WRHA Surgery Program

Venous Thromboembolism Prophylaxis Clinical Practice Guideline

A guideline for all care providers under the WRHA Surgery Program for the Adult Surgical Inpatient Population including Gynecological Surgery

Authorship:
Lorena Thiessen - Quality Officer, WRHA Surgery Program
Lanette Siragusa - Program Director, WRHA Surgery Program
Tricia Carta – Clinical Nurse Specialist, HSC
Dr. Amit Chopra – Anaesthesiologist, WRHA
Trica (Pat) Garrioch – Continuing Education Instructor, SBH
Dr. Don Houston – Hematologist, WRHA
Clint Huber – Pharmacist, WRHA Pharmacy Program
Bruce Knoll – Program Manager, WRHA Anaesthesia Program
Graciana Medeiros – Perioperative Educator, WRHA Surgery Program
Kavitha Nadarajah-Gbeve – Surgical Inpatient Educator, GH
Dr. Sarvesh Logsetty - General Surgeon, WRHA
Dr. Joel Loiselle – Anaesthesiologist, WRHA
Elizabeth Reddoch – Quality Officer, WRHA Women’s Health
Violet Sung – Quality Officer, WRHA Surgery Program
Dr. Thomas Turgeon - Orthopaedic Surgeon, WRHA
Dr. Michael West- Neurosurgeon, WRHA
WRHA Venous Thromboembolism Prophylaxis Clinical Practice Guidelines for the Adult Surgical Inpatient Population including Gynecological Surgery.

POLICY STATEMENT

Venous thromboembolism (VTE) is one of the most common complications of hospitalization, resulting in significant patient morbidity, and it is a preventable cause of hospital related mortality. It is WRHA policy that evidence-informed practice be followed to ensure that hospitalized patients are assessed for their risk of VTE and that they receive appropriate thromboprophylaxis, if indicated.8

The following is a suggested guideline, and does not replace ongoing clinical assessment and professional judgment.

DEFINITIONS & ABBREVIATIONS

Deep Vein Thrombosis (DVT) “is a thrombus (blood clot) occurring in one or more deep veins, especially in the legs, where it may produce leg swelling and/or pain”.5

Low molecular weight heparin - LMWH (dalteparin, or formulary equivalent).

LMWH Usual Prophylactic Dosing- typically dalteparin 5000 units subcutaneously once daily.

LMWH Therapeutic Dosing- dalteparin 200 units/kilogram subcutaneously once daily.

Low dose unfractionated heparin- LDUH (typically 5000 units, subcutaneously twice or three times daily)

Major Bleeding: “a bleeding event that results in one or more of the following: death, decrease in haemoglobin of 20 or more g/L, transfusion of 2 or more units of blood, bleeding into a retroperitoneal, intracranial or intraocular site, a serious or life-threatening clinical event, or a surgical or medical intervention”.2

Mechanical Prophylaxis: Non pharmacological treatments for the prevention of VTE, such as anti-embolic stockings, intermittent pneumatic compression devices, or sequential compression devices.

Pharmacological Prophylaxis: Medications for the prevention of VTE, such as LMWH, LDUH.

Pulmonary Embolism (PE) “is a thrombus that arises in a deep vein and that embolizes to one or more of the pulmonary arteries where it may result in breathlessness, chest pain, haemoptysis, syncope or death”.5,8

Neuraxial catheters: Pertaining to catheters inserted for anaesthesia and/or analgesia near nerve structures within the spinal column including epidural, caudal, intrathecal (spinal) and combined techniques.9
**Thromboprophylaxis** “refers to the use of mechanical methods or anticoagulant medication to prevent VTE from developing in patients who are at risk”. ⁵

**Venous Thromboembolism (VTE)** “is a thromboembolic event (blood clot) that develops within the venous system and includes both Deep Vein Thrombosis and Pulmonary Embolism” ⁵, ⁸

**WRHA THROMBOPROPHYLAXIS POLICY**

1.1 To improve patient outcomes through compliance with evidence-informed practice on VTE prophylaxis. ⁸

1.2 To reduce preventable harm to patients from hospital-acquired and community-acquired venous thromboembolism by having sites, facilities, and/or programs develop processes and/or tools for VTE risk assessment and determine appropriate thromboprophylaxis. ⁸

1.3 To ensure the communication about a patient’s VTE risk and care plan among service care providers at each transition point across the continuum. ⁸

1.4 To promote staff and patient education about VTE risks, signs and symptoms, prophylaxis and prevention. ⁸

1.5 To demonstrate regional consistency and compliance with Accreditation Canada requirements for VTE Prophylaxis. ⁸

**THROMBOPROPHYLAXIS GUIDELINES**

**Background and Rationale for Thromboprophylaxis**

- More than 50% of venous thromboembolic events in the community are found to be in association with factors related to hospitalization, are a leading cause of long term morbidity and death and significantly impact health care. ¹⁰, ¹¹, ¹²

- Without thromboprophylaxis, 10-80% of hospitalized patients will develop asymptomatic DVT. ⁵, ¹³

- VTE is a common cause of preventable hospital mortality. ¹, ², ⁵, ⁶, ¹⁰

- VTE, whether suspected or diagnosed, is associated with increased hospital length of stay and consumption of significant resources. ², ⁵, ⁶, ⁷, ¹⁴,

- Pharmacological thromboprophylaxis in major general surgery procedures was found to significantly reduce the rate of symptomatic VTE (by 60-70%), DVT, PE, fatal PE and all-cause mortality. ¹⁰

- In a large meta-analysis IPC was more effective than no prophylaxis in reducing DVT and PE without any effect on mortality. ¹⁵

- The routine use of thromboprophylaxis for most hospitalized patients, has been recommended and supported through evidence-based guidelines for more than 25 years. ⁵, ¹⁶
• Evidence supports appropriate thromboprophylaxis use in patients at risk, and has been ranked as the number one patient safety practice.\textsuperscript{5, 12, 17, 18}

• As a standard of care, all patients should be assessed and evaluated for VTE prophylaxis, based on consideration of thromboembolic and bleeding risks.\textsuperscript{5, 6, 16, 19}

• Thromboprophylaxis (both mechanical and pharmacological interventions) has repeatedly been shown to be safe and cost effective.\textsuperscript{1, 5, 12, 13, 15, 20, 21}

**PRINCIPLES UNDERLYING THE WRHA THROMBOPROPHYLAXIS GUIDELINES**
(adapted from Sunnybrook Guidelines\textsuperscript{5})

1. **Appropriate** thromboprophylaxis (as defined by):\textsuperscript{5}
   
a. *Modality*: should be considerate of the patient’s risks of VTE and bleeding

   b. *Dose*: (if an anticoagulant) should comply with recommended guideline and patient variables (if applicable) such as body weight, or renal failure.

   c. *Timing*: after admission, after surgery, in relation to anaesthetic intervention (peripheral nerve blocks, neuraxial anaesthesia), or after transfer within the institution

   d. *Compliance*: education to enhance patient participation and comprehension of rationale for mechanical and/or pharmacological thromboprophylaxis.

   e. *Duration*: should be appropriate to the patient risk factors, level of mobility, and surgical intervention.

