WARFARIN:
PERI-OPERATIVE MANAGEMENT

OBJECTIVE:

- To provide an approach to the perioperative management of warfarin–treated patients who require an elective or urgent surgery/procedure.
- To provide an approach for bridging anticoagulation if needed during warfarin interruption.

BACKGROUND:

Bridging anticoagulation refers to giving a short-acting anticoagulant, typically a low molecular weight heparin (LWMH), before and after surgery to minimize the time that patients are not anticoagulated.

INDICATIONS FOR BRIDGING ANTICOAGULATION:

There are no strong evidence-based indications for bridging anticoagulation; bridging is suggested in patients at high risk for thromboembolism, not suggested in low-risk patients and optional in intermediate-risk patients based on individual patient characteristics.

BRIDGING ANTICOAGULATION OPTIONS:

Pre- and post-operative dosing:

- Subcutaneous (SC) therapeutic-dose LMWH: enoxaparin 1 mg/kg twice daily or 1.5 mg/kg once daily; dalteparin 100 IU/kg twice daily or 200 IU/kg once daily; or tinzaparin 175 IU/kg once daily.
- Intravenous (IV) unfractionated heparin (UFH) to achieve a therapeutic activated partial thromboplastin time (aPTT) defined according to local laboratory parameters.

Alternative post-operative dosing:

- In patients having a high-bleeding-risk surgery/procedure, an alternate post-operative management option is a prophylactic dose of SC LMWH: enoxaparin 40 mg once daily; dalteparin 5000 IU once daily; or tinzaparin 4500 IU once daily.
- In patients having a very-high-bleeding-risk surgery/procedure, post-operative therapeutic-dose LMWH bridging should be avoided; alternate options are low-dose LMWH, delaying anticoagulation until the high bleeding risk decreases or resuming warfarin alone.

MONITORING:

There is no need for laboratory monitoring of bridging with SC LMWH. Monitoring is required for bridging with IV UFH (aPTT).

ADVERSE EFFECTS:

Bridging is associated with a 3% risk for major bleeding and a 10-15% risk for minor bleeding. Bridging should be used carefully, as suggested in this clinical guide, to minimize this bleeding risk.
PERI-PROCEDURE MANAGEMENT QUESTIONS AND ANSWERS:

Is peri-procedure warfarin interruption always needed?

Deciding if warfarin interruption is needed is based on the bleeding risk of the surgery/procedure (see Table 1). Most major procedures require warfarin interruption but some (e.g. dental, cataract surgery, minor skin procedures) do not need warfarin interruption.

**TABLE 1. PATIENT STRATIFICATION FOR BLEEDING RISK**

<table>
<thead>
<tr>
<th>HIGH:</th>
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<tr>
<td>- Any surgery or procedure with neuraxial (spinal or epidural) anesthesia</td>
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<td>- Neurosurgery (intracranial or spinal)</td>
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<td>- Cardiac surgery (e.g. CABG, heart valve replacement)</td>
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<td>- Major intra-abdominal surgery</td>
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<td>- Major vascular surgery (e.g. aortic aneurysm repair, aortofemoral bypass)</td>
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<td>- Major orthopaedic surgery (e.g. hip or knee replacement)</td>
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<td>- Lung resection surgery</td>
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<td>- Urological surgery (e.g. prostatectomy, bladder tumour resection)</td>
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<td>- Extensive cancer surgery (e.g. pancreas, liver)</td>
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<td>- Intestinal anastomosis surgery</td>
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<td>- Reconstructive plastic surgery</td>
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<td>- Selected procedures (e.g. kidney biopsy, prostate biopsy, cervical cone biopsy, pericardiocentesis, colonic polypectomy)</td>
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<th>MODERATE:</th>
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<td>- Other intra-abdominal surgery (e.g., laparoscopic cholecystectomy or hernia repair)</td>
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<td>- Other general surgery (e.g. breast)</td>
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<td>- Other intrathoracic surgery</td>
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<td>- Other orthopedic surgery</td>
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<td>- Other vascular surgery</td>
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<tr>
<td>- Non-cataract ophthalmologic surgery</td>
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<td>- Gastroscopy or colonoscopy with biopsies</td>
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<td>- Selected procedures (e.g. bone marrow biopsy, lymph node biopsy)</td>
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<td>- Complex dental procedure (e.g. multiple tooth extractions)</td>
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<th>LOW (NON-DENTAL):</th>
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<tr>
<td>- Cataract surgery</td>
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<td>- Dermatologic procedures (e.g. biopsy)</td>
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<tr>
<td>- Gastroscopy or colonoscopy without biopsies</td>
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<tr>
<td>- Coronary angiography</td>
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<tr>
<td>- Permanent pacemaker insertion or internal defibrillator placement (if bridging anticoagulation is not used)</td>
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<tr>
<td>- Selected procedures (e.g. thoracentesis, paracentesis, arthrocentesis)</td>
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LOW (DENTAL):
- Dental extractions (1 or 2 teeth)
- Endodontic (root canal) procedure
- Subgingival scaling or other cleaning

