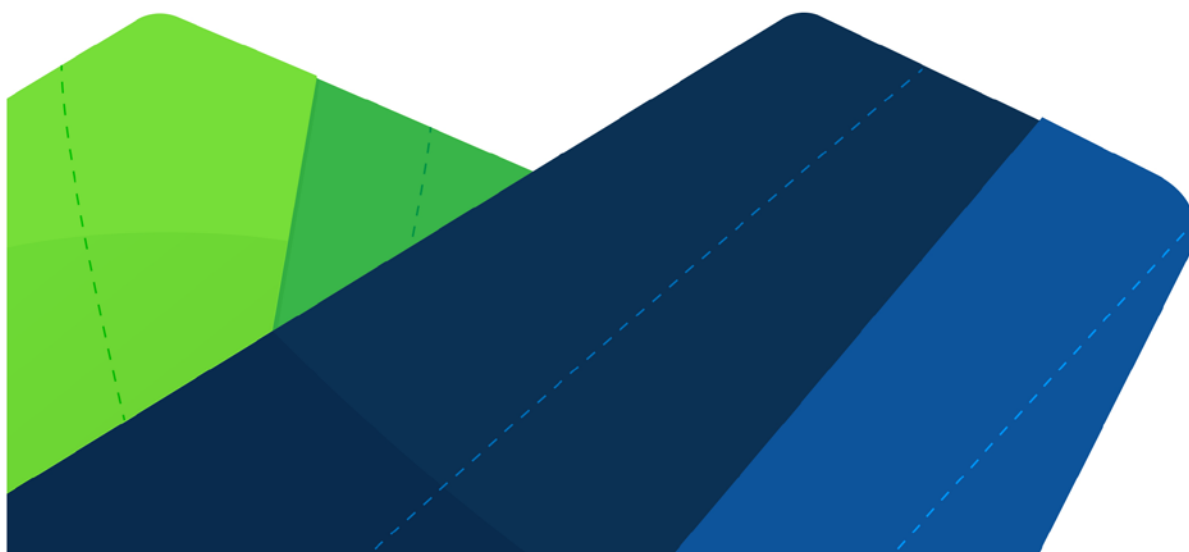


Guideline for the Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients

December 2018



Guideline for the prevention of Venous Thromboembolism (VTE) in adult hospitalised patients.

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Introduction

Venous thromboembolism (VTE), a disease which encompasses deep vein thrombosis (DVT) and pulmonary embolism (PE) is a major health-care problem, resulting in significant mortality and morbidity, and expenditure in healthcare resources. PE remains one of the leading causes of preventable in-hospital deaths.(1)

The prevention of VTE, or VTE prophylaxis, is an important patient safety strategy in hospital settings where patients are at risk of developing VTE.(2)

Purpose

This guideline provides recommendations regarding best practice for the prevention of VTE in adults admitted to Queensland Health facilities and those discharged from the emergency departments of Queensland public hospitals. The use of this guideline is not mandatory. The objectives of this guideline are to:

- provide guidance to clinicians on the prevention of VTE,
- minimise the incidence of VTE in patients admitted to hospital or discharged from the emergency department, and
- optimise VTE prophylaxis to reduce adverse patient outcomes.

Scope

This guideline provides information for all Queensland Health employees (permanent, temporary and casual) and all organisations and individuals acting as its agents (including Visiting Medical Officers and other partners, contractors, consultants and volunteers).

This guideline is for use in **adults (patients aged 18 years and over) admitted to hospital** as well as the following groups:

- Day surgery or procedure patients that are undergoing day procedures under general and prolonged anaesthesia with significant reduction in their mobility
- Sub-acute facilities such as rehabilitation and palliative care
- Patients admitted to mental health (psychiatric) inpatient units
- Adult ambulatory patients with isolated injury and subsequent temporary lower limb immobilisation (including those that are discharged from Emergency Departments)

The following are outside the scope of this guideline:

- Pregnant and post-partum women (refer to '[Queensland Clinical Guidelines: Venous thromboembolism \(VTE\) prophylaxis in pregnancy and the puerperium](#)')
- Paediatric patients
- Outpatients including ambulatory cancer patients receiving chemotherapy as day procedures
- Treatment of VTE

Related documents

The general recommendations in this guideline have been developed utilising the following documents. Specific recommendations have also been individually referenced within the guideline.