2. **Standardization**- keep the number of *evidenced-based* thromboprophylaxis options to a minimum both within and between patient groups to simplify clinical decision making.\textsuperscript{5}

3. **Routine**- routine thromboprophylaxis should be ordered unless there is a contraindication or an active decision to not provide it, as almost every patient has at least one risk factor for VTE.\textsuperscript{5}

4. If thromboprophylaxis is NOT indicated, **document the reason** for not providing in the patient’s health record.\textsuperscript{8, 22}

5. **Uninterrupted treatment**- doses of LMWH are not held unless there is evidence of bleeding or there is a substantial increase in bleeding risk.\textsuperscript{5} If interrupted, the reason must be documented in the chart.

6. The *administration time* of haemostasis altering medications **must be considered** with the discontinuation or initiation of a spinal, epidural, or a peripheral nerve catheter.\textsuperscript{2, 23} (see Timing section below, and Appendix C).

7. **Embedded in order sets**- the use of routine pre-printed (and eventually *electronic*) order sets are the most effective strategy to ensure that the best practices are followed.\textsuperscript{5, 8} As new order
sets are developed within the WRHA, appropriate evidence-based thromboprophylaxis, consistent with the WRHA thromboprophylaxis policy and guidelines should be addressed.

8. **Reassessment** - with changes in patient condition and at transitions of care within the hospital (upon admission, post-operative, transfer to or from the ICU, transfer to another service), thromboprophylaxis, risks of VTE and bleeding should be reassessed.\(^2,5\) At the time of transfer to another care facility, nursing home, or discharge home, a decision should be made to discontinue thromboprophylaxis (as in most situations) or to recommend and, in some cases to arrange for, thromboprophylaxis to continue after the transition.\(^5\) At time of discharge home, clearly indicate time frames and identify prescriber responsible for follow-up and dose adjustment after discharge. Reassessment is also recommended with any changes to patient condition, with the addition of medications, or with procedural interventions that may affect bleeding risk.

9. **Periodic review** – clinical practice guidelines should be reviewed and updated approximately every four years (or more frequently if new evidence becomes available).\(^5\)

**PROVISION of PHARMACOLOGICAL THROMBOPROPHYLAXIS**

**REMEMBER: Mechanical prophylaxis should be initiated preoperatively, especially with high risk surgical interventions and for patients with one or more high risk factors for VTE.**

**Preoperative:**

- While it is primarily the role of the ‘most responsible physician’ (such as the surgeon) to prescribe appropriate thromboprophylaxis, it is the responsibility of all team members to ensure patients are regularly reassessed, regardless of provision or absence of thromboprophylaxis.
- Individualized care is essential and the patient’s risks for both VTE and bleeding need to be carefully considered along with planned interventions.
- It benefits all patients to have pharmacological agents administered as soon as safely possible, however as some procedures may be contraindicated when these medications are given preoperatively- there must be communication between the anaesthesia and surgery teams prior to administration.
- Generally, pharmacological thromboprophylaxis is initiated postoperatively; however there may be times where appropriate preoperative pharmacological thromboprophylaxis is warranted, with either LDUH or LMWH.
  - Anaesthesia will administer immediate perioperative pharmacological VTE thromboprophylaxis if ordered (by most responsible physician), for all elective patients, and will document administration on the Medication Administration Record and/or Electronic Patient Record, if indicated, and in addition to the Anaesthetic Record. If the decision is to hold the prescribed pharmacological agent, timely and direct communication to the surgeon should occur. This may occur in the briefing period in the operating room or earlier if time permits.
In emergent surgical situations, direct communication regarding pharmacological thromboprophylaxis or mechanical prophylaxis should occur in the briefing period when appropriate between the surgeon (or prescribing designate), and the anaesthesiologist. The discussion must occur prior to administration. This recommendation, or another option to address this emergent population, should be decided and agreed upon by site Surgical Leadership, involving Anaesthesia.

Postoperative:

- Start pharmacological VTE prophylaxis as soon as safely possible after the risk assessment has been completed. See Appendix A and C.
- LMWH, if indicated may be started in the evening after elective surgery, with consideration of all haemostasis altering medications, interventions and risks. (i.e. greater than 6-8 hours after surgery). See Appendix A and C.
- Do not offer pharmacological VTE prophylaxis to patients with any of the risk factors for bleeding (Appendix A) unless the risk of VTE outweighs the risk of bleeding.
- Duration of thromboprophylaxis should generally continue until discharge and return of mobility, unless prolonged pharmacological thromboprophylaxis is recommended. It is suggested by the National Institute for Health and Clinical Excellence (NICE) guidelines to continue the addition of pharmacological thromboprophylaxis for 5-7 days postoperatively (or longer in some cases); however we acknowledge that circumstances requiring patients to remain in hospital are generally risk factors for VTE and therefore may benefit from VTE prophylaxis until discharge. All patients need individual assessment.

Patient specific considerations

As there is no absolute directive for all patient populations or even each surgical specialty- the need for individualized care cannot be emphasized strongly enough. Consideration of all risks towards a propensity to bleed or clot need to be weighed along with surgical and anaesthetic interventions, the patient’s dynamic condition, and their preference and informed choice (when possible). Timely communication to all involved team members is essential and will further assist to reduce the risk of adverse events.

Day surgery patients:

As with all patients, an individualized assessment and approach is required for the thromboprophylactic management and care of day surgery patients. It is best provided utilizing most recent evidence, consideration of risk factors and patient preference. As much as safely possible, early ambulation is recommended as a minimum.