Is bridging anticoagulation needed during warfarin interruption?
The need for bridging is driven by patients’ estimated risk for thromboembolism (see Table 2).

**TABLE 2. PATIENT STRATIFICATION FOR THROMBOEMBOLISM RISK**

**HIGH THROMBOEMBOLIC RISK (BRIDGING ANTICOAGULATION SUGGESTED):**
- any mechanical prosthetic mitral valve
- older generation (cage-ball, tilting disc) mechanical aortic valve
- chronic atrial fibrillation (valvular or non-valvular) with a CHADS2 score* of 5-6
- recent (within 3 months) arterial thromboembolism (stroke, systemic embolism, transient ischemic attack [TIA])
- recent (within 3 months) venous thromboembolism (deep vein thrombosis, pulmonary embolism)†
- prior arterial or venous thromboembolism during appropriate interruption of warfarin
- severe thrombophilia with history of venous thromboembolism (e.g. deficiency of protein C, protein S or antithrombin, antiphospholipid syndrome)

**INTERMEDIATE THROMBOEMBOLIC RISK (BRIDGING ANTICOAGULATION OPTIONAL AND BASED ON INDIVIDUAL PATIENT CHARACTERISTICS):**
- newer generation (bileaflet) mechanical aortic valve
- prior arterial or venous thromboembolism within last 3-12 months

**LOW-RISK (BRIDGING ANTICOAGULATION IS NOT RECOMMENDED):**
- chronic atrial fibrillation (valvular or non-valvular) with a CHADS2 score* of 0-4
- prior venous thromboembolism over 12 months ago
- bioprosthetic heart valve

*CHADS2 score estimates the risk of stroke in patients with non-valvular atrial fibrillation. The score is the total points for the presence of congestive heart failure (1), hypertension (1), age > 75 yrs (1), diabetes (1), stroke, transient ischemic attack or systemic embolism (2).

†Consider a temporary inferior vena cava filter to be inserted after warfarin interruption and prior to surgery for patients in whom surgery is planned within 1 month of a proximal DVT; it can be left in situ for 1-2 weeks until therapeutic anticoagulation is re-established.

What is the peri-operative anticoagulant management after warfarin interruption?
A suggested management algorithm is shown in the Figure 1.
Figure 1. Peri-operative Management of Warfarin-Treated Patients Before and After Surgery/Procedure

Is surgery an elective or emergency/urgent?

Elective

Is warfarin interruption needed in patients who are undergoing elective surgery?

No

Bleeding risk associated with the procedure is low

No need to stop warfarin before surgery or procedure

Patient at low risk for thromboembolism (suggest not bridging)

Day -5: stop warfarin (last dose Day -6)
Day -1: INR testing (if INR >1.5, administer vitamin K1 1.0 to 2.0 mg orally)
Day 0: resume warfarin on evening after surgery if patient drinking fluids
Day +1 to +3: resume warfarin when patient drinking fluids

Yes

Bleeding risk associated with procedure is intermediate or high

Is bridging anticoagulation needed during warfarin interruption?