Policies/Standards

- [Queensland Health List of Approved Medicines](#)
- [National Safety and Quality Health Service Standard 4: Medication Safety](#)
- [Australian Commission on Safety and Quality in Health Care \(ACSQHC\) Venous Thromboembolism Prevention Clinical Care Standard](#)

Local procedures, guidelines and protocols

- Guideline for Anticoagulation and Prophylaxis Using Low Molecular Weight Heparin (LMWH) in Adult Inpatients (Queensland Health)
- Guidelines for Anticoagulation using Warfarin – Adult (Queensland Health)
- Managing patients on dabigatran (Pradaxa[®]) (Queensland Health)
- Guideline for managing patients on a factor Xa inhibitor – Apixaban (Eliquis[®]) or Rivaroxaban (Xarelto[®]) (Queensland Health)
- Management of Adult Acute Heparin Induced Thrombocytopenia/Thrombosis (HIT) (Queensland Health)

Supporting documents

- National Inpatient Medication Chart (NIMC)

Key definitions and abbreviations

ACCP	American College of Chest Physicians
ACSQHC	Australian Commission on Safety and Quality in Health Care
ADR	Adverse Drug Reaction
Anticoagulated	Receiving an anticoagulant (i.e. unfractionated heparin, low molecular weight heparin [dalteparin, enoxaparin, nadroparin], warfarin with INR in therapeutic range, direct oral anticoagulant [apixaban, dabigatran, rivaroxaban], danaparoid, bivalirudin, fondaparinux)
Antiplatelet agent	Medication that inhibits platelet aggregation. As at publication antiplatelet agents available in Australia include: aspirin, dipyridamole, clopidogrel, prasugrel, ticagrelor, ticlopidine, abciximab, eptifibatide and tirofiban.
APTT	Activated Partial Thromboplastin Time
ARTG	Australian Register of Therapeutic Goods
ASA	Arthroplasty Society of Australia: a subspecialty group of the Australian Orthopaedic Association
AUSCARE / AUSLAB	Online pathology results system / Pathology information technology system – used in Queensland Health
BMI	Body Mass Index
BSA	Body Surface Area
Caprini risk assessment / Caprini score	VTE risk assessment model commonly used in surgical patients. This is a 'Point-Based Individualised' method of stratifying surgical patients into 4 different levels of VTE risk (very low, low, moderate or high). The Caprini score is calculated by adding the scores of all the factors present for an individual patient with the total score determining the VTE risk level. The Caprini model is used in this guideline for general and abdominal-pelvic surgery and thoracic surgery patients.
CKD-EPI	Chronic Kidney Disease Epidemiology Collaboration
Charlson Index	A weighted index measure of comorbidity used to predict 1-year or 10-year mortality.(3) A calculator version is available at https://www.mdcalc.com/charlson-comorbidity-index-cci .
CrCl	Creatinine Clearance
DOAC	Direct-acting oral anticoagulant [also referred to as non-vitamin K antagonist oral anticoagulant (NOAC)]. As at publication DOACs available in Australia include: direct thrombin inhibitor (dabigatran); and factor Xa inhibitors (apixaban, rivaroxaban)
DVT	Deep Vein Thrombosis
eGFR	Estimated Glomerular Filtration Rate
EMM	Electronic Medication Management
ESA	European Society of Anaesthesiology
GCS	Graduated Compression Stockings
GEMNet	Guidelines in Emergency Medicine Network, United Kingdom
Heparin-based VTE prophylaxis	Prophylactic dose of low molecular weight heparin or unfractionated heparin
HIT/HITT	Heparin-Induced Thrombocytopenia / Thrombosis
ieMR	Integrated Electronic Medical Record
INR	International Normalised Ratio
IPC	Intermittent Pneumatic Compression
IVC filter	Inferior Vena Cava Filter

LAM	List of Approved Medicines (Queensland Health)
LMWH	Low Molecular Weight Heparin. As at publication LMWHs available in Australia include: dalteparin, enoxaparin and nadroparin
NICE	The National Institute for Health and Care Excellence
NIMC	National Inpatient Medication Chart
NSAID	Non-Steroidal Anti-Inflammatory Drug
Padua Risk Assessment Model / Padua Score	VTE risk assessment model for the medical patient population. This is a 'Point-Based Individualised' method of stratifying medical patients into low or high risk of VTE. The Padua score is calculated by adding the scores of all the factors present for an individual patient with the total score determining the VTE risk level. The PADUA model is used in this guideline for acute stroke, medical cancer inpatients, acutely ill and mental health patients
PBS	Pharmaceutical Benefits Scheme
PE	Pulmonary Embolism
TGA	Therapeutic Goods Administration
THR	Total Hip Arthroplasty (Total Hip Replacement)
TKR	Total Knee Arthroplasty (Total Knee Replacement)
SCD	Sequential Compression Device
Subcut	Subcutaneously
UFH	Unfractionated Heparin
VTE	Venous Thromboembolism

Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients – Guideline Overview

Abridged information; refer to 'Guideline for the Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients' for full details

Identify all patients requiring VTE Risk Assessment (section 1.1); **conduct advance-planning when possible** (section 1.2)

Not in scope of THIS guideline: pregnancy and puerperium*, paediatrics, outpatients or cancer day patients, treatment of VTE

*Refer to 'Queensland Clinical Guidelines: Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium'

VTE Risk Assessment required: (section 1.1)

- All inpatient admissions including mental health, rehabilitation and palliative care
- Day surgery or procedures under general and prolonged anaesthesia with significantly reduced mobility
- Isolated injury requiring temporary lower limb immobilisation, including Emergency Department discharge

