Guidelines on Periprocedural Management of Anticoagulant and Antiplatelet Agents

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Any enquiries about or comments on this publication should be directed to:
Clinical Excellence Commission
Locked Bag 230
St Leonards NSW 1590
Phone: (02) 9269 5500
Email: CEC-MedicationSafety@health.nsw.gov.au

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1 Introduction

This clinical guideline is intended to assist clinicians with the inpatient and outpatient management of adult patients (16 years of age and above) undergoing procedures[a] who are taking anticoagulant or antiplatelet agents. Please note, importantly, this guideline does not apply to patients undergoing renal dialysis – in such cases, it is recommended that clinicians seek specialist medical advice.

This guideline outlines a standardised approach for:

- elective procedures – pre-procedural assessment
- elective procedures – periprocedural management of:
  - patients taking antiplatelet agents
  - patients taking oral anticoagulants who can have anticoagulant therapy **continued** in the periprocedural period
  - patients taking oral anticoagulants who can have anticoagulant therapy **withheld** prior to procedure without bridging therapy
  - patients taking oral anticoagulants who require bridging therapy (see definition below)
  - patients taking anticoagulants or antiplatelet agents for whom a neuraxial (regional) procedure is planned
- reversal of anticoagulant therapy for urgent procedures.

This guideline should be used in conjunction with Therapeutic Goods Administration approved Product Information for the relevant medicine(s), local protocols (endorsed by the Local Health District/Speciality Health Network Drug and Therapeutics Committee) and specialist medical advice. This clinical guideline was developed in conjunction with a multi-disciplinary Anticoagulant Medicines Working Party[b]. Where indicated, consensus recommendations in the guideline are based on expert opinion from members in the Working Party.

Clinicians must review current evidence and the listings for medicines on the NSW Medicines Formulary prior to use within NSW Health facilities (see NSW Medicines Formulary online platform for further details including any restrictions on use). Where relevant, refer to NSW Health Policy Directive Approval Process for Medicines and Their Use (PD2022_056) for guidance on the use of medicines not listed on the NSW Medicines Formulary via the Individual Patient Use approval pathway.

Interpretation of recommendations within this guideline should always be taken in the context of the patient's current medical conditions and formal clinical assessment, recognising this guidance is not a substitute for clinical judgement.

Bridging therapy

Bridging therapy in this document refers to the administration of a therapeutic dose of a short-acting anticoagulant, typically low molecular weight heparin (LMWH), during the interruption of warfarin (Douketis et al. 2015). Bridging therapy **does not** refer to the administration of a venous thromboembolism (VTE) prophylactic dose of an anticoagulant during the post procedural period.

This guideline provides guidance on bridging with enoxaparin (a LMWH) or unfractionated heparin. Refer to local guidelines for information on bridging with other LMWH medicines.

[a] The term 'procedure' also refers to surgical procedures.
[b] The Anticoagulant Medicines Working Party members included a consumer, a nursing representative (CNC), pharmacy representatives and medical representatives including: consultants in anaesthetics, cardiology, general medicine, geriatrics, haematology, intensive care, respiratory, stroke neurology and surgical as well as a Junior Medical Officer, Basic Physician Trainee and Advanced Trainee (Haematology).

Should a delay in procedure be considered?

It is important to note that patients who require elective procedures within the first three months following an episode of VTE are likely to benefit from delaying the procedure, even if the delay is only for a few weeks. A delay in procedure should be considered in other circumstances such as after stent placement, after recent cerebrovascular accident (CVA) or prosthetic valve insertion. The decision to delay a procedure should be made in conjunction with specialist medical advice, carefully weighing the risks and benefits for the individual patient.

2 Pre-procedural assessment

Several factors need to be taken into consideration during the pre-procedural assessment, including:

- the proceduralist and prescribing doctor's clinical judgment
- other prescribed and over-the-counter medications including those with an antiplatelet action, for example, fish oil
- patient related bleeding and risk factors for bleeding complications, for example, platelet count, haemoglobin concentration and medical history.

For most surgical procedures, anticoagulants are usually stopped due to bleeding risk. However, some procedures pose minimal bleeding risk or allow for definitive control using simple surgical techniques, making it safe to anticoagulation. These scenarios can be confirmed with the proceduralist.

For patients deemed at high risk for both bleeding and thromboembolism, determining the need for ongoing anticoagulation requires specialist medical expertise and detailed procedure knowledge. Such decisions should **not** rest with junior doctors. Instead, they should be referred to the consultant proceduralist responsible for patient care, unless specific local delegation protocols are established. For instance, cardiothoracic and vascular surgical units typically have established scope of practice guidelines where senior registrars or postgraduate surgical fellows, including Fellows of the Royal Australasian College of Surgeons (FRACS), have clearly defined credentialing, supervision and delegation for such procedures. Nevertheless, these practices must be clearly defined and readily accessible, either in written or electronic format.

Specific surgical procedures can be performed without stopping routine VTE prophylaxis, in such cases individual decision by the consultant proceduralist is required.

In contrast to anticoagulants, antiplatelet agents can usually be continued throughout the periprocedural period (except for intra-cranial or spinal procedures). Seek advice from the specialist managing the antiplatelet agent and from the proceduralist about the risk of bleeding during specific procedures and anatomical regions (see section 3.3).

In comparison to patients with atrial fibrillation (AF), patients with paroxysmal atrial fibrillation (PAF) have a lower absolute risk of thromboembolism. Clinicians will need to consider the frequency of episodes and individual risk factors such as CHA_2DS_2-VASc score. Further guidance regarding risk may need to be considered.

2.1 Estimating procedural bleeding risk

The accurate assessment of bleeding risk in surgical patients presents a significant challenge for clinicians. Stratifying bleeding risk according to the type of surgical procedure is particularly complex due to the numerous variables that contribute to the overall risk of bleeding (including patient factors, surgical and post procedural considerations).

Each surgical intervention carries its own distinct considerations, making it difficult to generalise the likelihood of bleeding complications. Patient factors such as age, underlying comorbidities, and haemostatic function may increase an individual's overall absolute risk of major bleeding. Given the complexity, the risk of bleeding is best assessed by the proceduralist.

Table 1 provides a guide, listing common high, low/moderate, and minimal bleeding risk procedures based on the International Society on Thrombosis and Haemostasis Guidance Statements. This list is not exhaustive and is based on expert opinion. Clinicians must consider the multifactorial variables when assessing bleeding risk associated with different surgical procedure types. Local policies and guidelines may exist to further stratify risks based on consensus opinion.