Surgical Intervention Risk:

Surgical interventions that place patients at high risk of VTE, regardless of the patient’s inherent risk for VTE, automatically qualify for prophylaxis. Bleeding risk must still be considered and if present, mechanical prophylaxis should be strongly considered. (See Appendix A).
Renal Insufficiency:

Approved WRHA Formulary Adult dosing criteria for dalteparin is as follows:

- **Avoid dalteparin** if CrCl less than 30 mL/min or if on dialysis *(Exception: If CrCl 10-30 mL/minute, dalteparin may be considered for use in CRITICAL CARE ONLY but should be reassessed after 10-15 days)*
- Preferred alternative – typically Heparin 5000 units subcutaneously every 12 hours

Body Weight Variances:

Approved WRHA Formulary Adult dosing criteria for dalteparin is as follows:

- Usual dose for VTE prophylaxis: dalteparin 5,000 units subcutaneously once daily.
- If body mass index (BMI) is **greater than or equal to 40**: dalteparin 7,500 units subcutaneous daily. (Consult Anaesthesia if dosing preoperatively, or with neuraxial analgesia).
- If body **weight** is less than 40 kg: dalteparin 2,500 units subcutaneous daily.

Patients Under the age of 18:

- For patients under the age of 18 receiving care under the Adult Surgical Program, it is recommended that care providers consult specialty care providers and the Venous Thromboembolism Prophylaxis Practice Guideline for Child Health (Health Sciences Centre).

**GENERAL STATEMENT ON LITERATURE**

These guidelines were primarily developed utilizing the most recent recommendations for prevention of thrombosis and risk assessment from:

- National Institute for Health and Clinical Excellence (NICE) guidelines (2010)
- American Society of Regional Anaesthesia (ASRA) (2010)
- Venous Thromboembolism Prevention - Getting Started Kit Safer Healthcare Now and Sunnybrook Health Sciences Centre guidelines (2012)

For all cited resources, please refer to reference list.

**WRHA General Approach to Thromboprophylaxis**

The underlying principle guiding the use of thromboprophylaxis within the WRHA is that all patients at risk receive appropriate treatment (see Appendix A).

The WRHA’s general approach to thromboprophylaxis involves three steps:

**Step 1: Assess Risk of Thrombosis.** (See Appendix A)

- All patients should be assessed for risk of thrombosis. 8, 5, 19, 25
• Early, frequent mobilization is strongly recommended and patients should be encouraged to be as mobile as possible, especially if no specific thromboprophylaxis is provided.\(^2\),\(^{25}\),\(^{26}\)

• If the surgical intervention does not automatically place the patient at risk for VTE and only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient. (See Appendix A- Box 4)

• If a patient’s clinical status changes significantly, a decision about thromboprophylaxis should be reassessed at that time.\(^2\),\(^8\) Documentation of assessment must be provided.\(^8\)

• For patients with heparin-induced thrombocytopenia, either currently or in the past, LMWH and unfractionated heparin are contraindicated; alternative thromboprophylaxis should be selected and Hematology should be contacted.\(^27\) There may be select circumstances where LDUH or LMWH may still be indicated or utilized in these patients, and should be at the discretion of a hematologist.

**Step 2: Assess Risk of Bleeding.** (See Appendix A)

• For patients who are actively bleeding or have a high risk of bleeding (appendix A), pharmacological prophylaxis is not given.\(^2\) In this situation, mechanical thromboprophylaxis should be considered. Upon additional consideration, if the risk of VTE is greater than the risk of bleeding, pharmacological prophylaxis may be indicated.\(^2\)

• These patients should be reassessed daily for proper use of the mechanical thromboprophylaxis and bleeding risk. This daily re-assessment shall be documented in the patient’s record. When the high bleeding risk decreases, appropriate thromboprophylaxis should be started.

**Step 3: Provide thromboprophylaxis.** *(Note section on “Timing in Relation to Neuraxial Anaesthesia/Analgesia” below)*

(See Appendix B)

• There is evidence that dual therapy, (pharmacological thromboprophylaxis added to mechanical prophylaxis) will further reduce the risk of VTE.\(^{15}\)

• With patients who meet indications for thromboprophylaxis, but do not receive pharmacotherapy, mechanical thromboprophylaxis should be used and monitored, unless contraindicated.

• Intermittent pneumatic compression devices have been shown to be more effective than thromboembolic deterrent stockings in reducing deep vein thrombosis.\(^{15}\)

• Intermittent pneumatic compression devices should be utilized for as much time as possible and is practical, (ideally for a minimum of 18 hours daily, or while in bed or chair).\(^{2\),\(^{15\),\(^{19\),\(^{28}\)}}
• Anti-embolism stockings (if selected) should be worn as long as possible (i.e. continuously during period of immobility until return of full ambulation). 2,29

• Ensure appropriate skin assessment with all mechanical interventions. 2,28

**Timing in Relation to Neuraxial Anaesthesia/Analgesia (refer to Appendix C & D)**

• If patients are receiving *pharmacological* anticoagulation preoperatively (*prescribed by the most responsible physician, such as the surgeon*), Anaesthesia shall be contacted regarding the dose, time, and anticoagulant pharmacotherapy choice, prior to administration. Note should be made of any other pharmacologic agents ordered or administered that may alter haemostasis, such as ASA, NSAIDs, warfarin, clopidogrel, etc...

• Anaesthesia will *administer* immediate perioperative pharmacological VTE thromboprophylaxis *if ordered, for all elective patients*, and will document administration on the Medication Administration Record and/or Electronic Patient Record, *if indicated, and in addition to the Anaesthetic Record*.

• For patients with *neuraxial and peripheral nerve block catheters*, the timing of all anticoagulants/haemostasis altering medications (in relation to insertion and removal) should be at the discretion and guidance of the Acute Pain Service/Aanaesthesiologist.

• Generally for the peripheral or neuraxial catheter removal, allow for at least 12 hours after the previous LMWH prophylactic dose before removal. For patients who have had a catheter removed, the next dose of LMWH should be delayed for at least 4 hours after removal.
  
  o Do not administer clopidogrel, warfarin, Direct Thrombin Inhibitors, Factor Xa Inhibitors, *full anticoagulant/therapeutic doses* of UFH/LMWH to patients with indwelling neuraxial/neural plexus catheters. Discuss with Acute Pain Service/Aanaesthesiologist for safe removal of catheter before commencement of these medications.

  o Postoperatively, if LDUH is ordered greater than 5000 units twice daily, or if LMWH is ordered at higher doses than ‘usual prophylactic dose’, anaesthesia must be contacted prior to administration. *Neuraxial and peripheral nerve catheters* may only be discontinued after a minimum of 4 hours have elapsed from the last “usual prophylactic” dose of LDUH, or 12 hours after the last dose of LMWH. (See Appendix C)

• Refer to site specific *neuraxial and peripheral nerve catheter* policies regarding further directive for the management of catheters.