VTE Risk Assessment NOT routinely required: (section 1.1)

- Terminally ill or end of life care patients (in consultation with patient or carer and multidisciplinary team)
- Day surgery or procedures under local anaesthesia without reduced mobility
- Emergency Department discharge other than lower limb immobilisation

Undertake VTE Risk Assessment (section 1.3)
As soon as possible using statewide 'Adult Venous Thromboembolism Risk Assessment Tool' or locally endorsed equivalent

Specific patients at increased VTE risk: (section 1.3.4)

<p>Medical Patients:</p> <ul style="list-style-type: none"> • Acute stroke • Critically ill • Decompensated heart failure • Active inflammatory bowel disease 	<p>Surgical and Orthopaedic Patients:</p> <ul style="list-style-type: none"> • Major abdominal-pelvic surgery for cancer • Total hip or knee arthroplasty • Fragility fractures (pelvis, hip, proximal femur) • Major trauma surgery • Craniotomy • Cardiac surgery • Abdominal aortic aneurysm repair 	<ul style="list-style-type: none"> • Thoracic surgery with primary or metastatic cancer with risk factors • Elective spinal surgery (admission longer than 2 days) • Bariatric surgery • Temporary immobilisation (above or below knee cast, or backslab)
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ALL other patients individually risk assessed

Increased risk
Low risk

VTE prophylaxis required
No VTE prophylaxis required

Assess Contraindications and Special Considerations to Prophylaxis (section 1.4)

Mechanical Prophylaxis Contraindications (section 1.4.1)

Contraindications:

- Severe peripheral arterial disease or ulcer
- Skin graft or peripheral arterial bypass graft
- Severe leg or pulmonary oedema
- Allergy to material of manufacture
- Severe localised leg problems

Additional contraindications specific to graduated compression stockings only:

- Leg deformity or obesity preventing correct fit
- Peripheral neuropathy
- Stroke

Pharmacological Prophylaxis Contraindications (section 1.4.2) and **Special Considerations** (section 1.4.3)

<p>Absolute contraindications:</p> <ul style="list-style-type: none"> • Already anticoagulated • Active major bleeding • Recent clinically significant bleeding • Thrombocytopenia (platelets less than $50 \times 10^9/L$) • Inherited or acquired bleeding disorders 	<p>Relative contraindications:</p> <ul style="list-style-type: none"> • High bleeding risk surgery within last 2 weeks • Recent gastrointestinal or genitourinary bleeding • Recent central nervous system bleeding • High bleeding risk intracranial or spinal lesion • Uncontrolled systolic hypertension • High bleeding risk condition 	<p>Special considerations:</p> <ul style="list-style-type: none"> • Heparin-induced thrombocytopenia or thrombosis • Lumbar puncture • Therapeutic anticoagulation • Antiplatelet therapy • Patient's personal beliefs
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Mechanical Prophylaxis Contraindicated
No contraindications to Mechanical Prophylaxis
Pharmacological Prophylaxis Contraindicated
No contraindications or special considerations to Pharmacological Prophylaxis
Special considerations with Pharmacological Prophylaxis

Conduct baseline tests (section 1.5)

Identify relevant VTE prophylaxis recommendations (sections 2.1 and 2.2)

<p>Medical and Mental Health Patients:</p> <ul style="list-style-type: none"> • Acute stroke (section 2.1.1) • Critically ill (section 2.1.2) • Medical cancer inpatients (section 2.1.3) • Acutely ill (section 2.1.4) • Mental health patients (section 2.1.5) • All other medical patients – see prophylaxis options: pharmacological (section 1.7) and mechanical (section 1.8) 	<p>Surgical and Orthopaedic Patients:</p> <ul style="list-style-type: none"> • General and abdominal-pelvic surgery (section 2.2.1) • Major abdominal-pelvic surgery for cancer (section 2.2.2) • Total hip or knee arthroplasty (section 2.2.3) • Fragility fractures (section 2.2.4) • Ambulatory patients with isolated lower limb immobilisation (section 2.2.5) • Other orthopaedic procedures (section 2.2.6) • Major trauma (section 2.2.7) 	<ul style="list-style-type: none"> • Craniotomy (section 2.2.8) • Cardiac surgery (section 2.2.9) • Vascular surgery (section 2.2.10) • Thoracic surgery (section 2.2.11) • Elective spinal surgery (section 2.2.12) • Bariatric surgery (section 2.2.13) • All other surgical patients – see prophylaxis options: pharmacological (section 1.7) and mechanical (section 1.8)
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Assess benefits versus risks of VTE prophylaxis

Develop VTE Prevention Plan (section 1.6); document in patient record or ieMR
Prescribe VTE prophylaxis as appropriate in the medication chart or ieMR

Monitor patient (sections 1.10.1 to 1.10.3)

Reassess risks of VTE and bleeding (section 1.10.4)

Write discharge plan (section 1.10.6); ensure transfer of care

General recommendations for VTE prevention in all stages of care

The following recommendations apply throughout the patient's episode of care and are not necessarily observed in any set sequence.