Please note:

- a **procedure with minimal** risk of bleeding can be safely performed under full anticoagulation. However, for patients taking a direct oral anticoagulant (DOAC), withholding the patient's dose on the day of the procedure may be considered to avoid peak anticoagulant effect (Douketis et al. 2022)
- a **procedure with a low/moderate** of bleeding allows for some residual anticoagulant effect at the time of the procedure (i.e. requires a 2 – 3 drug half-life[a] interruption pre-procedure)
- a **procedure with high** bleed risk procedure requires no residual anticoagulant effect at the time of the procedure (i.e. requires a 4 – 5 drug half-life interruption pre-procedure).

[a] the drug half-life is the time required for the concentration of a drug in the bloodstream to decrease by half. This parameter is crucial in determining dosing intervals and assessing how long a drug's effects may persist in the body.

Table 1: Risk of procedural bleeding[a]

Bleeding risk	Procedure/procedure
Minimal (30–day risk of major bleed is ~0%)	• Minor dental procedures[b] (dental extractions, restorations, prosthetics, endodontics), dental cleanings, fillings • Minor dermatologic procedures (excision of basal and squamous cell skin cancers, actinic keratoses, and premalignant or cancerous skin nevi) • Ophthalmological (cataract) procedures • Pacemaker or cardioverter – defibrillator device implantation • Removal of external fixators.
Low/moderate (30–day risk of major bleed is 0-2%)	• Abdominal hernia repair • Abdominal hysterectomy • Arthroscopy • Cutaneous/lymph node biopsies • Bronchoscopy +/- biopsy • Colonoscopy +/- biopsy • Coronary angiography[c] • Foot/hand procedure • Gastrointestinal endoscopy +/- biopsy • Haemorrhoidal procedure • Laparoscopic cholecystectomy • Small skin grafts.
High (30–day risk of bleed is ≥ 2%)	• Any major[#] operation (procedure duration of >45 min) • Bowel resection • Cancer procedure – including solid tumour resection (lung, oesophagus, gastric, colon, hepatobiliary, pancreatic) • Cardiac, intracranial, or spinal procedure • Colonic polyp resection • Epidural injections • Major procedure with extensive tissue injury • Major orthopaedic procedure (including hip, knee or shoulder replacement procedure) • Major thoracic procedure • Nephrectomy, kidney biopsy • Neuraxial anaesthesia (including spinal and epidural anaesthesia or other neuraxial intervention) • Percutaneous endoscopic gastrostomy placement, endoscopic retrograde cholangiopancreatography • Procedure in highly vascular organs (kidneys, liver, spleen) • Reconstructive plastic procedure • Transurethral prostate resection, bladder resection, or tumour ablation • Urologic or gastrointestinal procedure – including anastomosis procedure.

[a] Based on International Society on Thrombosis and Haemostasis Guidance Statements.

[b] Whilst most dental procedures are minimal or low bleeding risk, some may be higher risk. For further advice regarding the management of patients undergoing dental procedures, please refer to the Australian Therapeutic Guidelines: Oral and Dental.

[c] Radial approach may be considered minimal bleed risk compared to femoral approach.

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2.2 Estimating risk of thromboembolism

The risk of thromboembolism is best assessed by the prescribing physician. Table 2 lists the risk of thromboembolism for certain conditions.

Table 2: Risk of thromboembolism for certain conditions

Risk category	Mechanical heart valve	Atrial fibrillation (AF)	Venous thromboembolism
High >10% per year risk of arterial thromboembolism **OR** > 10% per month risk of VTE[a]	• Any mechanical mitral valve prosthesis • Any caged-ball or tilting disc aortic valve prosthesis in mitral/aortic position • Recent (< 3 months) stroke or TIA[b]	• CHA_2DS_2VASc[c] score ≥7 or $CHADS_2$ score of 5 or 6 • Rheumatic valvular heart disease • Recent (< 3 months) stroke or TIA	• Recent (< 3 months and especially 1 month) VTE • Severe thrombophilia (e.g., deficiency of protein C, protein S, or antithrombin; homozygous factor V Leiden or Prothrombin gene mutation or double heterozygous for each mutation, multiple thrombophilias • Antiphospholipid antibodies • Associated with vena cava filter • Active cancer associated with high VTE risk[d]

Moderate
4–10% per year risk of arterial thromboembolism
OR
4–10% per month risk of VTE
	• Bileaflet aortic valve prosthesis with major risk factors for stroke
	  ○ AF, prior stroke or TIA
	  ○ Hypertension
	  ○ Diabetes
	  ○ Congestive Heart failure
	  ○ Age > 75 years
		• CHA_2DS_2VASc score 5 or 6 or $CHADS_2$ score of 3 or 4	• VTE that occurred within past 3-12 months
			• Non-severe thrombophilia (e.g., heterozygous factor V Leiden or prothrombin gene mutation)
			• Recurrent VTE
			• Active cancer or recent history of cancer[e]

Low <4% per year risk of arterial thromboembolism **OR** <2% per month risk of VTE	• Bileaflet aortic valve prosthesis without major risk factors for stroke	• CHA_2DS_2VASc score 1 – 4 or $CHADS_2$ score of 0 – 2 (and no prior stroke/TIA)	• VTE greater than 12 months ago

[a] Venous thromboembolism (VTE)
[b] Transient ischemic attack (TIA)
[c] For calculation of CHA_2DS_2VASc score, please refer to the Australian Therapeutic Guidelines.
[d] Includes pancreatic cancer, myeloproliferative disorders, primary brain cancer, gastric cancer, oesophageal cancer.
[e] Within 5 years if history of cancer, excluding non-melanoma skin cancer.

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Please note, conditions associated with higher VTE risk may not universally require bridging. An individualised approach to assessing patient risk and the need for bridging therapy should be based on specific patient factors and discussed with the treating physician.

Bioprosthetic heart valves and risk of thromboembolism

The risk of thromboembolism in patients with bioprosthetic heart valves is highest in the first three months following implantation, as endothelialisation of the valve is incomplete during this period. Warfarin for 3 months should be considered in all patients with a mitral or tricuspid bioprosthetic heart valve and aspirin or warfarin should be considered for 3 months after surgical implantation of an aortic prosthesis. Beyond three months, if there are no other indications for anticoagulation, such as persistent atrial fibrillation, the thrombotic risk is lower, and many patients can be managed with antiplatelet therapy (Vahanian et al. 2021). Careful assessment of individual thrombotic and bleeding risks is essential to determine the optimal management strategy in this population.

