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Oral Anticoagulants: Elective Interruption & Emergency Reversal

Effective Date: January 18, 2023

Scope

This guideline provides recommendations for the management of direct acting oral anticoagulants (DOACs) and warfarin in patients aged ≥ 19 years who require an elective or urgent procedure or are actively bleeding and require emergency reversal.

Key Recommendations

- Whenever possible, procedures in an anticoagulated patient should be undertaken on an elective basis to allow for planned periprocedural anticoagulation.
- Whenever possible, discuss appropriate periprocedural anticoagulant management with the practitioner performing the procedure.
- Temporary interruption of an oral anticoagulant **is not** indicated for procedures with minimal risk of bleeding. All other procedures require temporary drug interruption. The duration of interruption is based on the type of anticoagulant, the risk of thrombosis, and the risk of bleeding related to the procedure.
- Bridging with low molecular weight heparin (LMWH) is **only** indicated for patients on warfarin with very specific and high-risk factors for thrombosis. Bridging is **not** indicated for DOACs.
- Rapid reversal of anticoagulants is indicated for patients with potentially life-threatening bleeding or patients who require an urgent/emergent procedure.
  - Rapid reversal of warfarin is achieved with prothrombin complex concentrate (PCC) co-administered with vitamin K.
  - Rapid reversal of dabigatran is achieved with idarucizumab.
  - A specific agent for reversal of direct factor Xa (FXa) inhibitors (apixaban, edoxaban, and rivaroxaban) is not available in Canada. PCC has been used off-label for rapid reversal of these agents in life-threatening bleeding based on very weak evidence.
- In patients on chronic therapeutic dosing of a DOAC who undergo major surgeries that use prophylactic dosing of the DOAC post-operatively, timing of when to restart the therapeutic dose should be discussed with the surgeon.

Therapeutic Considerations

Periprocedural management of oral anticoagulant (OAC) therapy requires balancing the risk of hemorrhage if the procedure is performed while on anticoagulation and the risk of thrombosis if anticoagulation is interrupted. Risk of hemorrhage is influenced by patient age, relevant medical conditions, type and site of procedure, approach, type of incision and closure, operator skill, 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. Periprocedural anticoagulation recommendations are largely based on protocols evaluated in clinical trials, clinical experience, and expert consensus.[1]

Whenever possible, procedures in an 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 three months) to reduce the risk of recurrent stroke or thrombosis.

Rapid reversal of an OAC is necessary for patients presenting with potentially life-threatening bleeding or those requiring an urgent/emergent procedure. Specific reversal agents for warfarin and dabigatran are available to expedite normal hemostasis. See *Rapid Reversal* below for more detail.

Procedural Bleeding Risk

Procedural bleeding risk is based on the nature of the procedure itself, the urgency with which it must be performed, and practitioner skill. Patient comorbidities and medications also influence the risk of bleeding during a particular procedure.[2] Many organizations provide recommendations on procedure bleed risk categorization, though these are not always consistent. Such recommendations are not meant to replace clinical judgement or negate the importance of consulting with the practitioner performing the procedure if there is uncertainty regarding the risk of bleeding. For example, Thrombosis Canada categorizes procedural bleeding risks as **minimal**, **low/moderate**, or **high**, whereas regional medical imaging guidelines dichotomizes procedures into low-risk and high-risk groups.[1] This underscores the importance of proactively consulting with the practitioner performing the procedure to ensure appropriate and safe patient care. Refer to *Figure 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.

Figure 1: Procedure bleeding risks (adapted from Thrombosis Canada, 2021)[1]

MINIMAL

- Cataract surgery
- Dermatologic procedures (e.g., skin biopsy)
- Dental extractions of 1-2 teeth
- Endodontic procedure (e.g., 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 needles (e.g., thoracentesis, paracentesis, arthrocentesis)

LOW/MODERATE

- Gastroscopy or colonoscopy with or without biopsy*
- Non-cancer abdominal 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

- Colonic polypectomy*
- Select procedures involving vascular organs (e.g., kidney, liver, or prostate biopsy)
- High bleed risk interventions (e.g., pericardiocentesis, lumbar punctures, spinal injection, 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, 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

* Note: If colonoscopy is being performed and it is uncertain if polypectomy will be performed, treat as a high-risk procedure. If the procedure does not result in polypectomy, then restart anticoagulation as for low/moderate risk post-procedural.