Adequate hydration (unless this is contraindicated due to their clinical condition) and early mobilisation are measures that should be applied as standard practice to reduce the risk of VTE in **all** patients, regardless of risk category. An early mobilisation plan should be developed in consultation with the patient and their family/carer. Patients should also be encouraged to return to their pre-morbid level of mobility as appropriate.(4)

Involve and engage the patient/carer in shared decision making during all stages of VTE prevention from the advance-planning stage to when the discharge plan is written. Offer patients and/or their families or carers verbal and written information in a format that they can understand.(4)

The steps taken for each patient in VTE prevention should be appropriately documented and kept in a place that is easily accessible to all clinicians involved in the patient's care.(4) The relevant section for VTE prophylaxis in the current national inpatient medication chart (NIMC) or electronic medication management (EMM) profile should also be completed.

For further information, see [Appendix 1](#).

1. Steps involved in VTE prevention

The Australian Commission on Safety and Quality in Health Care (ACSQHC) [Venous Thromboembolism Prevention Clinical Care Standard](#) outlines the clinical care that a patient should be offered for the prevention of VTE. The steps and measures recommended in this guideline will assist in achieving compliance with the ACSQHC VTE Prevention Clinical Care Standard.

1.1 Assess all patients to identify need for VTE risk assessment

Assess all patients to identify whether they are **potentially at risk of hospital-acquired VTE** and therefore should have a VTE risk assessment.

The following patients should have a VTE risk assessment:

- All adult patients admitted to an inpatient ward (medical or surgical) or unit including mental health (psychiatric) inpatient units and sub-acute facilities (such as rehabilitation and palliative care)
- All adult patients undergoing day surgeries or procedures under general and prolonged anaesthesia with significant reduction in their mobility
- Pregnant and post-partum women (refer to '[Queensland Clinical Guidelines: Venous thromboembolism \(VTE\) prophylaxis in pregnancy and the puerperium](#)')
- Adult ambulatory patients with isolated injury who will be requiring temporary lower limb immobilisation (including those discharged from Emergency Departments)

The following patients do NOT routinely require VTE prophylaxis (and therefore do not require a VTE risk assessment):

- Day surgery or procedure patients where procedures are carried out under local anaesthesia without any limitation of mobility
- All patients discharged home from the Emergency Department other than those with lower limb immobilisation
- Terminally ill or end of life care patients. (However, this needs to be reviewed taking account the views of the patient, their families and/or carers and the multidisciplinary team).

1.2 Conduct advance-planning for planned hospitalisation patients

At the pre-admission appointment conduct preliminary risk assessments to allow for VTE prevention planning. A multidisciplinary team should be involved in assessing:

- the patient's VTE risk
- the VTE and bleeding risks associated with the planned procedure
- whether regional anaesthesia should be considered for the surgery/procedure
- the patient's current medications and their impact on both VTE and bleeding risk
- the risks versus benefits of temporarily stopping certain current medications.

If a medication is to be temporarily stopped, the team should ascertain:

- when it needs to be stopped and when it needs to be resumed
- where anticoagulants are to be temporarily stopped, whether the patient should be considered for bridging therapy.

For further information, see [Appendix 2](#).

1.3 Undertake VTE risk assessment

1.3.1 VTE risk assessment

VTE risk assessments should be carried out as soon as possible after admission. The VTE risk assessment should be undertaken using the statewide '[Adult Venous Thromboembolism Risk Assessment Tool](#)' or other locally endorsed tool, and the assessment results documented in a place that is easily accessible to all clinicians involved in the patient's care.(4) The statewide tool was endorsed by the Queensland Statewide VTE Prevention Working Group following extensive stakeholder consultation.

Document that the assessment has been completed in the red VTE section of the NIMC (by ticking the appropriate box) or in the appropriate section of the ieMR for digital facilities.

1.3.2 VTE risk factors

The risk of developing VTE depends on a combination of risk factors related to the patient and their reason for hospitalisation. Tools and methods in assessing VTE risks using these risk factors in medical and surgical patients have been widely published and used (e.g. Caprini and Padua). The statewide VTE risk assessment tool uses an individualised risk assessment approach and is based on the following risk assessment models or risk stratification sources.