No

Patient at low risk for thromboembolism (suggest not bridging)

Day -6: last dose of warfarin
Day -5: no warfarin; no LMWH SC/UFH IV
Day -4: no warfarin; no LMWH SC/UFH IV
Day -3: no warfarin; start LMWH SC/UFH IV
Day -2: no warfarin; continue LMWH SC/UFH IV
Day -1: no warfarin and check INR (if >1.5, give vitamin K1 1-2 mg PO); give LMWH SC in morning (give only half of daily dose) if very high risk for stroke; continue UFH IV
Day 0 pre-op: no warfarin; no LMWH SC; stop UFH IV 4 hrs before surgery
Day 0 post-op: assess surgical site for hemostasis; resume warfarin in evening if patient drinking
Day +1 to +3: resume warfarin if patient drinking; resume LMWH SC or UFH IV when hemostasis is secured (no earlier than 12 hrs post-op)
Day +5 to +6: stop LMWH SC or UFH IV when INR is therapeutic

> 24 hours

Give IV vitamin K1 2.5-5 mg, and prothrombin complex concentrate (PCC) 30 IU/kg (if needed)

< 24 hours

Give IV vitamin K1 2.5-5 mg, and PCC (if needed)

Emergency/Urgent

Patient at intermediate or high risk for thromboembolism (bridging suggested in high-risk, possibly in intermediate-risk)

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When is it safe to resume bridging anticoagulation after surgery/procedure?
The timing of post-procedure resumption of bridging depends on:
a) the bleeding risk of the procedure (see Table 3),
b) whether there has been adequate post-operative hemostasis (based on wound inspection and drainage tubes to detect bleeding), and
c) the class of anticoagulant used.

Minimizing bleeding is important because of associated morbidity; a delay in warfarin resumption because of bleeding also exposes patients to an increased thromboembolic risk.

**Table 3. Post-operative resumption of bridging anticoagulation**

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<tr>
<th>High bleeding risk procedure:</th>
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<tr>
<td>• therapeutic-dose LMWH/UFH, starting 48-72 hours after surgery</td>
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<tr>
<td>• <em>alternate management</em>: low-dose LMWH, starting 12-24 hours after surgery (i.e. day after surgery) or resume warfarin alone with no post-operative LMWH/UFH</td>
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<th>Moderate bleeding risk procedure:</th>
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<tr>
<td>• therapeutic-dose LMWH/UFH, starting 24-48 hours after surgery</td>
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<th>Low bleeding risk procedure:</th>
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<tbody>
<tr>
<td>• therapeutic-dose LMWH/UFH, starting 12-24 hours after surgery (i.e. day after surgery)</td>
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**Special considerations:**

**Dental procedures:** In patients having 1-2 dental extractions or endodontic (root canal) procedures, warfarin can be safely continued. To reduce the incidence of gingival bleeding, patients can take oral tranexamic acid mouthwash (5 mL just before the procedure, and 2-3 times daily after the procedure until bleeding subsides). An alternative approach is to hold warfarin for 2 days before the dental procedure. Warfarin can be resumed on the evening after the procedure.

**Colonoscopy & gastroscopy:** Warfarin interruption will be needed for most patients who undergo colonoscopy because the potential for biopsies and/or polyp removal cannot always be determined beforehand. Caution is warranted after removal of large (>1 cm) polyps since bleeding can occur 2-7 days after polypectomy due to dislodgement of eschar. Polyp-related bleeding may be reduced with endoscopic application of clips to the polyp stalk.

**Minor diagnostic or other procedures:** Caution is warranted with anticoagulation after selected diagnostic tests (e.g. biopsy of kidney, liver or prostate; endoscopic retrograde cholangiopancreatography [ERCP] with sphincterotomy) or minor surgeries (e.g. pacemaker placement) which are associated with increased bleeding risk.

**Peri-operative management of patients receiving antiplatelet therapy:** Please see the specific guides on clopidogrel, ticagrelor, prasugrel, and ASA, as well as the 2012 Canadian Cardiovascular Society Guidelines on Antiplatelet Therapy, which discusses peri-operative management [www.ccsguidelineprograms.ca/].
**Pediatrics:** Pediatricians with expertise in thromboembolism should manage, where possible, pediatric patients on warfarin. Adult guidelines are appropriate in children although holding warfarin 3 days instead of 5 days is usually sufficient. Consultation with an experienced pediatric hematologist and cardiologist (as appropriate) is recommended to determine the need for bridging anticoagulation.

**Other relevant Thrombosis Canada clinical guides:**
- Warfarin
- Unfractionated Heparin and Low Molecular Weight Heparin

**References:**


**Date of version:** 2016Sept15

*Please note that the information contained herein is not to be interpreted as an alternative to medical advice from your doctor or other professional healthcare provider. If you have any specific questions about any medical matter, you should consult your doctor or other professional healthcare providers, and as such you should never delay seeking medical advice, disregard medical advice or discontinue medical treatment because of the information contained herein.*