• Management should be ultimately upon the discretion of Acute Pain Service team, considering the nature of the catheter inserted and the patient risk factors.

*Note: Epidural and spinal hematomas are rare, but serious complications of neuraxial blockade.* 23, 30, 31

Administering haemostatic altering medications can further increase the risk of developing complications...
indicating the need for awareness of symptoms, vigilance with monitoring and immediate reporting to Anaesthesia/Acute Pain Service any symptoms of concern. 31

VTE Prophylaxis for Patients Already on Anticoagulant Therapy to Treat Other Conditions

- Patients receiving full anticoagulation for an alternative indication (e.g. mechanical heart valve or atrial fibrillation) do not need additional thromboprophylaxis. 2, 32
- If the anticoagulant is interrupted for surgery or invasive procedure, the period of interruption pre-operatively should be long enough for the anticoagulant effect to abate, but not unduly long.32
- Post-operatively, most such patients will do well with resumption of their anticoagulant once haemostasis is secure. 32
- Conventional VTE prophylactic doses of LMWH may be started postoperatively if resumption of full anticoagulation will be delayed.
- For patients on warfarin at high risk of thrombosis if anticoagulation is stopped, ‘bridge’ therapy with full-dose LMWH or intravenous unfractionated heparin may be useful (with careful assessment of all risks) during the period that the INR is sub therapeuinc. 32,33

Patient & Family Education/Discharge

- Before starting VTE prophylaxis provide patients and family/advocates with information and education, verbally and in writing (handouts, resource links, contact numbers) regarding the following 2, 8, 25, 28
  - Risk reduction for VTE, including signs and symptoms of DVT and PE.
  - Possible risks as well as signs and symptoms of bleeding, associated with pharmacological thromboprophylaxis.
  - Importance of seeking appropriate medical attention if suspicious of adverse event.

- If patient is discharged on prolonged thromboprophylaxis, offer additional information on 2, 8, 28
  - Benefits and risks of treatments indicated (including aspects of care and monitoring with stockings, hygiene, need for frequent skin assessment).
  - Medication information and usage (including injection techniques if applicable).
  - Third party payer information, as appropriate.
  - Arrangements to follow up for injections (when and where) if applicable.
  - Follow up blood work/monitoring/appointments as required.
  - Which care provider should be contacted regarding thromboprophylactic pharmacological questions or concerns.

- Ensure the Medication Reconciliation form is faxed to the primary care provider, providing them with the most recent medication history and treatments information (as per site protocol).28

- Patients going home on pharmacological treatment must have a care provider identified prior to discharge for the monitoring of this medication.
References


4. Selby, R., & Geerts, W. Prevention of venous thromboembolism: consensus, controversies, and challenges. Thromboembolism Program, Sunnybrook Health Sciences Centre, Departments of Medicine and Clinical Pathology, University of Toronto, Toronto, ON, Canada. American Society of Haematology. 2009.


**Special Acknowledgements**

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Appendix A
Assessment of VTE Risk and Bleeding

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<thead>
<tr>
<th>Box 1</th>
<th>HIGH RISK Surgical Interventions</th>
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<tr>
<td></td>
<td><strong>Automatic Indication for Prophylaxis GO DIRECTLY TO APPENDIX B (after consideration of box 5- below)</strong></td>
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<tr>
<td></td>
<td>• Major Orthopaedic surgery: Total Hip Replacement, Total Knee Replacement, Hip Fracture Surgery</td>
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<tr>
<td></td>
<td>• Major Spinal Surgery, Cranial Surgery, Major Trauma, Spinal Injury, Major abdominal surgery</td>
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<td>• Major Thoracic Surgery</td>
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<tr>
<th>Box 2</th>
<th>Non-Surgical Patients at Risk for VTE (Automatic Indication for Prophylaxis)</th>
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<tr>
<td></td>
<td>• If mobility significantly reduced for greater than or equal to 3 days OR</td>
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<td></td>
<td>• If expected to have ongoing reduced mobility OR</td>
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<td></td>
<td>• If any Patient Specific VTE HIGH risk factor present OR consider with cumulative LOWER risk factors (see Box 4)</td>
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<tr>
<th>Box 3</th>
<th>Surgical Patients and Patients with Trauma at Risk for VTE</th>
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<tr>
<td></td>
<td>• If total anaesthetic and surgical time greater than 90 minutes OR</td>
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<tr>
<td></td>
<td>• If surgery involves pelvis or lower limb and total anaesthetic and surgical time greater than 60 minutes OR</td>
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<td></td>
<td>• If acute surgical admission with inflammatory or intra-abdominal condition OR</td>
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<td>• If expected to have significant reduction in mobility OR</td>
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<td></td>
<td>• If any Patient Specific VTE HIGH risk factor present OR consider with cumulative LOWER risk factors (see Box 4)</td>
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<tr>
<th>Box 4</th>
<th>Patient Specific VTE Risk Factors</th>
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<td><strong>High Risk VTE factors</strong></td>
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<td></td>
<td>• Age 75 years or greater</td>
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<td>• Personal or Family History VTE</td>
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<td></td>
<td>• Known thrombophilia condition</td>
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<td>• Acute Spinal Cord Injury</td>
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<td>• Active cancer or cancer treatment</td>
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<td>• Stroke less than 1 month</td>
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<td></td>
<td><strong>Lower risk factors</strong></td>
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<td>• Age 60-74 years</td>
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<td>• Critical Care admission</td>
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<td>• Obesity (BMI greater than 30 kg/m2)</td>
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<td></td>
<td>• Use of Hormone replacement therapy or estrogen-containing contraceptive therapy</td>
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<td></td>
<td>• Varicose veins with phlebitis</td>
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<td></td>
<td>• One or more significant medical co-morbidities, such as acute infectious diseases, acute myocardial infarction, inflammatory conditions, congestive heart failure, debilitating respiratory disease.</td>
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<td>• Pregnancy and Pregnancy/Post Partum related risk factors*</td>
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*Consultation/discussion with obstetrics care provider should be considered for thromboprophylaxis interventions for all pregnant patients and those up to 6 weeks post-partum.

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<thead>
<tr>
<th>Box 5</th>
<th>Patients Who are at Risk of Bleeding</th>
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<tr>
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<td><strong>All patients who have any of the following</strong></td>
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<tr>
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<td>• Active bleeding</td>
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<td>• Acquired bleeding disorders (such as acute liver failure)</td>
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<td>• Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR &gt;2)</td>
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<td>• Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours</td>
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<td>• Acute Stroke</td>
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<td>• Thrombocytopenia (platelets less than 75x109/l)</td>
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<td>• Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)</td>
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<td></td>
<td>• Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)</td>
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Non-Orthopaedic Surgery Management Algorithms

**Gastrointestinal Surgery**
- If VTE risk increased *
  - Consider mechanical VTE prophylaxis at admission. Continue generally until mobility is no longer significantly decreased.
- If risk of major bleeding low
  - Add LMWH (or LDUH 2). Continue generally until discharge.