Periprocedural Management for Warfarin

Warfarin must be discontinued for several days to allow normalization of the anticoagulant effect. This might take longer in older patients and those treated to a higher target international normalized ratio (INR) (e.g., INR 3.0). Refer to *Figure 2: Considerations for periprocedural management of warfarin* below for information regarding how to determine the pre-procedure INR that would be considered 'safe' to go ahead (referred to as 'safe INR' throughout this document), whether bridging is required, and exact timing of drug interruption.

Special considerations for warfarin interruption in patients with epidural catheters:

- Do not start warfarin until epidural catheter is removed.
- Standard prophylactic dosing of LMWH can be used with an epidural in place.
- Do not give therapeutic level dosing of LMWH or any DOAC 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 4 hours *after* removal of epidural catheter (and there are no neurological concerns).
- Always discuss timing of epidural catheter removal with anesthesiologist.

Periprocedural Management for DOACs

Protocols for periprocedural DOAC management have been evaluated in clinical studies and are well described in consensus recommendations and manufacturer instructions. Timing of the last dose of a DOAC primarily depends on the procedural bleeding risk, patient renal function, and drug half-life.[1] Refer to *Figure 3: Considerations for periprocedural management of DOACs* for more details and below for additional considerations for DOAC management:

- 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]
- Timing of the last dose of DOAC is unclear for patients with severe renal dysfunction (CrCl < 30 mL/min).[1] Because clearance of the DOAC will be delayed in these patients, a longer duration off DOAC than what is recommended in *Figure 3: Considerations for periprocedural management of DOACs* may be required. 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 what is recommended in *Figure 3: Considerations for periprocedural management of DOACs*. Discuss further with an anesthesiologist.

Figure 2: Considerations for periprocedural management of warfarin

STEP 1: Determine Pre-Procedure 'Safe INR'

- Procedures with minimal risk of bleeding = No warfarin interruption required
- Procedures with low/moderate risk of bleeding = Safe INR ≤ 1.5
- Procedures with high risk of bleeding = Safe INR ≤ 1.2

STEP 2: Determine Need for Bridging

There is general consensus that bridging may be indicated for the following conditions with a very high risk of arterial or venous 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 CHADS2 score of 5 or 6
- Venous thromboembolism occurring within past 3 months
- Triple positive anti-phospholipid syndrome (i.e., positive for lupus anticoagulant, anticardiolipin, and anti-β2-glycoprotein I antibodies)

STEP 3: Determine Timing of Drug Interruption

Without bridging:

DAY - 7	DAY - 6	DAY - 1	DAY 0	DAY + 1	DAY 2 - 5	DAY + 6
Last dose of warfarin, if normal target INR is 3.0.	Last dose of warfarin, if normal target INR is 2.5.	Check INR. If INR is not less than the 'safe INR', discuss with practitioner performing the procedure.	PROCEDURE	Resume warfarin if no epidural in place. Initiate LMWH prophylaxis 12-24 hrs after procedure, if in hospital. Warfarin/LMWH should only be initiated once homeostasis is secured after the procedure. If unsure, discuss with the practitioner who performed the procedure.	Warfarin dose requirement may change after the procedure if there were significant changes in medication (e.g., especially use of antibiotics) or nutrition.	Check INR Discontinue LMWH prophylaxis once INR is in normal therapeutic range.

With bridging:

DAY - 7	DAY - 6	DAY - 4, - 3, - 2	DAY - 1	DAY 0	DAY + 1	DAY + 3	DAY + 6
Last dose of warfarin, if normal target INR is 3.0	Last dose of warfarin, if normal target INR is 2.5	Therapeutic LMWH in evening	Check INR If INR is not less than 'safe INR', discuss with practitioner performing the procedure. LMWH is not generally given within 24 hrs of the procedure. However, a halftherapeutic dose of LMWH is sometimes given the morning of Day -1 for those with the highest risk of thrombosis.	PROCEDURE	Resume warfarin if no epidural in place. Initiate LMWH prophylaxis 12-24 hrs after procedure, if in hospital. Warfarin/LMWH should only be initiated once homeostasis is secured after the procedure. If unsure, discuss with the practitioner performing the procedure.	Increase LMWH to therapeutic dose, if no bleeding and no epidural in place. Continue warfarin. Warfarin dose requirement may change after the procedure if there were significant changes in medication (e.g., especially use of antibiotics) or nutrition.	Check INR Discontinue LMWH once INR is in therapeutic range.

