermal ablations – liver, kidney, lung, MSK	▪ warfarin (Coumadin®)	Yes	- 5 days, CHECK INR, TARGET ≤ 1.5 *consider bridging in high thrombosis risk cases	Day + 1
	▪ subcutaneous heparin (prophylactic)	Yes	- 8 hrs prior	Day 0 (evening)
	▪ low molecular weight heparin (LMWH)	Yes	prophylactic: > 12 hrs prior therapeutic: > 24 hrs prior	Day 0 (evening)
	▪ (IV) unfractionated heparin	Yes	infusion to stop 4 hrs prior	8 hrs after
High Risk Spine & Neurological Procedures ▪ Vertebroplasty ▪ Kyphoplasty ▪ Cervical spine facet blocks ▪ Epidural injection (lumbar/thoracic/cervical)	▪ dabigatran (Pradaxa®)	Yes	GFR >50: - 3 days GFR ≤50: - 5 days	Day + 2 or + 3
	▪ rivaroxaban (Xarelto®) ▪ apixaban (Eliquis®) ▪ edoxaban (Lixiana®)	Yes	Withhold 2 doses if CrCl ≥ 50 mL/min Withhold 3 doses if CrCl < 50 mL/min	Day + 2 or + 3
NOTE: Specialized Neurovascular Procedures are excluded, including carotid stenting, and intra-cranial embolization	▪ fondaparinux (Arixtra®)	Yes	-3 days for CrCl ≥ 50 mL/min -5 days for CrCl < 50 mL/min	Day + 1 Day + 2 or + 3

*Ordering Physician must give instructions to patient; † Consider minimum of 7 days if concomitant ASA

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Management Guidelines for * N O N - U R G E N T * Invasive Procedures in Medical Imaging

LOW RISK PROCEDURES				
LOW RISK No routine pre-procedural INR/CBC unless bleeding diathesis suspected; then consider INR ≤ 3.0 and Platelets > 20 x 10^9/L. For chronic liver disease, INR is not required.	**Anticoagulant / Antiplatelet MEDS**	**Discontinue Yes*/ No**	**Suggested Timing of LAST dose BEFORE procedure if discontinuing**	**Timing of FIRST dose AFTER day of procedure***
VASCULAR ▪ Dialysis access and venous interventions including varicocele embolization, venography ▪ IVC filter placement/removal ▪ PICC insertion ▪ Uncomplicated catheter/line exchange/removal ▪ Angiography/arterial intervention up to 6 Fr access (eg. UAE) ▪ Transjugular liver biopsy ▪ Tunneled CVC/Port/Hickman **NON-VASCULAR** ▪ Catheter exchange or removal (GU, biliary, abscess) ▪ Superficial abscess drainage ▪ Core biopsy – breast, extremity or other superficial location ▪ Joint injection or aspiration, including facet joint, nerve root /medial branch, and caudal epidural injections/blocks ▪ GI tract stenting (colon, esophagus) ▪ Hysterosalpingography, Fallopian Tube Recanalization ▪ Non-tunneled chest tube ▪ Lumbar puncture **Exception:** Thoracentesis or paracentesis can be carried out with any platelet count or INR **Superficial Aspiration / Biopsy (FNAB)** **Breast, Extremities, Lymph nodes, Thyroid** NOTE: Most LOW risk procedures do not require the discontinuation of anticoagulation/antiplatelet therapy.	▪ aspirin (ASA), any dose	No		
	▪ clopidogrel (Plavix®) ▪ ticagrelor (Brilinta®)	Possible to continue	Do not withhold	
	▪ prasurgrel (Effient®)	Possible to continue	Do not withhold	
	▪ warfarin (Coumadin®)	Possible to continue	- 5 days, TARGET INR ≤ 3.0, *consider bridging in high thrombosis risk cases	Day 0 (evening)
	▪ subcutaneous heparin ▪ low molecular weight heparin (LMWH) – prophylactic	No		
	▪ low molecular weight heparin (LMWH) – therapeutic	Possible to continue	Do not withhold	
	▪ (IV) unfractionated heparin	Possible to continue	Do not withhold	
	▪ dabigatran (Pradaxa®)	Possible to continue	Do not withhold	
	▪ rivaroxaban (Xarelto®) ▪ apixaban (Eliquis®) ▪ edoxaban (Lixiana®)	Possible to continue	Do not withhold	
	▪ fondaparinux (Arixtra®)	Possible to continue	Do not withhold	

*Ordering Physician must give instructions to patient; † Consider minimum of 7 days if concomitant ASA

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Booking Clerk Script:

- "You are booked for a: _____ procedure in Medical Imaging.
  If you are on any blood thinner medication, you must ask your Ordering Physician for instructions on discontinuing and resuming your medications".
- We ask that you contact your doctor for more details on this, as we have faxed this info to them.
- If you don't discuss this with your doctor, your procedure may be cancelled.