Table 1: Risk assessment models used by the statewide VTE Risk Assessment Tool

Patient cohort	Risk assessment model or sources of risk stratification
Medical patients who are critically ill	British Medical Journal best practice VTE prophylaxis, 2017(5); Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines (9 th edition), 2012(6); National Institute for Health and Care Excellence: Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism, 2018(7)
Surgical patients with major abdominal-pelvic surgery for cancer ; major trauma ; cardiac surgery	
Medical except critically ill	Padua Prediction Score 2010. (8) (see Appendix 3)
Mental Health	
General and abdominal-pelvic surgery	Caprini risk assessment score 2005. (9) (see Appendix 4)
Thoracic surgery	
Total hip arthroplasty and total knee arthroplasty	Adapted from the Arthroplasty Society of Australia guidelines for VTE prophylaxis for hip and knee arthroplasty, 2018. (10)
Fragility fractures of the pelvis, hip and proximal femur	European Society of Anaesthesiology - European Guidelines on perioperative venous thromboembolism prophylaxis – Day surgery and fast track surgery, 2017. (11)
Other orthopaedic procedures	
Ambulatory patients with isolated lower limb immobilisation	Guidelines in Emergency Medicine Network (GEMNet)-Guideline for the use of thromboprophylaxis in ambulatory trauma patients requiring temporary limb immobilisation, 2012. (12)
Craniotomy	European Society of Anaesthesiology - European Guidelines on perioperative venous thromboembolism prophylaxis – Neurosurgery, 2017. (13)
Elective spinal surgery	
Vascular surgery	European Society of Anaesthesiology - European Guidelines on perioperative venous thromboembolism prophylaxis – Cardiovascular and thoracic surgery, 2017. (14)
Bariatric surgery	European Society of Anaesthesiology - European Guidelines on perioperative venous thromboembolism prophylaxis -Surgery in the obese patient, 2017. (15)

1.3.3 Patients on therapeutic anticoagulation

VTE prophylaxis should NOT be prescribed for patients who are already anticoagulated (i.e. currently receiving an anticoagulant such as UFH, LMWH, DOAC or warfarin with an INR in therapeutic range). These patients should have had an assessment either at pre-admission clinic or on admission and a decision made by the treating team whether to interrupt their anticoagulant therapy.

If therapeutic anticoagulation is temporarily interrupted and VTE prophylaxis is indicated, see [1.7.4](#) for timing of VTE prophylaxis in these situations and refer to your hospital's guidelines on peri-procedural management of anticoagulants for further information.

1.3.4 Specific patient groups at increased VTE risk

The following specific patient groups are recognised to be at increased VTE risk due to the risk factors related to their reason for hospitalisation and will require VTE prophylaxis. All other patients that are not covered in the list below will require an individualised VTE risk assessment to determine their VTE risk and need for VTE prophylaxis.

Medical patients

- Admitted following acute stroke with significant reduction in mobility
- Critically ill patients
- Hospitalised for decompensated heart failure
- Active inflammatory bowel disease

Surgical patients

- Major abdominal-pelvic surgery for cancer
- Total hip arthroplasty or total knee arthroplasty
- Fragility fractures of the pelvis, hip and proximal femur
- Major trauma surgery (including traumatic brain injury, acute spinal cord injury, traumatic spinal injury and complex traumatic pelvic / lower extremity injury)
- Craniotomy
- Cardiac surgery
- Abdominal aortic aneurysm repair surgery
- Thoracic surgery patients with primary or metastatic cancer
- Elective spinal surgery (with hospital admission) resulting in reduced mobility
- Bariatric surgery

Ambulatory patients with isolated lower limb immobilisation

- Ambulatory patients temporarily immobilised with above or below knee cast, or backslab with additional risk factors

1.4 Assess contraindications to prophylaxis

Assess contraindications to prophylaxis (including bleeding risks) taking into consideration:

- Reason for admission
- Patient-related factors
- Comorbidities
- Medication history

1.4.1 Contraindications to mechanical VTE prophylaxis

A comprehensive vascular assessment which includes palpation of peripheral pulses and skin blanch tests should be conducted to help assess contraindications to mechanical prophylaxis. Contraindications are:

- Severe peripheral arterial disease or ulcers
- Recent skin graft
- Peripheral arterial bypass grafting
- Severe leg oedema or pulmonary oedema from congestive heart failure
- Known allergy to material of manufacture
- Severe local problems on legs (e.g. gangrene, dermatitis, untreated infected wounds, fragile 'tissue paper' skin)

Patients for whom IPC is a suitable option, however, GCS is contraindicated:

- Patients admitted for stroke
- Severe leg deformity or morbid obesity preventing correct fit
- Severe peripheral neuropathy

If VTE prophylaxis is not required or if contraindicated, document on the NIMC by ticking the appropriate box and ensure the relevant section is signed and dated to indicate that the risk assessment is complete. For facilities using ieMR, the appropriate section in the EMM should be completed.

1.4.2 Contraindications to pharmacological VTE prophylaxis

Absolute: Where there is an absolute contraindication to pharmacological prophylaxis, consider mechanical prophylaxis instead until the absolute contraindication is resolved.