Figure 3: Considerations for periprocedural management of DOACs

STEP 1: Determine Risk of Bleeding

- Procedures with **minimal** risk of bleeding = No DOAC interruption required
- Procedures with **low/moderate/high** risk of bleeding = DOAC interruption required

STEP 2: Determine Renal Function

- Calculate creatinine clearance (CrCl) using the Cockcroft-Gault equation.
- Do **not** use the estimated glomerular filtration rate (eGFR). Laboratory reported eGFR does not account for age or body weight and will thus give an over-estimation of renal function in those at highest risk of bleeding.

STEP 3: Determine Timing of Drug Interruption

- Unlike INR for warfarin, there is no reliable laboratory test to measure the anticoagulant effect of DOACs.
- Drug interruption protocols are based on pharmacokinetics, procedural bleed risk and patient renal function.
- Consult with the practitioner performing the procedure if protocol modifications are being considered.

DAY - 5	DAY - 3	DAY - 2	DAY 0	DAY + 1	DAY + 2	DAY + 3
Dabigatran • Last dose if **CrCl 30-49 mL/min** for procedure with **high** bleed risk.	**Dabigatran** • Last dose if **CrCl 30-49 mL/min** for procedure with **low/moderate** bleed risk. • Last dose if **CrCl ≥50 mL/min** for procedure with **high** bleed risk. **Apixaban, endoxaban, or rivaroxaban** • Last dose if **CrCl ≥30 mL/min** for procedure with **high** bleed risk.	**Apixaban, endoxaban, or rivaroxaban** • Last dose if **CrCl ≥30 mL/min** for procedure with **low/moderate** bleed risk.	PROCEDURE	If hemostasis is secured but epidural is in-situ or patient is in hospital, use LMWH prophylaxis. If hemostasis secured and no epidural in-situ, use: • LMWH prophylaxis if in-patient; or • low-dose DOAC if indicated (e.g total joint replacement If unsure about hemostasis, discuss with the practitioner who performed the procedure.	If hemostasis secured and no epidural in-situ, can: • resume full-dose DOAC for **low/ moderate** bleed risk; or • use LMWH prophylaxis if inpatient.	If hemostasis secured and no epidural in-situ, can: • resume full-dose DOAC for **high** bleed risk; or • use LMWH prophylaxis if inpatient; or • use therapeutic LMWH if full-dose DOAC cannot be resumed (e.g., NPO).

Rapid Reversal for Serious Bleeding or Urgent Procedures

Bleeding is a common adverse event of all anticoagulants.[8,9] Complete and rapid reversal of an OAC is necessary when a patient presents with serious bleeding or requires an urgent or emergent procedure. Individual reversal agents for warfarin and DOACs are outlined below.

Controlling the source of bleeding is important. Additional considerations in patients with serious bleeding or is requiring procedure associated with very high risk of critical bleeding (e.g., neurosurgery):[12]

- Maintain platelet count >50 X 109/L (>100 X 109/L if intracranial hemorrhage) with platelet transfusion.
- Consider platelet transfusion if patient on antiplatelet therapy (excluding acetylsalicylic acid).
- Consider tranexamic acid for trauma-associated coagulopathy (1 g IV given within 3 hours of trauma) or abnormal uterine bleeding (1 g PO or IV). Contraindicated in hematuria and no definitive benefit in gastrointestinal bleeding.
- Recommend fibrinogen replacement if fibrinogen <1.5 g/L.

Therapeutic Agents for Rapid Warfarin Reversal

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** be coadministered to provide sustained reversal.[10] Refer to *Appendix B: Warfarin Reversal Flow Chart* for flow chart on how to rapidly reverse warfarin with a combination of PCC and vitamin K.