Please Note:

- Patients on anti-inflammatory medications (NSAIDs) such as the following: (Advil® [ibuprofen], Voltaren®, Celebrex®) may **continue** taking them, except for HIGH RISK procedures.
- Please inform your Ordering Physician if you are taking supplements as these may affect blood test results.

References

1. SIR Journal of Vascular Radiology 2019; 30:P1168-1184.E1 – Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions—Part II: Recommendations. Retrieved from https://www.jvir.org/article/S1051-0443(19)30407-5/fulltext
2. Canadian Journal of Cardiology 2011; 27:S1-S59 – The Use of Antiplatelet Therapy in the Outpatient Setting: Canadian Cardiovascular Society Guidelines. Retrieved from https://www.onlinecjc.ca/article/S0828-282X(17)31221-7/fulltext
3. Department of Hematology, VCHA, 27 Jan 2015 – Recommendations for the Interruption of Anticoagulation or Anti-platelet Therapy for Elective Invasive Procedures or Surgery. Retrieved from http://shop.healthcarebc.ca/MedicalImaging/ABCD-21-07-90001.pdf

External links to online version
VCH, PHC & VCH SHOP: http://shop.healthcarebc.ca/MedicalImaging/ABCD-21-07-90001.pdf
This above link is used to access the guidelines on the external websites for FH & VCH.

Intranet links to online version
VCH, PHC & VCH SHOP: http://shop.healthcarebc.ca/MedicalImaging/ABCD-21-07-90001.pdf
FH Pulse: https://pulse/clinical/medical-imaging/Pages/Medical-imaging-nuclear-medicine-regional-guidelines.aspx

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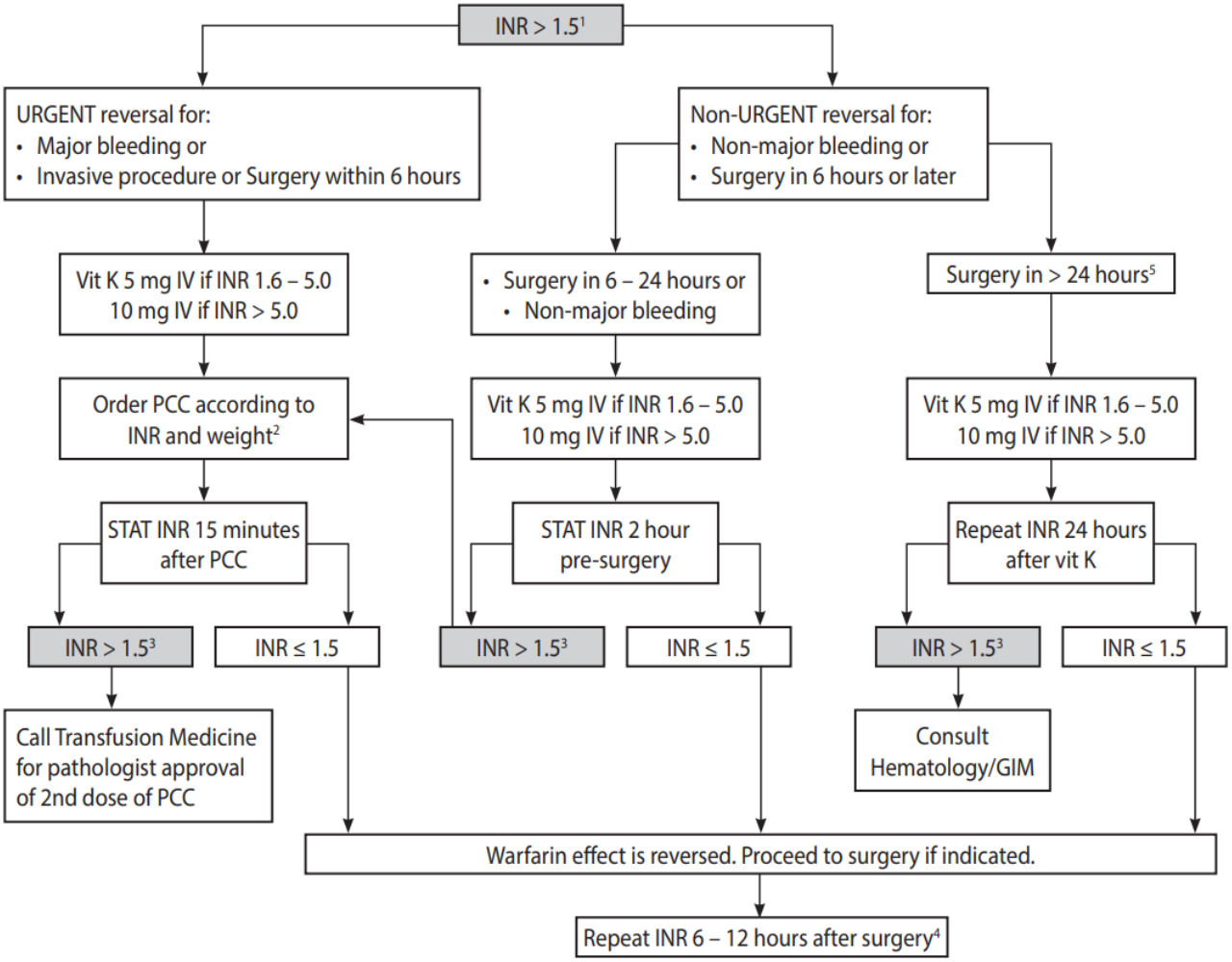
Appendix B: Warfarin Reversal Flow Chart