Absolute contraindications are:

- Already anticoagulated (i.e. currently receiving an anticoagulant such as UFH, LMWH, DOAC or warfarin with an INR in therapeutic range, danaparoid, bivalirudin, fondaparinux)
- Active major bleeding (e.g. 2 units or more of blood or blood products transfused in 24 hours)
- Recent clinically significant bleeding (within the last 48 hours)
- Thrombocytopenia (platelets less than $50 \times 10^9/L$)¹
- Inherited or acquired bleeding disorders (e.g. haemophilia)

Relative: Where there are relative contraindications, caution needs to be exercised and the benefits of pharmacological prophylaxis weighed against the risks. Relative contraindications are:

- Surgical procedures with high bleeding risk (e.g. head and neck surgery, neurosurgery, or eye surgery) within the last two weeks
- Recent gastrointestinal or genitourinary bleeding
- Recent central nervous system bleeding
- Intracranial or spinal lesion deemed by neurosurgery to be at high risk of bleeding
- Uncontrolled systolic hypertension (230/120 mmHg or higher)
- Conditions associated with high risk of clinically significant bleeding
 - Active peptic ulcer and/or active ulcerative gastrointestinal disease
 - Severe hepatic disease or acute liver failure
- Other conditions with significant bleeding risk

¹ In exceptional cases, anticoagulation may be continued if the patient's platelets fall below $50 \times 10^9/L$ in consultation with haematology

1.4.3 Special considerations with pharmacological VTE prophylaxis

Heparin-induced thrombocytopenia or thrombosis (HIT/HITT)

- A history of HIT/HITT is a contraindication to low molecular weight heparin (LMWH) or unfractionated heparin (UFH). Seek haematologist advice for appropriate pharmacological VTE prophylaxis alternatives. See [1.10.2](#) for more information regarding HIT/HITT.

Lumbar puncture

- Including intrathecal administration of medication or neuraxial anaesthesia. To minimise the risk of spinal epidural haematomas there should be careful planning of the timing of pharmacological prophylaxis administration with respect to the timing of the catheter or needle insertion AND removal.(16) See [1.7.3](#), Table 7 for further information.

Temporary interruption of therapeutic anticoagulation

- If therapeutic anticoagulation is temporarily interrupted and VTE prophylaxis is indicated, see 1.7.4 for timing of VTE prophylaxis in these situations and refer to your hospital's guidelines on peri-procedural management of anticoagulants for further information.
- Do NOT prescribe VTE prophylaxis to patients who are already anticoagulated throughout their hospitalisation.

Patients on antiplatelet therapy for other conditions

- Antiplatelet agents are not adequate to prevent VTE for most patients These patients would still need to be assessed for their VTE risk and prescribed VTE prophylaxis if indicated.(7, 17) However, in some patients undergoing orthopaedic procedures aspirin may be used for VTE prophylaxis (refer to sections [2.2.3](#), [2.2.4](#), [2.2.6](#)).
- Patients that have had a temporary interruption in their dual antiplatelet therapy should resume both antiplatelet agents shortly after the procedure unless otherwise instructed by the cardiologist.

Patient's personal beliefs

- A patient may have personal beliefs that could prevent them from receiving blood products and blood transfusion in the event of a bleed. This should be considered when selecting an appropriate anticoagulant. This may include choosing agents for which the therapeutic effect is readily reversible (e.g. UFH).
- If a patient's personal beliefs prevent them from taking a pharmacological VTE prophylaxis product containing porcine, refer to the statewide guideline, [Medicines/ pharmaceuticals of animal origin](#) and seek specialist advice.

1.5 Conduct baseline tests for heparin-based VTE prophylaxis

The following tests are recommended if heparin-based VTE prophylaxis is being considered.(5) For other pharmacological VTE prophylaxis, the clinician should assess the need for the following tests and conduct if appropriate:

- full blood count
- renal function (See [1.5.1](#))
- coagulation profile (including INR, APTT etc.) if a coagulation disorder is suspected.

1.5.1 Renal function estimation

No method of estimating renal function is appropriate for use in patients who have rapidly changing renal function (e.g. patients with acute renal impairment, intensive care patients) or extremes of muscle mass (e.g. cachectic patients, body builders, obesity). In such patients a measured (urinary) creatinine clearance is recommended.(18, 19)

Due to the inherent limitations with estimating renal function, dose adjustment should be considered in the context of a patient's clinical status, potential toxic effects of the drug and likely consequences of under-dosing.(18)

Kidney Health Australia states that the use of eGFR to estimate kidney function for drug dosing is endorsed by domestic and international renal clinical guidelines.(20) The Statewide Renal Clinical Network have advised renal function for pharmacological VTE prophylaxis dosing can be estimated using either eGFR reported in pathology results or creatinine clearance (CrCl) calculated using the Cockcroft and Gault equation.(21)

Calculating eGFR corrected for body surface area

The value of eGFR as reported in AUSLAB/AUSCARE is standardised to a body surface area (BSA) of 1.73 m². For extremes of body size, the value reported needs to be adjusted for actual BSA. This is achieved by multiplying the eGFR by the patient's BSA (in m²) and dividing by 1.73m².(22) BSA can be calculated using the equation below or the [BSA calculator available in the Australian Medicines Handbook](#).