Plasma-derived prothrombin complex concentrate (PCC)

- Product of choice for rapid reversal of warfarin because it contains factors II, VII, IX, X.
- Is available at most hospitals and can be ordered through the blood bank.
- Has a short duration (approximately 6 hrs) so **must** be used concomitantly with IV vitamin K (5-10 mg). See below for additional information on vitamin K administration.
- Contains heparin and thus is contraindicated in patients with heparin-induced thrombocytopenia, liver coagulopathy, and disseminated intravascular coagulation.
- 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. This is especially true during the peripartum and early postpartum periods due to the elevated risk of thrombosis.
- The following **PCC 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)

Source: Vancouver Coastal Prescriber Order.[12]

Vitamin K

- IV delivery is the fastest and most reliable way to obtain the vitamin K anticoagulant reversal effect. Avoid intramuscular and subcutaneous administration.
- If the procedure if >24 hrs away, there is no difference between using IV or oral administration.
- Effect of vitamin K on INR is observed ~8 hrs after IV and ~12 hrs after PO administration.
- For full reversal in urgent scenarios, give **5-10 mg in 50mL normal saline infused over 30 minutes**. This reduces the rare risk of anaphylactoid reactions.
- A large dose of vitamin K (i.e., >5 mg) can lead to difficulty with re-anticoagulation.

Frozen Plasma

- Frozen plasma is no longer indicated for the reversal of warfarin due to lower efficacy, higher complications, and larger administration volume compared to PCC.
- Frozen plasma should still be used in massive transfusion scenarios.

Therapeutic Agents for Rapid DOAC Reversal

DOACs do not often require reversal agents because their anticoagulant effect is quickly reversed by withholding doses due to their short half-lives.[11] However, rapid reversal may be indicated for life-threatening bleed situations or when an urgent or emergent procedure is required.[11] Currently, only dabigatran has an approved reversal agent available in Canada (i.e., idarucizumb). While andexanet alfa is effective for rapid reversal of direct factor Xa (FXa) inhibitors and has regulatory approval in some countries, it is **not yet approved or available in Canada**.

Idarucizumab

- Idarucizumab can **only** be used to reverse dabigatran. Cannot be used to reverse FXa inhibitors (i.e., apixaban, edoxaban, rivaroxaban).
- A monoclonal antibody that completely reverse the anticoagulant effect of dabigatran within minutes. The duration of action is 24 hrs in most patients.[13]
- Caution should be observed for patients with hereditary fructose intolerance as the drug contains 4 g of 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 min apart**.[14]

Plasma-derived prothrombin complex concentrate (PCC)

- See *Therapeutic Agents for Warfarin Reversal* for PCC product details and dosing information.
- 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]
- The duration of action for PCC for DOAC reversal is unclear. Concurrent administration of IV vitamin K is not required, unlike for warfarin reversal with PCC.
- PCC is available at most hospitals, though generally requires Transfusion Medicine department approval. Automatic approval for DOAC reversal if intracranial bleed and/or critical bleed may be available, depending on health authority.
- Off-label recommended one-time dose of PCC 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/

Abbreviations:

DOAC	Direct Acting Oral Anticoagulant
LMWH	Low Molecular Weight Heparin
INR	International normalized ratio
IV	Intravenous
PCC	Prothrombin Complex Concentrate

Resources

Clinical Decision Support Tools

- *Child-Pugh Calculator*
- *Cockcroft-Gault Calculator*
- *PharmaCare Special Authority*: Provides benefit status for medication coverage and specific medical circumstances of coverage, depending on BC PharmaCare plan rules.
- *Thrombosis Canada periprocedural algorithm tool*

Consultation Supports

- *RACE: Rapid Access to Consultative Expertise Program*: RACE means timely telephone advice from specialist for Physicians, Medical Residents, Nurse Practitioners, Midwives, all in one phone call.
  - Monday to Friday 0800 – 1700
  - Online at *www.raceapp.ca* or though *Apple* or *Android* mobile device.
  - Local Calls: 604–696–2131 | Toll Free: 1–877–696–2131
  - For a complete list of current specialty services visit the *Specialty Areas page*.
- *PathwaysBC*: An online resource for current and accurate referral information for specialists and specialty clinics, including wait times and areas of expertise.