**Gynaecological, Thoracic & Urological Surgery**
- If VTE risk increased *
  - Consider mechanical VTE prophylaxis at admission (especially with major surgery in the abdomen or pelvis). Continue generally until mobility is no longer significantly decreased.
- If risk of major bleeding low
  - Add LMWH (or LDUH 2). Continue generally until discharge.

**Bariatric Surgery**
- If VTE risk increased *
  - Consider mechanical VTE prophylaxis at admission. Continue generally until mobility is no longer significantly decreased.
- If risk of major bleeding low
  - Add LMWH (or LDUH 2). Continue generally until discharge.

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**Bleeding Risk Assessment**
*Patients who have any of the following...*
- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x10^9/l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

*If only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient, providing the surgical intervention does not automatically place the patient at high risk of VTE. (See Appendix A – Box 4)*

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Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Appendix B (Continued)

Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Non-Orthopaedic Surgery Management Algorithms

**Neurological (Cranial or Spinal) Surgery**

If VTE risk increased *

Consider mechanical VTE prophylaxis\(^1\) at admission. Continue generally until mobility is no longer significantly decreased.

If risk of major bleeding low

Is patient having neurological surgery and has ruptured cranial or spinal vascular malformations (for example, brain aneurysms) or acute traumatic or non-traumatic haemorrhage?

No

Craniotomy and High Risk Spinal Surgery

Yes

Do not offer LMWH (or LDUH\(^2\)) until lesion is secured or condition stabilized.

1. For mechanical prophylaxis choose either antiembolism stockings or intermittent compression devices
2. For patients with renal failure (CrCl less than 30 ml/min, or if patient is on dialysis)

Add LMWH (or LDUH\(^2\)). Continue generally until discharge.

**Bleeding Risk Assessment**

Patients who have any of the following...

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 \(\times\) 10\(^9\) /l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

* If only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient, providing the surgical intervention does not automatically place the patient at high risk of VTE. (see Appendix A –Box 4)

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Appendix B (Continued)

Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Non-Orthopaedic Surgery Management Algorithms

Vascular Surgery

- If VTE risk increased*
  - Consider mechanical VTE prophylaxis at admission.
  - If peripheral arterial disease present, seek expert opinion before fitting anti-embolism stockings.
  - Continue generally until mobility is no longer significantly decreased.

Other Surgery

- If VTE risk increased*
  - Consider mechanical VTE prophylaxis at admission.
  - Continue until mobility no longer significantly reduced.
  - If risk of major bleeding low
    - Add LMWH (or LDUH 3).
      - Continue generally until discharge.

Bleeding Risk Assessment

Patients who have any of the following...
- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x10^9/l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

* If only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient, providing the surgical intervention does not automatically place the patient at high risk of VTE. (see Appendix A – Box 4)

1. Vascular surgery patients may already be on anticoagulant therapy. Refer to the section “VTE Prophylaxis for Patients Already on Anticoagulant Therapy to Treat Other Conditions”.
2. For mechanical prophylaxis choose either anti-embolism stockings or intermittent compression devices
3. For patients with renal failure (CrCl less than 30 mL/min, or if patient is on dialysis)

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Orthopaedic Surgery Management Algorithms

**Elective Hip Replacement Surgery**
- Consider mechanical VTE prophylaxis<sup>1</sup> preoperatively.
- Continue generally until mobility is no longer significantly decreased.

**12-24 hours after surgery**
- Provided there are no contraindications, offer pharmacological VTE prophylaxis for 28-35 days<sup>2</sup>.

**Choose one of:**
- Rivaroxaban 10 mg PO daily
- LMWH (or LDUH<sup>3</sup>)

**Elective Knee Replacement Surgery**
- Consider mechanical VTE prophylaxis<sup>1</sup> preoperatively.
- Continue generally until mobility is no longer significantly decreased.

**12-24 hours after surgery**
- Provided there are no contraindications, offer pharmacological VTE prophylaxis for 14 days<sup>2</sup>.

**Bleeding Risk Assessment**
*Patients who have any of the following...*
- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x10<sup>9</sup>/l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand's disease)

---

1. For mechanical prophylaxis choose either anti-embolism stockings or intermittent compression devices
2. According to the summary of product characteristics for the individual agent being used.
3. For patients with renal failure (CrCl less than 30 ml/min, or if patient is on dialysis)

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Appendix B (Continued)

Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Orthopaedic Surgery Management Algorithms $^{2,34}$

### Hip Fracture Surgery

**At Admission:**
Consider mechanical VTE prophylaxis$^1$ at admission.
Provided there are no contraindications, offer LDUH and notify Anaesthesia.

**12-24 hours after surgery**
Start LMWH (or LDUH$^2$), or rivaroxaban 10 mg PO daily (ONLY with total hip replacement).
Continue for 28-35 days$^3$.

### Bleeding Risk Assessment

*Patients who have any of the following...*

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than $75 \times 10^9 /L$)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

---

1. For mechanical prophylaxis choose either anti-embolism stockings or intermittent compression devices
2. For patients with renal failure (CrCl less than 30 mL/min, or if patient is on dialysis)
3. According to the summary of product monograph for the individual agent being used.

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Appendix B (Continued)

Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Orthopaedic Surgery Management Algorithms

Other Orthopedic Surgery

At Admission:
Assess Patient’s risk of VTE *

If VTE risk increased

After assessing risks and discussing with patient:
Consider mechanical VTE prophylaxis

Consider offering LMWH (or LDUH) 6-12 hours after surgery.

Continue mechanical prophylaxis and LMWH generally until discharge.

Upper Limb Surgery

Do not routinely offer VTE prophylaxis

Bleeding Risk Assessment

Patients who have any of the following...
• Active bleeding
• Acquired bleeding disorders (such as acute liver failure)
• Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
• Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
• Acute stroke
• Thrombocytopenia (platelets less than 75 x \(10^9/l\))
• Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
• Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

* If only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient, providing the surgical intervention does not automatically place the patient at high risk of VTE. (see Appendix A – Box 4)

1. For mechanical prophylaxis choose either anti-embolism stockings or intermittent compression devices
2. For patients with renal failure (CrCl less than 30 mL/min, or if patient is on dialysis)
3. According to the summary of product monograph for the individual agent being used.