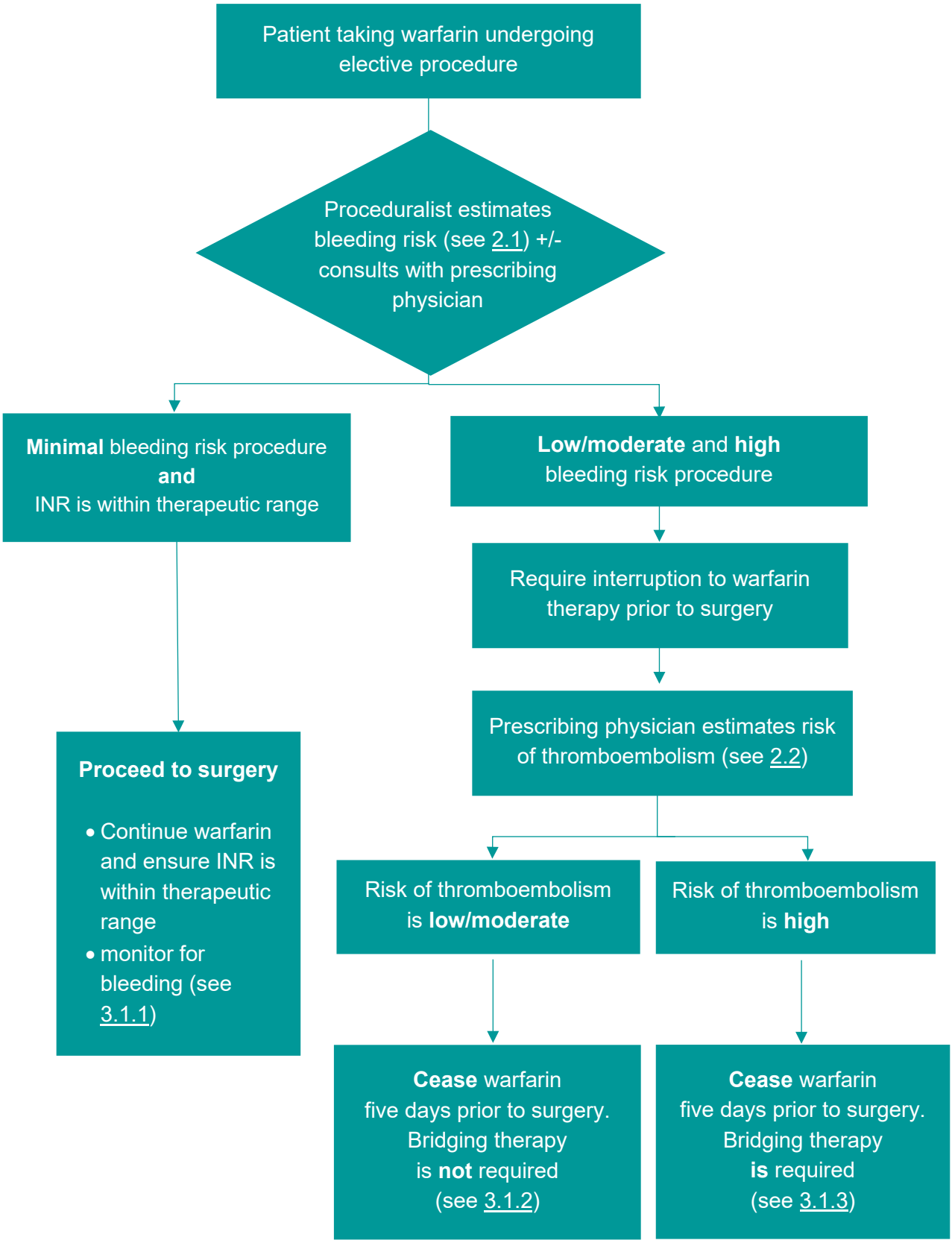
3 Periprocedural management of anticoagulant and antiplatelet agents for elective procedures

For the management of anticoagulant and antiplatelet agents in **neuraxial procedures** see section 4.

3.1 Warfarin

An estimation of procedural bleeding risk (see figure 1) is required to determine how warfarin should be managed in the periprocedural period on an individual basis. Whilst the risk of bleeding is best assessed by the proceduralist, the specialist managing the anticoagulant therapy (for example, haematologist) or original prescriber should also be consulted as an individual management plan may have been developed specific to the patient history and/or circumstances.

Figure 1: Pre-procedure warfarin management



3.1.1 Patients for whom warfarin can be continued (minimal bleeding risk)

Clinicians may not need to withhold warfarin for specific minimal bleeding risk procedures (see table 1 for guidance) (Tran et al. 2013). For patients undergoing a procedure who are taking warfarin, it is important to confirm that the International Normalised Ratio (INR) is not supratherapeutic at the time of the procedure. Clinicians should also consider potential drug interactions with anticoagulant therapy if surgical prophylaxis with antimicrobials is required for the procedure. Additionally, they must account for the effects fasting or reduced oral intake on anticoagulant therapy. In such cases, adjusting warfarin dosing, monitoring INR more frequently, or considering alternative anticoagulation may be necessary.

3.1.2 Patients for whom warfarin therapy should be withheld prior to procedure (low/moderate or high bleeding risk) with no bridging

Seek relevant expert advice when stopping warfarin therapy prior to a procedure. The risk of bleeding is best assessed by the proceduralist. The thromboembolic risk may be assessed by utilising table 2, or through direct consultation with the prescribing clinician where there is uncertainty regarding thrombotic risk.

Patients with a **low** or **moderate** risk of thromboembolism where warfarin cessation is required for their procedure (see table 2):

- should have warfarin withheld during the pre-procedural period
- do **not** require bridging therapy (pre-procedure) (see definition of bridging therapy)
- should have INR testing performed on the day prior to the procedure.

Warfarin should be withheld for patients who are assessed as **low** or **moderate** of thromboembolism (see table 2) for **5 full days** before the procedure. **The procedure can proceed safely if the INR is < 1.5 on the day of procedure**.

To avoid cancellation of procedures because the INR is above this level, check the INR on the day before the procedure so that vitamin K_1 can be administered if needed, in time to take effect (Tran et al. 2013) (see section 5.1). An initial dose of 1-3 mg of vitamin K_1 orally or via intravenous administration can be considered (Burbury et al. 2011).