Abbreviations: GIM =General Internal Medicine; INR = International Normalized Ratio; IV = Intravenous; LMWH = low molecular weight heparin; PCC = prothrombin complex concentrate; VTE = Venous thromboembolism; vit = vitamin.

Footnotes:

1) This algorithm is recommended for Warfarin reversal only and should not be used for reversal of other anticoagulants.

2) Do not give frozen plasma in addition to PCC. If indicated, transfuse red cells (for severe anemia) or platelets (e.g., platelet count < 50 x 10^9 /L or patient on antiplatelet therapy).

3) If INR is still greater than 1.5 after one dose of vitamin K or one dose of PCC, contact Transfusion Medicine and/or consult Hematology for further assistance.

4) Half-life of PCC is approximately 6 hours therefore, should reassess the need for repeat PCC infusion (e.g., if surgery is ongoing, INR > 1.5 and patient is still bleeding) at 6 – 12 hr after surgery or PCC infusion.

5) In patients with high or very high risk of stroke (e.g., atrial fibrillation with CHADS2 score 5 or 6, previous stroke, mechanical heart valve), thrombosis (e.g., VTE within past 3 months, cancer-associated thrombosis, antiphospholipid antibody syndrome), consider need for bridging therapy with LMWH if surgery is expected to occur later than 24 hours after INR reversal.

Patient Record Sheet: Warfarin Before and After Surgery

Patient Name: _____ Patient Weight: _____Kg

Surgeon Name: _____ Warfarin dose: _____Mg

Type of Procedure: _____ Low molecular weight heparin (LMWH) _____

Date	Number of days before/after procedure	Please take your warfarin and LMWH injection as instructed below:	Testing
	-7	**[STOP]** aspirin, clopidogrel (Plavix®), prasugrel (Effient®) and ticagrelor (Brilinta®), if asked by your surgeon	
	- 6	LAST DOSE OF WARFARIN BEFORE SURGERY	
	- 5	**No warfarin**	
	- 4	LMWH _____ units in evening. **No warfarin.**	
	- 3	LMWH _____ units in evening. **No warfarin.**	
	- 2	LMWH _____ units in evening. **No warfarin.**	
	- 1	No LMWH. **No warfarin.**	INR
	Procedure (Day 0)	Warfarin _____ mg at bedtime if you have no bleeding or start the next evening.	
	+ 1	LMWH _____ units AND Warfarin ____ mg in evening	
	+ 2	LMWH _____ units AND Warfarin ____ mg in evening	
	+ 3	LMWH _____ units AND Warfarin ____ mg in evening	
	+ 4	LMWH _____ units AND Warfarin ____ mg in evening	
	+ 5	LMWH _____ units AND Warfarin ____ mg in evening	
	+ 6	Continue warfarin and LMWH (if needed), as instructed by your doctor.	INR

If you have any questions or experience serious bleeding, call your doctor: _____

MD Signature: _____ Date: _____