Firstly, calculate the patient's actual BSA:

$$BSA(m^2) = \sqrt{\frac{HEIGHT(cm) \times WEIGHT(kg)}{3600}}$$

Next, adjust eGFR for patient's actual BSA:

$$eGFR (mL/min) = \frac{eGFR (mL/min/1.73 m^2) \times BSA (m^2)}{1.73}$$

Source: Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula

1.6 Develop VTE Prevention Plan and initiate VTE prophylaxis

After assessing the patient's VTE risk, bleeding risks and contraindications, consider whether the benefits of VTE prophylaxis outweigh the risks and decide if VTE prophylaxis is required. The VTE prevention plan is a written proposal of steps and measures to prevent VTE based on risk-benefit assessments undertaken. The plan should:

- be developed in consultation with the patient, taking consideration of individual beliefs and preferences
- include the type of VTE prophylaxis to be prescribed, when to initiate and the duration
- contain general steps to reduce VTE
- document the frequency of reassessments
- be easily accessible to all clinicians involved in the patient's care.

Following a decision to prescribe VTE prophylaxis, an order for VTE pharmacological and/or mechanical prophylaxis must be documented either on the VTE section of the NIMC (or a regular medication section of the NIMC long-stay chart) or in an EMM system.

1.7 Pharmacological Prophylaxis

1.7.1 Options for pharmacological VTE prophylaxis

This guideline recommends LMWH as the preferred option for heparin-based VTE prophylaxis except in patients with significant renal impairment and in patients at increased bleeding risk. The tables below outline pharmacological options and their restrictions according to the [Queensland Health List of Approved Medicines \(LAM\)](#). Refer also to the [Australian Register of Therapeutic Goods \(ARTG\)](#) and [Pharmaceutical Benefits Scheme \(PBS\)](#) websites for additional information regarding indications.

Note regarding heparin-induced thrombocytopenia/thrombosis (HIT/HITT): in 2016 the American Society of Haematology reported that the use of an 'Avoid-Heparin Initiative' resulted in dramatic reduction in the burden of HIT/HITT and associated costs. The 'Avoid-Heparin Initiative' was implemented in a tertiary care hospital in Canada where they developed a hospital-wide strategy of replacing UFH with LMWH for VTE prophylactic and therapeutic indications. The authors concluded that they successfully decreased the patient burden and costs of HIT over a prolonged time.(23)

Table 2: Pharmacological VTE prophylaxis options

Drug Class	Medication	Notes
LMWH ^Ω	Dalteparin	Preferred option except in patients with renal impairment or patients at increased risk of bleeding (see 1.7.5)
	Enoxaparin	
UFH	Heparin	Option for patients with renal impairment and patients at increased risk of bleeding (see 1.7.5)
DOAC	Rivaroxaban	Option for VTE prophylaxis following THR or TKR surgery
	Dabigatran	
	Apixaban	
Antiplatelet	Aspirin	Option for specific orthopaedic patients without additional VTE risk factors (see 2.2.3 , 2.2.4 and 2.2.6 for further detail). Note: The national VTE Prevention Clinical Care Standard includes aspirin "for use in hip and knee replacement surgery only, usually in combination with mechanical methods and in patients without major risk factors for VTE and bleeding."(4)

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.

Table 3: LAM restrictions relating to pharmacological VTE prophylaxis options

Drug Class	Medication	LAM status/restrictions in relation to VTE prophylaxis
LMWH ^Ω	Dalteparin	For adult use: for prophylaxis of venous thromboembolism (VTE) and during haemodialysis
	Enoxaparin	NOT currently listed for VTE prophylaxis in adults
UFH	Heparin	Unrestricted
DOAC	Rivaroxaban	For use as per PBS indications and for VTE prophylaxis for inpatients previously diagnosed with Heparin-Induced Thrombocytopenia (This is an off-label use)
	Dabigatran	For use as per PBS indications
	Apixaban	NOT currently listed for VTE prophylaxis
Antiplatelet	Aspirin	Unrestricted

Source: Queensland Health List of Approved Medicines, August 2018, (24)

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. Use of dalteparin for VTE prophylaxis in medical patients is currently off-label: however, its LAM listing for this indication is supported by its registration in the United States and the United Kingdom for VTE prophylaxis in medical patients, as well as its registration for VTE prophylaxis in surgical patients in Australia. This information is correct as at publication.

1.7.2 Standard dosing and timing

Medical patients

If pharmacological prophylaxis is indicated, it should be commenced as early as possible after the risk assessment has been carried out. Pharmacological prophylaxis for medical patients should generally continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from the hospital.(5)

Table 4: Standard prophylactic doses in medical patients

Drug Class	Medication	Standard prophylactic dose in medical patients
LMWH ^Ω	Dalteparin	5000 units subcutaneously once daily
	Enoxaparin	40mg subcutaneously once daily
UFH	Heparin	5000 units subcutaneously every 8-12 hours

Source: MIMS Online 2018, (25); electronic Medicines Compendium 2016, (26)

Surgical patients

Consult the product information of the relevant medication for guidance on the dose and timing of pre-operative and post-operative VTE prophylaxis. Where there are specific recommendations for the timing of prophylaxis relevant to specific patient cohorts (e.g. cardiac surgery, elective spinal surgery, etc), these are detailed within tables in [Section 2](#). Section 2 also outlines the minimum recommended duration of prophylaxis for these cohorts. The timing of administration of VTE pharmacological prophylaxis will need to be modified if epidural or spinal anaesthesia is performed (see [1.7.3](#)).