Table 3: Withholding warfarin pre-procedure for patients not requiring bridging therapy

	6 days prior to procedure	5 days prior to procedure	4 days prior to procedure	3 days prior to procedure	2 days prior to procedure	1 day prior to procedure	Morning of procedure
Warfarin	Take last dose of warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin
INR test	X	X	X	X	X	Check if INR <1.5	

Recommencing warfarin for patients for whom warfarin therapy was withheld prior to procedure with no bridging therapy

While pre-procedural management of patients on warfarin therapy follows a similar approach across cases, post procedural management recommencement of therapy will differ depending on the specific indication for use. The treating proceduralist should advise when warfarin can be recommenced. Generally, once there is adequate haemostasis, warfarin is recommenced at the patient's usual maintenance dose 12 to 24 hours post-procedure (Tran et al. 2013).

Post-procedural bridging therapy is not required for patients with a low/moderate thrombotic risk, including those with mechanical heart valves and AF. VTE prophylaxis should be considered separately. However, in patients at moderate to high risk of recurrent VTE, the post-procedural risk of thromboembolism is greater than the pre-procedural risk. As such, crossover parenteral therapy will be necessary post-procedure until the INR is therapeutic.

3.1.3 Patients for whom warfarin should be withheld (low/moderate or high bleeding risk) who require bridging therapy

Patients with low/moderate or high bleeding risk and a **high** risk of thromboembolism:

- should have warfarin withheld during the pre-procedural period **and**
- **require** bridging therapy.

Bridging therapy involves the use of either LMWH (enoxaparin) or unfractionated heparin.

Bridging with therapeutic dose enoxaparin

The following guide may be used for providing bridging therapy using a therapeutic dose enoxaparin for patients who require their warfarin therapy to be interrupted and are at a high risk of thromboembolism.

Pre-procedure

Discontinue warfarin **5 full days** prior to the procedure (see table 4). Check the INR and when INR is ≤ 2, commence recommended dose of enoxaparin (see table 5). Enoxaparin is continued until 24 hours before the procedure. Consider halving the last dose of enoxaparin prior to procedures with a high bleeding risk (Tran et al. 2013).

Table 4: Withholding warfarin and commencing enoxaparin pre-procedure for patients requiring bridging therapy[a]

	6 days prior to procedure	5 days prior to procedure	4 days prior to procedure	3 days prior to procedure	2 days prior to procedure	1 day prior to procedure	Morning of procedure
Warfarin	Take last dose of warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin
INR test	X	X	Check INR			Either 1 day prior, or morning of procedure: Check if INR < 1.5[c]	
Enoxaparin	X No enoxaparin	X No enoxaparin	Commence enoxaparin when INR is ≤ 2[b]			LMWH is continued until 24 hours before procedure	

[a] Consider halving the last dose of LMWH prior to procedures with a high bleeding risk (Tran et al. 2013).
[b] For patients with an INR target of 2.5 – 3.5 commence enoxaparin when INR is ≤ 2.5.
[c] Procedures can proceed safely if the INR is < 1.5 on the day of the procedure. To avoid cancellations because the INR is above this level, check the INR on the day before the procedure so that vitamin K_1 can be administered if required (Tran et al. 2013) (see section 5).

Table 5: Enoxaparin treatment dose

Creatinine clearance (CrCl)	Dose[a]
Patient with CrCl ≥ 30 mL/min	1 mg/kg subcutaneous injection twice daily **OR** 1.5 mg/kg subcutaneous injection once daily
Patient with CrCl < 30 mL/min	Seek haematologist or renal physician advice prior to commencing 1 mg/kg subcutaneous injection once daily[b]

[a] Dosing above as per Australian Product Information for Clexane (Sanofi-Aventis Australia Pty Ltd. 2023). Dose adjustments should be made according to local protocols for individuals at extremes of body weight, along with monitoring parameters (for example, anti-Xa levels) as required. For patients on a once-daily dose of enoxaparin that requires two or more injections to achieve the desired dose, consider dividing the dose across a twice daily dosing regimen.

Post procedure

The treating proceduralist and treating physician should advise when the patient's regular anticoagulant therapy can be recommenced. Bleeding risk can be minimised after major procedures by adjusting the time when anticoagulant is resumed (Tran et al. 2013). Following high bleeding risk procedures, therapeutic LMWH should be delayed for 48 to 72 hours or substituted with prophylactic dose LMWH (Tran et al. 2013).

Consider restarting warfarin on the evening of the procedure at the previous maintenance dose if there is adequate haemostasis. Continue LMWH until the target INR is reached.

There is no evidence to date available to support using dabigatran (direct thrombin inhibitor) or apixaban or rivaroxaban (factor Xa inhibitors) as bridging agents.

Bridging with an intravenous unfractionated heparin infusion

For most patients requiring their warfarin therapy to be interrupted and are at a high risk of thromboembolism, bridging therapy with therapeutic enoxaparin is appropriate. Use of intravenous unfractionated heparin infusion is reserved for patients where:

- creatinine clearance (CrCl) is less than 15 mL/min, and or
- rapid onset and/or offset of anticoagulant effect is required (TG 2023; AMH 2024).

Bridging with an intravenous unfractionated heparin infusion should occur according to the pre-procedure schedule outlined below in table 6. Clinicians should refer to their local intravenous unfractionated heparin procedure or guideline to determine how to prescribe, administer and manage an unfractionated heparin infusion. A NSW Health Intravenous Heparin Infusion Guideline is currently being developed to support standardisation of heparin infusion management across NSW Health facilities. Clinicians may need to adjust heparin doses based on anti-Xa activity instead of aPTT in certain patient groups where the aPTT may not indicate anticoagulant effect accurately, for example those who are lupus anticoagulant positive (LAC) (Garcia et al. 2012; Olsen et al. 1998).

Pre-procedure

Discontinue warfarin **5 full days** prior to the procedure (see table 6). Check the INR and when the INR is ≤ 2, commence therapeutic heparin infusion according to the local intravenous heparin infusion protocol. Heparin infusion is continued until 4 to 6 hours before the procedure. If the aPTT is above the target range, a longer delay may be required (Douketis et al. 2022; Schug et al. 2020).

There may be some cases where a heparin infusion will continue during a procedure, for example certain vascular procedures, however this will be managed by the proceduralist and anaesthetist.

Table 6: Withholding warfarin and commencing intravenous heparin infusion pre-procedure for patients requiring bridging therapy

	6 days prior to procedure	5 days prior to procedure	4 days prior to procedure	3 days prior to procedure	2 days prior to procedure	1 day prior to procedure	Morning of procedure
Warfarin	Take last dose of warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin	X No warfarin
INR test	X	X	X	X	X	Check INR	Check if INR < 1.5[a]
Heparin infusion	X No infusion	X No infusion	X No infusion	X No infusion	X No infusion	Commence infusion when INR is ≤ 2	Infusion continued until 4 - 6 hours before procedure
aPTT	X	X	X	X	X	Monitor aPTT according to local infusion protocol	

[a] Procedures can proceed safely if the INR is < 1.5 on the day of the procedure. To avoid cancellations because the INR is above this level, check the INR on the day before the procedure so that vitamin K_1 can be administered if required (Tran et al. 2013) (see section 5).