Related Guidelines

- *Thrombosis Canada*
- *HealthLink BC*
- *BC Guidelines: Warfarin*
- *BC Guidelines: Direct Acting Oral Anticoagulants (DOACs)*
- *BC Guidelines: Stroke and Transient Ischemic Attack*
- *BC Guidelines: Atrial Fibrillation*
- *BC Guidelines: Venous Thromboembolism*

Additional Resources

- *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.
- *General Practice Services Committee*:
  - Practice Support Program: Offers focused, accredited training sessions for BC physicians to help improve practice efficiency and support enhanced care.
  - Chronic Disease Management and Complex Care Incentives: Compensates for the time and skill needed to work with patients with complex conditions or specific chronic diseases.

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*
- *Patient Record Sheet: Warfarin Before & After Procedures*
- *Patient Record Sheet: DOAC Before & After Procedures*

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.

For more information about how BC Guidelines are developed, refer to the GPAC Handbook available at *BCGuidelines.ca: GPAC Handbook*.

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

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 109/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 **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 **High Risk Spine & Neurological Procedures** • Vertebroplasty • Kyphoplasty • Cervical spine facet blocks • Epidural injection (lumbar/thoracic/ cervical) **NOTE:** Specialized Neurovascular Procedures are excluded, including carotid stenting, and intra-cranial embolization	• 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
	• 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
	• 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
	• 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**

Management Guidelines for *NON-URGENT* 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 109/L. For chronic liver disease, INR is not required.	**Anticoagulant / Antiplatelet MEDS**	**Discontinue Yes*/ No**	**Suggested Timing of LAST dose BEFORE procedure***	**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**

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

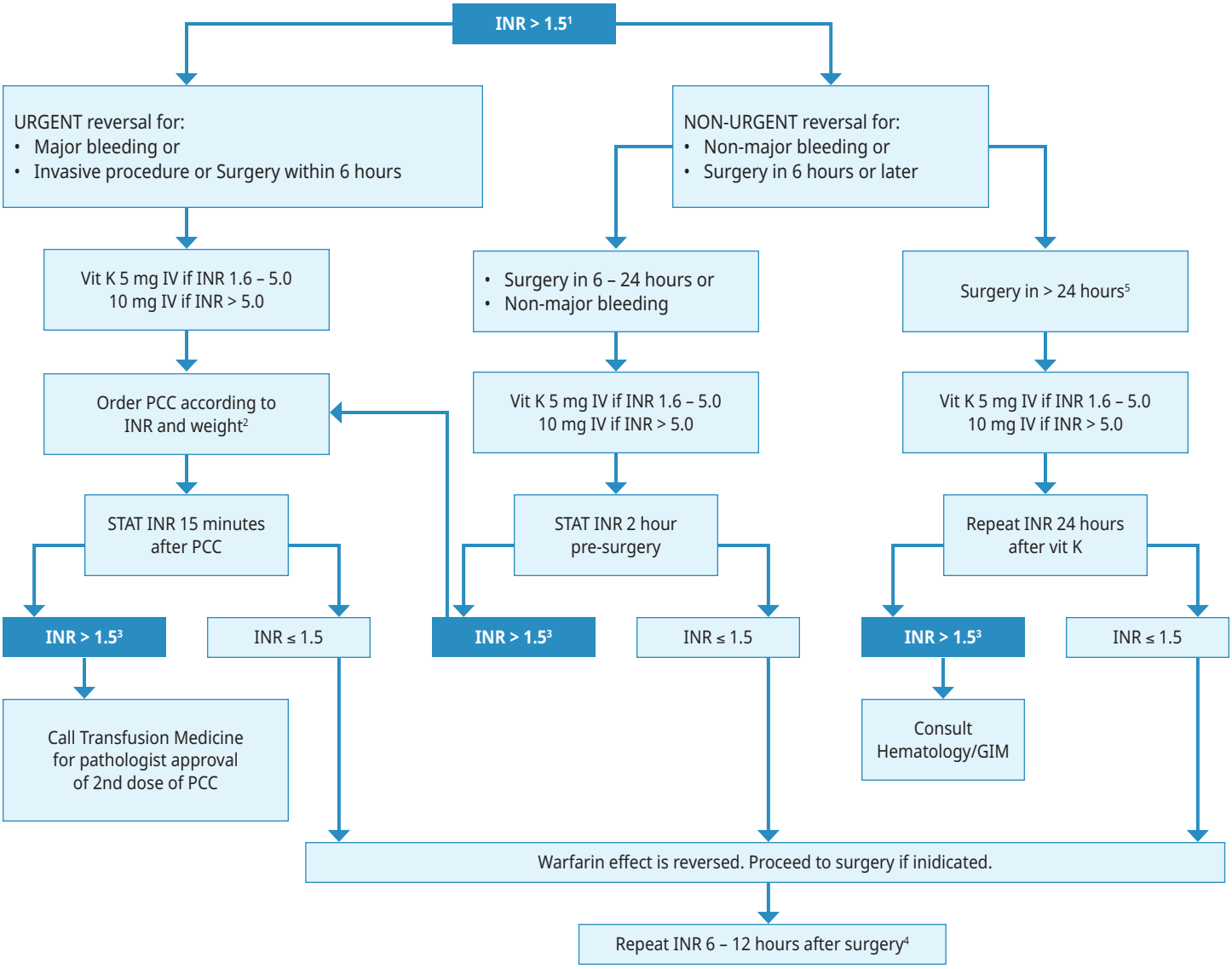
1. SIR Journal of Vascular Radiology 2019; 30:P1168-1184.E1 – Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions—Part II: Recommendations. Retrieved from https://www.jvir.org/article/S1051-0443(19)30407-5/fulltext
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*