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis. Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Major Trauma or Spinal Injury Management Algorithms

Patient admitted with Major Trauma

Consider mechanical VTE prophylaxis at admission or as soon as clinically possible.
Continue generally until mobility is no longer significantly decreased.

Assess Patient’s risk of VTE and bleeding (See Appendix A)
[Caution with high grade traumatic solid organ injury as potentially increased bleeding risk]  

Is patient having traumatic neurological surgery, acute traumatic haemorrhage (such as intracranial bleed), or spinal/epidural haemorrhage/haematoma

NO

If risk of VTE outweighs risk of bleeding

If bleeding risk is low

Offer LMWH (or LDUH)  
Continue generally until discharge.

YES

Neurological or Spinal Consult prior to pharmacological thromboprophylaxis

Bleeding Risk Assessment

Patients who have any of the following...

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x10^9 /l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

1. For mechanical prophylaxis choose either anti-embolism stockings or intermittent compression devices
2. For patients with renal failure (CrCl less than 30 mL/min, or if patient is on dialysis)
3. According to the summary of product characteristics for the individual agent being used.

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Appendix B (Continued)

Balance risks of VTE and bleeding before offering VTE prophylaxis. (See Appendix A)

Lower Limb (Plaster/Fiberglass) Casts Management Algorithms

Patient having lower limb plaster/fiberglass cast

Assess Patient’s risk of VTE *

If VTE risk increased

Consider offering LMWH (or LDUH ¹) after evaluating risks and benefits and based on clinical discussion with patient.

Continue until plaster or fiberglass cast removed.

Bleeding Risk Assessment

Patients who have any of the following...

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours or expected within the next 12 hours
- Acute stroke
- Thrombocytopenia (platelets less than 75 x10⁹ /l)
- Uncontrolled systolic hypertension (greater than or equal to 230/120 mmHg)
- Untreated inherited bleeding disorders (such as haemophilia or von Willebrand’s disease)

* If only 1-2 “lower risk” factors present, mechanical prophylaxis may be sufficient, providing the surgical intervention does not automatically place the patient at high risk of VTE. (see Appendix A – Box 4)

1. For patients with renal failure (CrCl less than 30 mL/min, or if patient is on dialysis)

Prescribers should consult the summary of product monograph for further details of the drugs being used or planned for pharmacological VTE prophylaxis.

Treatment and care should take into account patients’ individual needs and preferences. Good communication is essential, supported by evidence-based information, to allow patients to reach informed decisions about their care.
Regional Anaesthesia and Pharmacological Considerations

Appendix C

Recommendations below are based on the guidelines of the American Society of Regional Anesthesia (ASRA) [ASRA 4th Consensus Statement - 2018], the European Society of Regional Anesthesia and WRHA practice. Because this is an area of active research, with new therapies and emerging evidence, newer guideline recommendations may differ from what is provided below. As high level evidence is limited in this area, different guidelines may make different recommendations on the same clinical question. Individualization of the approach, by lengthening or shortening the listed acceptable times, may be reasonable given particular clinical circumstances. Accordingly, the following is suggested guideline which does not replace ongoing clinical assessment and professional judgment as to the risks and benefits of regional anesthesia in an individual patient given their comorbidities and any medications that affect hemostasis.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Time to peak effect</th>
<th>Elimination half-life</th>
<th>Acceptable time after drug for block performance</th>
<th>Administration of drug while catheter ² in place</th>
<th>Acceptable time after block performance or catheter removal for next drug dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparins</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>LDUH subcut prophylaxis</td>
<td>LESS than 30 min</td>
<td>1-2 h</td>
<td>4-6 h</td>
<td>Yes (Minimum of 4-6 h between last dose of UFH and catheter removal)</td>
<td>1 h</td>
</tr>
<tr>
<td>(5000 units BID)</td>
<td>0: 20-30 min</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>P: 2-4 h</td>
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<tr>
<td></td>
<td>* consideral</td>
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<tr>
<td></td>
<td>interindividual</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>variability exists</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfractionated heparin</td>
<td>LESS than 5 min</td>
<td>1-2 h (dose dependent)</td>
<td>4 - 6 h and normal APTR</td>
<td>NR</td>
<td>1 h</td>
</tr>
<tr>
<td>intravenous therapeutic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMWH subcut prophylaxis (i.e.</td>
<td>3-4 h</td>
<td>3-7 h</td>
<td>12 h</td>
<td>Yes (First post-op dose at least 12 hours after needle/ catheter placement - Minimum of 12 hours between last dose of LMWH and catheter removal)</td>
<td>4 h</td>
</tr>
<tr>
<td>Dalteparin) dose 5000 units</td>
<td>O: 1-2h</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ONCE daily in patients greater</td>
<td>P: 4 h</td>
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<tr>
<td>than 40 kg)</td>
<td>Dalteparin</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>LMWH subcut therapeutic (i.e.</td>
<td>3-4 h</td>
<td>3-7 h</td>
<td>24 h</td>
<td>NR</td>
<td>4 h</td>
</tr>
<tr>
<td>Dalteparin) dose greater than</td>
<td>O: 1-2h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5000 units once daily, or in</td>
<td>P: 4 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>patients less than 40 kg)</td>
<td>Dalteparin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heparin alternatives</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Danaparoid prophylaxis</td>
<td>4-5 h</td>
<td>24 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>NR</td>
<td>6 h</td>
</tr>
<tr>
<td></td>
<td>29-35h (renal</td>
<td></td>
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<tr>
<td></td>
<td>impairment)³</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Danaparoid therapeutic</td>
<td>4-5 h</td>
<td>24h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>NR</td>
<td>6 h</td>
</tr>
<tr>
<td></td>
<td>29-35h (renal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>impairment)³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

² Per WRHA consensus; refer to 2018 ASRA guidelines (pg 722) for doses higher than 5000 units subcut BID

LDUH - Unfractionated heparin; APTR, activated partial thromboplastin time ration; iv, intravenous; LMWH, low molecular weight heparin; NSAIDs, non-steroidal anti-inflammatory drugs; INR, international normalized ratio; CrCl, creatinine clearance; NR, not recommended; sec, seconds; min, minutes; h, hours; d, days; OI, Onset; P, Peak; EC ASA, enteric coated acetasalicylic acid.