Post procedure

The treating proceduralist should advise when the intravenous unfractionated heparin infusion can be recommenced postoperatively.

Generally, the following is recommended:

Patients with a high risk of thromboembolism, for example patients with a mechanical heart valve:

- recommence the heparin infusion (without bolus) 6 to 8 hours after the procedure.

For patients with a high bleeding risk:

- recommence the heparin infusion 24 to 48 hours after the procedure.

Consider restarting warfarin on the evening of the procedure at the previous maintenance dose if there is adequate haemostasis. Continue the intravenous unfractionated heparin infusion until the target INR is reached (Douketis et al. 2022, Schug et al. 2020).

3.2 Direct oral anticoagulants (DOACs)

The advice provided within this guideline offers a framework for managing DOACS in the periprocedural context. Further information regarding the general management of DOACs can be found in the Clinical Excellence Commission Direct Oral Anticoagulant (DOAC) Guidelines.

3.2.1 DOACs and minimal bleeding risk procedures

Maintaining treatment with an oral direct thrombin inhibitor (dabigatran) or factor Xa inhibitor (apixaban and rivaroxaban) therapy may be considered clinically appropriate for patients who are undergoing selected minimal bleeding risk procedures (see table 1).

Clinicians may consider withholding DOAC doses on the day of the procedure to avoid peak anticoagulant effect.

3.2.2 DOACs and low/moderate or high bleeding risk procedures

If the decision is made to withhold therapy, it should be withheld according to the guidelines (see table 7). Bridging therapy is **not required** for patients receiving DOACs (Douketis et al. 2022; TG 2023).

For patients taking dabigatran, it is necessary to confirm their renal function (CrCl) to determine the duration to withhold prior to therapy.

Table 7: Periprocedural management for patients receiving DOACs[a,b]

DOAC	Surgical procedure associated bleeding risk	5 days prior to procedure	4 days prior to procedure	3 days prior to procedure	2 days prior to procedure	1 day prior to procedure	DAY OF SURGICAL PROCEDURE DOAC NOT TO BE ADMINISTERED	1 day post-procedure	2 days post-procedure	3 days post-procedure	4 days post-procedure
Apixaban	High			Take last dose of apixaban	X	X		X	X	Restart apixaban	
	Low/ Moderate				Take last dose of apixaban	X		Restart apixaban			
Rivaroxaban	High			Take last dose of rivaroxaban	X	X		X	X	Restart rivaroxaban	
	Low/ Moderate				Take last dose of rivaroxaban	X		Restart rivaroxaban			
Dabigatran (CrCl ≥ 50 mL/min)	High			Take last dose of dabigatran	X	X		X	X	Restart dabigatran	
	Low/ Moderate				Take last dose of dabigatran	X		Restart dabigatran			
Dabigatran (CrCl < 50 mL/min)	High	Take last dose of dabigatran	X	X	X	X		X	X	Restart dabigatran	
	Low/ Moderate			Take last dose of dabigatran	X	X		Restart dabigatran			

[a] The decision to restart DOACs during the post procedural period may vary based on individual patient factors, including the nature of the surgical procedure and the risk of thromboembolic events. This approach warrants careful consideration and should be guided by clinical judgment and evidence-based practice to optimise patient outcomes and minimise complications.

[b] Post-procedure, the anticoagulant effect will be present within 4 hours of the first dose.

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3.3 Antiplatelet agents

In contrast to anticoagulant medications, a wide range of medical and surgical procedures can be performed in patients who are maintained on antiplatelet agents. Decision making for periprocedural management requires the evaluation of individual patient risk-benefit for the antiplatelet agent.
If the decision to alter antiplatelet agents is made, then it is important to determine:

- the optimal periprocedural antiplatelet regimen
- the safe interval for pre-procedural cessation of antiplatelet agent.

For patients on combination antiplatelet agents, clinicians should seek specialist advice from both the proceduralist and the specialist managing the antiplatelet agents regarding management in the periprocedural period. Patients receiving a single antiplatelet agent **do not** require bridging therapy.

Detailed information on specific conditions and antiplatelet agents is not always available, and further advice may be required. When consulting with a proceduralist about the cessation of antiplatelet agents in relation to risk and urgency of procedure it is important to consider the following key questions:

- What is the indication for the antiplatelet agent(s)?
- What is the specific procedure being considered? Noting that spinal, intracranial and urological procedures will have a higher risk of bleeding.
- What is the patient's underlying medical condition and cardiovascular risk profile?
- What is the duration and type of antiplatelet therapy the patient is currently receiving?
- What are the risks of periprocedural bleeding and thrombotic events?
- Are there alternative strategies to manage antiplatelet agents?
- What is the timeline for the procedure?
- Will the patient require reloading of antiplatelet agent(s)?

Addressing these questions enables the clinicians involved to make an informed decision regarding the cessation and management of antiplatelet agents peri-procedurally. Engaging in a comprehensive discussion with the proceduralist is critical for weighing the potential benefits and risks and ensuring optimal patient outcomes.

Patients with a moderate or high risk of cardiovascular event

For patients with a moderate or high risk of thromboembolism, specialist advice should be sought from the proceduralist and the specialist managing the antiplatelet agents.

Patients with a low risk of cardiovascular event

Bleeding risk for anti-platelet therapy is classified differently than for anticoagulant therapy. This is due to the less significant impact on the rate of major bleeding complication of these medications.

Specialist advice should be sought from the proceduralist and prescribing physician for patients undergoing high- bleeding risk procedures, including “closed space” surgery or surgery/surgeries with significant risk of major bleeding. For example:

- intracranial surgery
- transurethral resection of the prostate
- posterior segment ophthalmic surgery
- transurethral resection of the prostate
- major plastic reconstructive procedures. (Cardiac Society of Australia and New Zealand 2010).

In some circumstances, for patients undergoing high bleeding risk procedures, aspirin alone may be continued in patients taking dual antiplatelet agents. If antiplatelet agents are to be ceased, they should be ceased according to the timeframes outlined in table 8.

Generally, for patients with a low risk of thromboembolism and a minimal/low risk of procedural bleeding, aspirin can be continued. For patients taking dual antiplatelet agents, generally aspirin can be continued however other antiplatelet agents should be ceased according to table 8.