Version 13.0 Effective 21-APR-2022

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 109 /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 Procedures

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: _____

Patient Record Sheet: DOAC Before and After Procedures

Patient Name: _____ Patient Weight: _____ kg

Surgeon Name: _____ DOAC dose: _____ mg

Type of Procedure: _____ DOAC name: _____

Date	Number of days before/after procedure	Please take your DOAC as instructed below:
		Take last DOAC dose today
	Procedure (Day 0)	Do not take DOAC
		Resume normal DOAC dose today

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

MD Signature: _____ Date: _____

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WARFARIN PATIENT RECORD SHEET

ATTACH PATIENT INFORMATION LABEL HERE

PATIENT INFORMATION

SURNAME OF PATIENT	FIRST NAME (INITIALS)	PHN

Indications:
- ❑ atrial fibrillation
- ❑ DVT/PE
- ❑ thrombophilia
- ❑ prosthetic heart valve
- ❑ intracardiac thrombus
- ❑ Other: ➟

Target INR Range: ❑ 2.0 – 3.0 ❑ 2.5 – 3.5 ❑ Other: ➟ _____

Duration: ❑ 3 mos ❑ lifelong ❑ reassess when: ➟

Oral Anticoagulant: ❑ Warfarin ❑ Other: ➟

Please complete and indicate 1st and 2nd preference for contact

____ Work Phone: ( ) _____

____ Home Phone: ( ) _____

____ Cell: ( ) _____

____ Pager: ( ) _____

____ Fax: ( ) _____

____ Email:

Tablet Strengths: ❑ 1 - pink ❑ 2 - lavender ❑ 2.5 - green ❑ 3 - tan ❑ 4 - blue ❑ 5 - peach ❑ 6 - teal ❑ 7 - yellow ❑ 10 - white

OTHER INFORMATION

NAME OF PRIMARY PHYSICIAN	TELEPHONE NUMBER	FAX
NAME OF SPECIALIST	TELEPHONE NUMBER	FAX
NAME OF SPECIALIST	TELEPHONE NUMBER	FAX
INR RESULTS ALSO COPIED TO:	DATE	FAX

LAB	PHARMACY	OTHER

Specimen Date	HB if done	PLTS if done	INR Result	Dosage Instruction	Weekly mg	Next INR	MD Initials	Date/Status of Patient Notification	Notifier Initials
								D: S:	
								D: S:	
								D: S:	
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