1. Spinal, epidural or peripheral nerve block catheter.
2. Consider increasing to 24 h if block performance is traumatic.
3. Manufacturer recommends caution with use of neuraxial catheters.
4. Time to normal platelet function rather than elimination half-life.
5. Manufacturer recommends neuraxial catheters are not used.
6. Lexicomp
7. Micromedex
8. American Society of Health-Systems Pharmacists
9. ASRA 2018 Consensus Guidelines
### Appendix C (Continued)

Recommendations are based on American Society of Regional Anesthesia and European Society of Regional Anesthesia guidelines and WRHA practice. The following is a suggested guideline and does not replace ongoing clinical assessment and professional judgment.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Time to peak effect</th>
<th>Elimination half-life</th>
<th>Acceptable time after drug for block performance</th>
<th>Administration of drug while catheter in place</th>
<th>Acceptable time after block performance or catheter removal for next drug dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heparin alternatives (continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bivalirudin</td>
<td>5 min</td>
<td>25 min</td>
<td>Avoid (consider APTT^1)</td>
<td>NR</td>
<td>6 h</td>
</tr>
<tr>
<td>Argatroban</td>
<td>LESS than 30 min</td>
<td>30-35 min 39-51 min</td>
<td>Avoid (consider APTT^1)</td>
<td>NR</td>
<td>6 h</td>
</tr>
<tr>
<td>Fondaparinux prophylaxis^3</td>
<td>1-2 h P: 2-3h</td>
<td>17-20 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>NR</td>
<td>6-12 h</td>
</tr>
<tr>
<td>Fondaparinux therapeutic^3</td>
<td>1-2 h P: 2-3h</td>
<td>17-20 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>NR</td>
<td>12 h</td>
</tr>
<tr>
<td><strong>Antiplatelet drugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSAI^4DS</td>
<td>1-12 h</td>
<td>1-12 h</td>
<td>Caution if on NSAID and concurrent LDUH or LMWH</td>
<td>Caution if on NSAID and concurrent UFH or LMWH (except celecoxib)</td>
<td>No additional precautions</td>
</tr>
<tr>
<td>ASA</td>
<td>12-24 h</td>
<td>Not relevant; irreversable effect</td>
<td>Caution with concurrent LDUH or LMWH</td>
<td>Caution with concurrent LDUH or LMWH</td>
<td>No additional precautions</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>12-24 h</td>
<td>5-7 days</td>
<td>NR</td>
<td>6 h</td>
<td></td>
</tr>
<tr>
<td>Prasugrel</td>
<td>15-30 min</td>
<td>7-10 days</td>
<td>NR</td>
<td>6 h</td>
<td></td>
</tr>
<tr>
<td>Ticlopidine</td>
<td>10 d</td>
<td>NR</td>
<td>6 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticagrelor</td>
<td>8-12 h</td>
<td>5-7 d</td>
<td>NR</td>
<td>Immediately - (NO loading dose) 6 h (LOADING dose)</td>
<td></td>
</tr>
<tr>
<td>Cilostazol</td>
<td>11 h^1 (prolonged with severe renal impairment) 21 h^2 (active metabolites)</td>
<td>2 d</td>
<td>NR</td>
<td>6 h</td>
<td></td>
</tr>
</tbody>
</table>

^1 WRHA Consensus
### Drug Time to peak effect Elimination half-life Acceptable time after drug for block performance Administration of drug while catheter 1 in place Acceptable time after block performance or catheter removal for next drug dose

#### Antiplatelet drugs (continued)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Time to peak effect</th>
<th>Elimination half-life</th>
<th>Acceptable time after drug for block performance</th>
<th>Administration of drug while catheter 1 in place</th>
<th>Acceptable time after block performance or catheter removal for next drug dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tirofiban</td>
<td>LESS than 5 min</td>
<td>4-8 h 1</td>
<td>4-8 h</td>
<td>NR</td>
<td>Review risk vs benefits of medication and individualize care as required 4</td>
</tr>
<tr>
<td>Eptifibatide</td>
<td>LESS than 5 min O: Immediate P: &lt; 1 h 7</td>
<td>4-8 h 4</td>
<td>4-8 h</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Abciximab</td>
<td>LESS than 5 min</td>
<td>Platelet function abnormal x 72 h 6</td>
<td>24 - 48 h</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Dipyridamole</td>
<td>75 min P: 2 – 2.5 h 6</td>
<td>10 h</td>
<td>24 h</td>
<td>NR</td>
<td>6 h</td>
</tr>
</tbody>
</table>

#### Oral Anticoagulants

| Warfarin       | 3-5 d O: 1-3d 6 P: 5-7d 6 | 4-5 d 20-60 h 6 | WRHA Usual practice INR ≤ 1.4** | NR | After catheter removal |

**NOTE: There are multiple opinions on the safe duration of delay from last dose of anticoagulant to neuraxial technique.**

<table>
<thead>
<tr>
<th>Rivaroxaban (prophylaxis) (CrCl GREATER than 30mL/min)</th>
<th>3 h</th>
<th>7-9 h 6</th>
<th>5-9h 6</th>
<th>11-13h (elderly) 6</th>
<th>24 h -48 h (consider longer if CrCl 30-50 mL/min, hepatic impairment or advanced age)</th>
<th>NR</th>
<th>6 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivaroxaban (therapeutic) (CrCl GREATER than 30mL/min)</td>
<td>3 h</td>
<td>7-11 h 6</td>
<td>5-9h 6</td>
<td>11-13h (elderly) 6</td>
<td>72 h</td>
<td>NR</td>
<td>6 h</td>
</tr>
</tbody>
</table>

| Dabigatran (prophylaxis or therapeutic) (CrCl GREATER than or equal to 80 mL/min) | 0.5-2.0 h | 12-17 h | 72 h | NR | 6 h |
| (CrCl 50-79 mL/min) | 0.5-2.0 h | 15 h | 15-18 h 6 | 96 h | NR | 6 h |
| (CrCl 30-49 mL/min) | 0.5-2.0 h | 18 h | 15-18 h 6 | 120 h | NR | 6 h |
| Apixaban (prophylaxis or therapeutic) | 3-4 h | 12 h | 72 h | NR | 6 h |
| Edoxaban        | 1 – 2 h 7 | 10 - 14 h 7 | 72 h | NR | 6 h |