Post procedure

The treating proceduralist should advise when antiplatelet agents can be recommenced. Generally antiplatelet agents should be recommenced as soon as possible following the procedure.

The need for reloading with antiplatelet agents during the post procedural period depends on several factors, including the patient’s underlying cardiovascular risk, the type and urgency of surgical procedure and the risk of periprocedural bleeding. Reloading is often considered in patients who require long-term antiplatelet treatment to prevent thrombotic events.

Table 8 provides general advice regarding loading doses when reinitiating antiplatelet agents. The decision to reload with an antiplatelet agent must be carefully evaluated with regard to thrombotic risk and the potential for increased bleeding. Collaboration between the proceduralist and treating physician to determine the need for reloading should occur so that antiplatelet agents may be resumed as soon as feasible.

Table 8: Recommended time interval between discontinuation of antiplatelet agents pre-procedure (if required) and loading dose when reinitiating[a]

Antiplatelet agent	When to cease regular dose of antiplatelet agent (if required)	Loading dose when reinitiating antiplatelet agent	Maintenance dose
aspirin	At least **5 days** prior	300 mg once; then resume maintenance dose	100 mg daily
clopidogrel	At least **5 days** prior	300 mg once; then resume as usual	75 mg daily
ticagrelor	At least **5 days** prior	180 mg once; then resume as usual	90 mg twice daily

[a] Dosing information as per Hall and Mazer (2011).

4 Periprocedural management of anticoagulant and antiplatelet agents for patients requiring neuraxial procedures

Neuraxial procedures include lumbar puncture and insertion or removal of spinal or epidural catheter (Kietaibl et al. 2022). In general, neuraxial procedures for therapeutically anticoagulated patients is **not** recommended. Specialist anaesthetic advice should be sought for patients receiving anticoagulant or antiplatelet therapy who require neuraxial procedures.

The risk of epidural or spinal haematoma is greater with traumatic or repeated spinal/epidural puncture. The risk of epidural or spinal haematoma is increased with the use of indwelling catheters, and these should be avoided in patients requiring therapeutic anticoagulation.

4.1 Warfarin and heparins

The below table provides general guidance on the recommended time interval between discontinuation of therapeutic and prophylactic parenteral anticoagulation in neuraxial procedures (table 9). It is important to consider individual risk factors and patient-specific factors when determining the appropriate timing for anticoagulation.

Table 9: Management of prophylactic and therapeutic heparin and warfarin for isolated neuraxial procedures[a]

Medication	Dosing	Before catheter insertion ***Minimum*** *time after last anticoagulant dose until insertion*	While epidural catheter in place *Delay from epidural insertion until next anticoagulant dose*	Prior to catheter removal ***Minimum*** *time after last anticoagulant dose until removal of epidural catheter*	After catheter removal ***Minimum*** *time after epidural catheter removal and next anticoagulant dose*
Unfractionated heparin	**Therapeutic** Intravenous dosing	Withhold infusion for at least 6 hours **AND** Check the aPTT is within the normal ranges (if not a longer time will be needed)	Do not administer until at least 1 hour post insertion Wait 24 hours if a 'bloody' tap	Withhold infusion for at least hours 6 hours	Recommence infusion (without bolus) after at least 1 hour after
	Prophylactic Subcutaneous dosing (daily dose up to 15,000 units)	Withhold for at least 6 hours **OR** ensure normal aPTT is within the normal range	Do not administer until 1 hour post insertion	Withhold for at least 6 hours	Recommence after at least 1 hour
Low molecular weight heparin	**Therapeutic**	Withold dose for at least 24 hours	Do not administer until 12 hours post insertion	Withhold dose for at least 24 hours	Recommence after at least 4 hours[b]
	Prophylactic	Withhold for at least 12 hours	Do not administer until 12 hours after insertion	Withhold for at least 12 hours	Recommence after at least 4 hours
Warfarin	**Therapeutic** Full dose	Withhold for 5 days **AND** ensure INR < 1.5	**CONTRAINDICATED**	Ensure INR < 1.5	Do not administer until 4 hours after

[a] This table is based on the Australian and New Zealand college of Anaesthetics and Faculty of Pain Medicines: Acute Pain Management and the expert opinion from within the Anticoagulant Medicines Working Party. Timings and directions may differ from the approved Product Information.

[b] For post procedural therapeutic LMWH dosing, commencement should be at least 24 hours for low bleeding risk and 48-72 h post-procedure with high bleeding risk.

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4.2 Direct Oral Anticoagulants (DOACs)

Spinal or epidural anaesthesia is contraindicated in patients receiving the therapeutic dose of a DOAC. If a decision has been made to cease therapeutic dose of a DOAC prior to a procedure to enable planned epidural or spinal anaesthesia, therapy should be ceased according to periprocedural guidelines (table 6). If therapy has not been ceased with sufficient time to predict absence of anticoagulant effect, then epidural or spinal anaesthesia should be avoided unless laboratory testing establishes the absence of anticoagulant effect based on specific anticoagulant levels.

For diagnostic lumbar puncture when the test indication may be urgent a shared assessment, risk stratification and management decision in conjunction with the treating physician should guide duration of DOAC cessation. A two-half-life cessation interval may be considered.

Table 10 provides general guidance regarding timing of DOAC doses in relation isolated neuraxial procedures, when not undergoing surgical procedures. Longer periods apply for patients with renal impairment. The recommendations in this table should be used in consultation with specialist medical advice.

VTE prophylaxis dose

There is limited data on the safety of prophylactic dose of a DOAC's use whilst a patient has an epidural catheter in situ. Prophylactic dose administration is not recommended for patients who have an epidural catheter in situ.

Table 10: Management of DOACs in relation to isolated neuraxial procedures [a]

Medication and dosing	Renal function (CrCl)	Before catheter insertion *Minimum time after last anticoagulant dose*	While epidural catheter in place *Delay from epidural insertion until next anticoagulant dose*	Prior to catheter removal *Minimum time after last anticoagulant dose until removal of epidural catheter*	After catheter removal[b] *Minimum time after epidural catheter removal and next dose of anticoagulant dose*
APIXABAN 2.5 mg BD	≥ 25 mL/min	Withhold for 36 hours[c]	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	< 25 mL/min	Seek specialist advice with haematologist			**CONTRAINDICATED**
APIXABAN 5 mg BD OR 10 mg BD	≥ 25 mL/min	Withhold for 3 days prior	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	< 25 mL/min	Seek specialist advice with haematologist			**CONTRAINDICATED**
RIVAROXABAN 2.5 mg BD OR 10 mg daily	≥30 mL/min	Withold for 24 hours prior	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	< 30 mL/min	Seek specialist advice with haematologist			**CONTRAINDICATED**
RIVAROXABAN 15 mg daily 15 mg BD OR 20 mg daily	≥ 30 mL/min	Withold for 3 days prior	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	< 30 mL/min	Seek specialist advice with haematologist			**CONTRAINDICATED**
DABIGATRAN 220 mg daily OR 150 mg daily	≥ 30 mL/min	Withhold for 48 hours	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	< 30 ml/min	Seek specialist advice with haematologist	**CONTRAINDICATED**	**CONTRAINDICATED**	**CONTRAINDICATED**
DABIGATRAN 150 mg BD 110 mg BD	≥80 mL/min	Withhold for 3 days prior	**CONTRAINDICATED**	**CONTRAINDICATED**	Recommence at least 6 hours after removal.
	50 – 79 mL/min	Withhold for 4 days prior			Recommence at least 6 hours after removal.
	30 – 49 mL/min	Withhold for 5 days prior			Recommence at least 6 hours after removal.
	< 30 mL/min	Seek specialist advice with haematologist			**CONTRAINDICATED**

[a] This table is based on literature including Douketis et al. (2017), Douketis et al. (2022), Schug et al. (2020) and Kietaibl et al. (2022), as well as the expert opinion from within the Anticoagulant Medicines Working party. Timings and directions may differ from the approved Product Information.
[b] A longer delay is required if there are multiple punctures or traumatic insertion of spinal or epidural catheter.
[C] Consider a longer withholding time (i.e. 3 days) if a patient taking apixaban 2.5 mg twice daily has at least **two** of the following criteria: 80 years or older, bodyweight ≤60 kg, or creatinine greater than 133 micromol/L.

4.3 Nonsteroidal anti-inflammatory drugs (NSAIDs) and aspirin

NSAIDs including aspirin alone do not significantly increase the risk of spinal haematoma but should be regarded as a risk factor if combined with other anticoagulants (Schug et al. 2020). Neuraxial procedures should be avoided in patients receiving NSAIDS (including aspirin) along with another anticoagulant.

COX-2 selective agents (for example, celecoxib) have less antiplatelet action and are considered safe.

4.4 Antiplatelet agents (other than NSAIDs or aspirin)

If a neuraxial procedure is considered absolutely necessary, antiplatelet agents (other than NSAIDs or aspirin) should be ceased in accordance with table 11 (Schug et al. 2020). Antiplatelet agents should not be resumed until the catheter is removed.

If a decision has been made to cease dose of antiplatelet therapy prior to the procedure to enable planned epidural or spinal anaesthesia, therapy should be ceased according to table 8.

Note: the concurrent use of herbal medications (such as garlic, ginko or ginseng) with other antithrombotic drugs may increase bleeding risk.

Table 11: Recommended time interval between discontinuation and recommencement of antiplatelet agents in relation to neuraxial procedures

Antiplatelet agent	When to cease antiplatelet therapy	Dosing while epidural catheter in place	Dosing after epidural catheter removal
clopidogrel	At least **5 days** prior	May be used without loading dose	6 hours after epidural catheter removal if loading dose given **OR** post procedural 24 hours after epidural catheter removal
ticagrelor	At least **5 days** prior	**CONTRAINDICATED**	6 hours after epidural catheter removal if loading dose given **OR** post procedural 24 hours after epidural catheter removal

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5 Periprocedural management of antithrombotic agents for urgent procedures

The following guidance is for management of antithrombotic agents in the event **of urgent procedures**. For guidance regarding management in **elective procedures** see section 3. For guidance regarding management in **neuraxial procedures** see section 4.

5.1 Warfarin

The management of urgent procedures in patients receiving warfarin is dependent on assessing the patient's INR levels and surgical bleeding risk. For patients receiving warfarin with an INR ≥ 1.5, specialist haematology advice is required. If the INR is < 1.5, the procedure can proceed safely.

For **non-urgent procedures**, refer to figure 1 in section 3.1.2 for the management of warfarin.

For patients who require **semi-urgent reversal** (for example,12 – 24 hours to procedure) reversal of warfarin, (i.e., the day prior to the procedure) warfarin should be withheld and vitamin K_1 administered. The recommended dose of vitamin K_1 for warfarin reversal in a semi-urgent setting is 3 mg via intravenous injection[4]. A dose of intravenous vitamin K_1 will have an effect within 12 hours, while oral will have an effect within 24 hours of administration (Pharmaco Australia Ltd. 2025).

If **immediate reversal** is required in the case of urgent procedures or major trauma, vitamin K_1 should be administered intravenously in combination with a prothrombin complex concentrate (PCC) **or** fresh frozen plasma (if PCC is contraindicated). Co-administration of vitamin K_1 and a PCC leads to sustained reversal effect (Tran et al. 2013).

In January 2024, the National Blood Authority of Australia announced a transition from Prothrombinex®-VF, a 3-Factor prothrombin complex concentrate (3F-PCC) to Beriplex®, a 4-Factor prothrombin complex concentrate (4F-PCC) (Robinson et al. 2024).

The transition from Prothombinex-VF to Beriplex is expected to occur by late April 2025; however, dates for stock depletion may vary at a local level. The staged transition began with the interim use of Beriplex P/N, an imported product in July 2024. The final transition to Beriplex AU, an Australian manufactured PCC is expected to begin from March 2025. Different PCC products **must not** be combined together in a single dose.

Unlike Prothrombinex-VF, Beriplex **does not** require co-administration of FFP because it contains factor VII (Robinson et al. 2024).

Caution: Beriplex contains up to 200 units of heparin per 100 mL reconstituted solution and is **contraindicated** in patients with known history of Heparin-Induced Thrombocytopenia (HIT) (CSL Behring GmBH 2022; CSL Behring Australia Pty Ltd 2024).

Please note, that the process of reversing warfarin for urgent surgery with Beriplex should be individualised, taking into account the patient's initial INR, the target INR, thrombotic risk, and potential for high-risk bleeding with invasive procedures.

When prescribing for patients weighing more than 100 kg, the dose of 4F-PCC should be calculated based on capped 100 kg body weight and a maximum dose of 50 units/kg.

The rapid reversal effect of Beriplex on an elevated INR occurs within 30 minutes, and for Prothrombinex-VF within 15 minutes. If PCC is not available or contraindicated, use fresh frozen plasma (FFP) 10 – 15 mL/kg (Tran et al 2013; Robinson et al. 2024) for warfarin reversal.