#### Thrombolytic drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Time to peak effect</th>
<th>Elimination half-life</th>
<th>Acceptable time</th>
<th>Administration of drug while catheter 1 in place</th>
<th>Acceptable time after block performance or catheter removal for next drug dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alteplase</td>
<td>LESS than 5 min</td>
<td>4-24 min</td>
<td>Avoid (minimum 2 days with normalization of clotting studies including fibrinogen)</td>
<td>NR</td>
<td>10 d</td>
</tr>
<tr>
<td>Tenecteplase</td>
<td>LESS than 5 min</td>
<td>90-130 min</td>
<td></td>
<td>NR</td>
<td>10 d</td>
</tr>
</tbody>
</table>

* Refer to 2018 ASRA guidelines (pg 280) for guidance

** With mildly elevated INR (i.e. ≥1.2 to ≤1.4) performance of a neuraxial procedure should be individualized according to the patient’s risk factors and careful considerations of the risks and benefits. In patients with an INR of 1.3 and 1.4, there is a slight reduction in clotting factors, hence there may be an increased risk depending on the patient’s individual risk assessment. (Average activities of clotting factors VII, IX, X, and II were normal in the patients with INR of 1.2 or less. In contrast, a patient with an INR of 1.3 had concentrations of 105%, 78%, 36%, and 46% for factors VII, IX, X, and II, respectively. A patient with an INR of 1.4 had clotting factors of 89, 66%, 20%, and 37%, respectively.) Clinical judgement is suggested. 3

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LDH = Lactate dehydrogenase; TNA = Total Nerve Anesthesia; INR = International Normalized Ratio; CTB = Corticosteroid Block; B = Bupivacaine; M = Mepivacaine; L = Lidocaine; P = Procaine; 2% = 2% lidocaine; 4% = 4% lidocaine; 2% T/R = 2% lidocaine with epinephrine; 4% T/R = 4% lidocaine with epinephrine; 0.125% = 0.125% ropivacaine; 0.25% = 0.25% ropivacaine; 0.5% = 0.5% ropivacaine; 0.75% = 0.75% ropivacaine; 1% = 1% ropivacaine; erector spinae = erector spinae plane block; L1 = Lumbar 1; SI = Sacral 1; D = Dorsal; N = Nerve; T = Thoracic; L = Lumbar; S = Sacral; R = Radicular; B = Bony; C = Cortical; CB = Cortical Block; 1. Spinal, epidural or peripheral nerve block catheter. 2. Consider increasing to 24 h if block performance is traumatic. 3. Manufacturer recommends caution with use of neuraxial catheters. 4. Time to normal platelet function rather than elimination half-life. 5. Manufacturer recommends neuraxial catheters are not used. 6. Lexicomp 7. Micromedex 8. American Society of Health-Systems Pharmacists 9. ASRA 2018 Consensus Guidelines
Relative risk related to neuraxial and peripheral nerve blocks in patients with abnormalities of coagulation.

Appendix D (Taken directly from Regional anesthesia and patients with abnormalities of coagulation 35.)

<table>
<thead>
<tr>
<th>Risk</th>
<th>Block Category</th>
<th>Examples of blocks in category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Risk</td>
<td>Epidural with catheter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single-shot epidural</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spinal</td>
<td></td>
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<tr>
<td></td>
<td>Paravertebral blocks</td>
<td>Paravertebral block</td>
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<tr>
<td></td>
<td></td>
<td>Lumbar plexus block</td>
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<tr>
<td></td>
<td></td>
<td>Lumbar sympathectomy</td>
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<tr>
<td></td>
<td></td>
<td>Deep cervical plexus block</td>
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<tr>
<td></td>
<td>Deep blocks</td>
<td>Coeliac plexus block</td>
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<tr>
<td></td>
<td></td>
<td>Stellate ganglion block</td>
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<tr>
<td></td>
<td></td>
<td>Proximal sciatric block (Labat, Raj, sub-gluteal)</td>
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<tr>
<td></td>
<td></td>
<td>Obturator block</td>
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<tr>
<td></td>
<td></td>
<td>Infraclavicular brachial plexus block</td>
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<tr>
<td></td>
<td></td>
<td>Vertical infraclavicular block</td>
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<tr>
<td></td>
<td></td>
<td>Supraclavicular brachial plexus block</td>
</tr>
<tr>
<td></td>
<td>Superficial perivascular blocks</td>
<td>Popliteal sciatric block</td>
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<tr>
<td></td>
<td></td>
<td>Femoral nerve block</td>
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<tr>
<td></td>
<td></td>
<td>Intercostal nerve blocks</td>
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<tr>
<td></td>
<td></td>
<td>Interscalene brachial plexus block</td>
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<tr>
<td></td>
<td></td>
<td>Axillary brachial plexus block</td>
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<tr>
<td></td>
<td>Fascial blocks</td>
<td>Ilio-inguinal block</td>
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<tr>
<td></td>
<td></td>
<td>Ilio-hypogastric block</td>
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<tr>
<td></td>
<td></td>
<td>Transversus abdominis plane block</td>
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<tr>
<td></td>
<td></td>
<td>Fascia lata block</td>
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<tr>
<td></td>
<td>Superficial blocks</td>
<td>Forearm nerve blocks</td>
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<tr>
<td></td>
<td></td>
<td>Saphenous nerve block at the knee</td>
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<tr>
<td></td>
<td></td>
<td>Nerve blocks at the ankle</td>
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<tr>
<td></td>
<td></td>
<td>Superficial cervical plexus block</td>
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<tr>
<td></td>
<td></td>
<td>Wrist block</td>
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<td></td>
<td>Digital nerve block</td>
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<td></td>
<td>Bier’s block</td>
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<tr>
<td>Normal Risk</td>
<td>Local infiltration</td>
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</tr>
</tbody>
</table>

There have only been 26 published reports of significant haemorrhagic complications of peripheral nerve and plexus blocks [16]. Half of these occurred in patients being given anticoagulant drugs and half in patients with normal coagulation. Patient harm has derived from:

- Spinal haematoma after accidental entry into the spinal canal during attempted paravertebral blocks as defined in the Table.
- Exsanguination.
- Compression of other structures, e.g. airway obstruction, occlusion of major blood vessels or tissue ischaemia.

The one death in this series was that of a patient on clopidogrel who underwent a lumbar plexus block and subsequently exsanguinated. The majority of the 26 cases underwent deep blocks or superficial perivascular blocks. From these data, and from other data relating to neuraxial blocks, we have placed blocks in the order of relative risk shown in the Table.

Catheter techniques may carry a higher risk than single-shot blocks. The risk at the time of catheter removal is unlikely to be negligible.

Ultrasound-guided regional anaesthesia, when employed by clinicians experienced in its use, may decrease the incidence of vascular puncture, and may therefore make procedures such as supraclavicular blocks safer in the presence of altered coagulation. ©2013