Table 12: Recommended PCC doses for periprocedural reversal of warfarin therapy to reduce INR to ≤ 1.3 in non-bleeding patients.

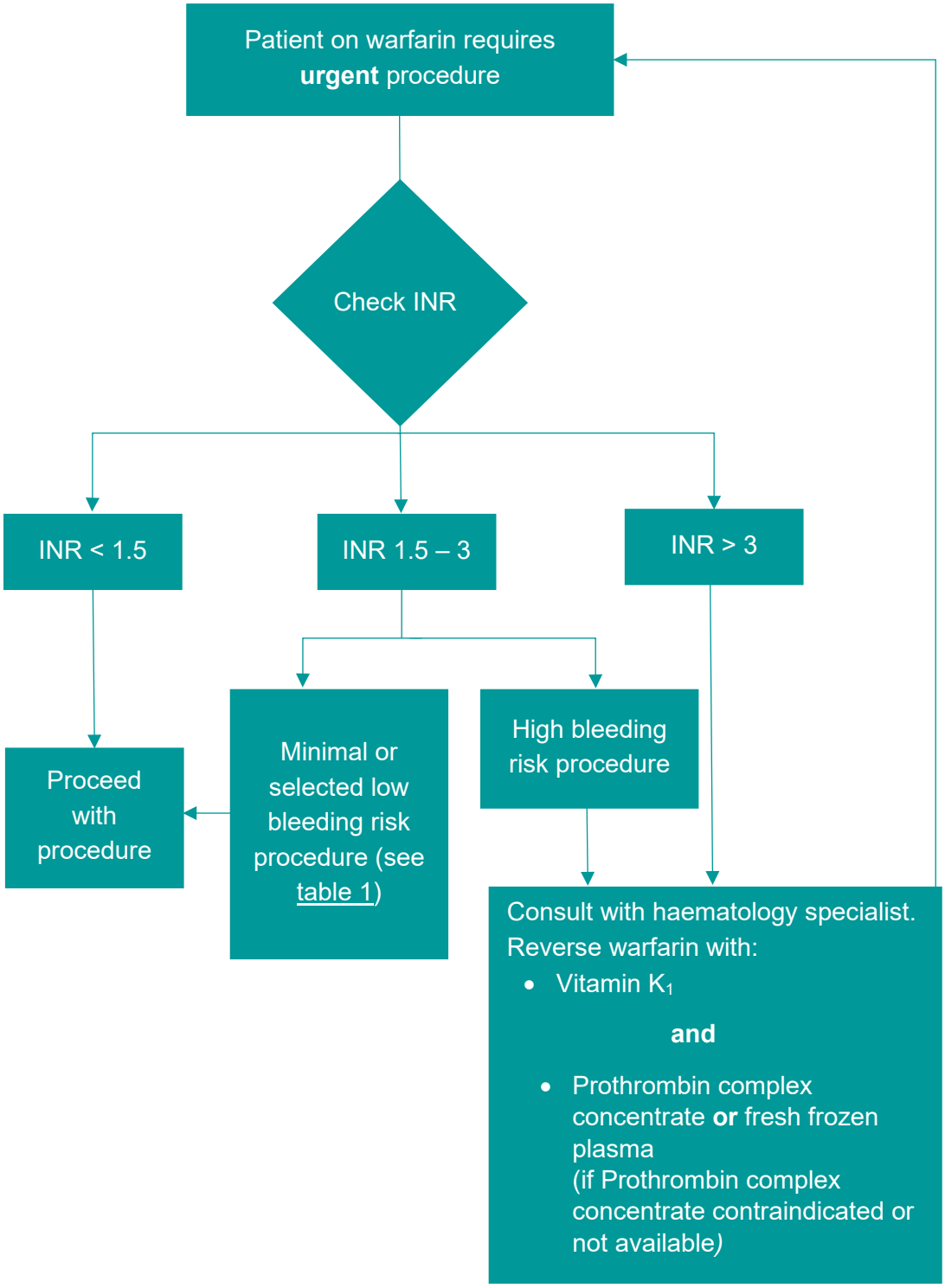
PCC	Initial INR	Dose required to reduce INR to ≤ 1.3[c]
Beriplex[ab]	1.5 – 2.5	30 units/kg
	2.6 – 3.5	35 units/kg
	3.6 – 10	50 units/kg
	> 10	50 units/kg
Prothrombinex-VF (in combination with FFP)	1.5 – 2.5	30 units/kg
	2.6 – 3.5	35 units/kg
	3.6 – 10	50 units/kg
	> 10.0	50 units/kg

[a] Please note, the dosing for Beriplex has been taken from guidance developed by the Thrombosis and Haemostasis Society of Australia and New Zealand (THANZ) for periprocedural reversal of warfarin (Robinson et al. 2024) and may differ from the Australian Product information which considers actively bleeding patients.

[b] For a target INR of 1.4 to 2.0, lower doses are recommended. See THANZ guidance for further information.

[c] When administering Beriplex, the recommended rate of administration is 3 units/kg body weight/minute with a maximum of 210 units/minute.

Figure 2: Warfarin reversal for urgent procedures flowchart



5.2 Direct oral anticoagulants

Further information on the availability and use of reversal agents for patients taking a DOAC is available in the DOAC Guidelines.

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Abbreviations / Definitions

Abbreviation/definition	Term
AF	Atrial fibrillation
aPTT	Activated Partial Thromboplastin Time
Bridging	Bridging anticoagulation involves the administration of a short-acting anticoagulant, typically a low molecular weight heparin (LMWH), during the interruption of a longer-acting anticoagulant, typically warfarin.
CrCl	Creatinine clearance (estimated using the Cockroft-Gault equation)
DOAC	Direct oral anticoagulant
DVT	Deep vein thrombosis
FBC	Full blood count
INR	International normalised ratio
LAC	Lupus anticoagulant positive
LMWH	Low molecular weight heparin
PCC	Prothrombin complex concentrate
PT	Prothrombin time
TT	Thrombin time
TIA	Transient ischaemic attack
VTE	Venous thromboembolism

Appendices

Patient Communication Forms

Please note that state-wide forms for the management of anticoagulant medications before and after medical procedures are currently under development.

It is essential that medical teams engage in adequate verbal and written communication with each patient regarding the specific clinical care plan and document the information provided to patients within the electronic medical record. This includes ensuring that patients are fully informed about the potential risks and benefits and providing them with comprehensive explanations to ensure shared decision making and mutual understanding of their plan.