For elderly patients undergoing inpatient rehabilitation, consider extending duration of VTE prophylaxis beyond the minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from the hospital. This recommendation is based on consensus expert opinion.

Table 5: Standard prophylactic doses and timing of prophylaxis in surgical patients

Drug Class	Medication	Standard prophylactic dose and timing in relation to surgery
Not all regimens suitable for procedures involving neuraxial anaesthesia For timing in relation to epidural or spinal anaesthesia see 1.7.3, Table 7		
LMWH ^Ω	Dalteparin	5000 units subcut the evening before the operation, then 5000 units daily thereafter OR 2500 units subcut 1-2 hours preoperatively repeated 12 hours later, then 5000 units daily thereafter
	Enoxaparin	40 mg subcut 12 hours preoperatively then daily thereafter
UFH	Heparin	5000 units subcut 2 hours preoperatively then every 8-12 hours thereafter

Adapted from: MIMS Online 2018, (25)

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.

Table 6: Standard prophylactic doses and timing of DOAC for THR/TKR surgery

DOAC	Standard prophylactic dose and timing in relation to THR/TKR surgery
Not all regimens suitable for procedures involving neuraxial anaesthesia For timing in relation to epidural or spinal anaesthesia see 1.7.3, Table 7	
Rivaroxaban	Rivaroxaban 10mg once daily; starting 6-10 hours after surgery when haemostasis established, for maximum 5 weeks THR or 2 weeks TKR
Dabigatran	Dabigatran 110 mg 1-4 hours postoperatively then 220mg daily thereafter. Delay treatment initiation if haemostasis unsecured. If not started on day of surgery, initiate with 220mg daily. Total treatment time following THR 28-35 days and TKR 10 days
Apixaban	Apixaban 2.5mg twice daily; starting 12-24 hours after surgery, for maximum 32-38 days THR or 10-14 days TKR

Source: MIMS Online 2018, (25)

Note: These recommendations are for post-operative commencement only. **Not applicable** to patients prescribed therapeutic anticoagulation with DOAC pre-operatively. For recommendations around re-commencement of therapy in these patients refer to [Queensland Health Guideline: Managing patients on dabigatran \(Pradaxa®\)](#) and [Queensland Health Guideline for managing patients on a factor Xa inhibitor – apixaban \(Eliquis®\) or rivaroxaban \(Xarelto®\)](#)

1.7.3 Neuraxial puncture or catheter insertion and removal

When neuraxial anaesthesia or spinal/epidural puncture (including intrathecal medication administration) is used in patients receiving VTE pharmacological prophylaxis, the patient is at risk of developing an epidural/spinal haematoma which can result in long-term or permanent paralysis. The risk may increase with traumatic or repeated puncture and the timing of pharmacological prophylaxis may need to be delayed; seek specialist advice. Potential risk can be reduced when anticoagulant effect is low.(16, 27)

The following table shows recommended time intervals for neuraxial puncture or catheter insertion and removal dependent on anticoagulant and dosage. Additional pathology testing may be required. All time intervals listed in the table refer to patients with normal renal and hepatic function.(16) Recommendations are continually changing as more knowledge is gained on this subject. Refer also to local or [statewide guidelines](#) on peri-procedural management of anticoagulants.

Table 7: Timing of anticoagulants and neuraxial puncture or catheter insertion/removal

Drug Class	Medication	Time after medication administration for puncture or catheter insertion/removal	Time after puncture or catheter removal for medication administration
UFH	Heparin		
	Prophylaxis: 15000 units per day maximum	Subcut: 4 to 6 hours	1 hour
	Treatment	IV: 4 to 6 hours Subcut: 8 to 12 hours	1 hour
LMWH [□]	Dalteparin / Enoxaparin		
	Prophylaxis	12 hours NB: If twice daily administration, omit one dose for a 24-hour time interval	4 hours
	Treatment	24 hours	4 hours
DOAC	Rivaroxaban	Extreme caution recommended	
	Prophylaxis: 10mg daily	22 to 26 hours	4 to 6 hours
	Dabigatran	Manufacturer recommends neuraxial catheters are not used	
	Prophylaxis 150-220mg daily	Contraindicated by the manufacturer	6 hours
	Apixaban	Extreme caution recommended	
	Prophylaxis: 2.5mg twice daily	26 to 30 hours	4 to 6 hours
Vitamin K antagonist	Warfarin	Await INR less than or equal to 1.4	After catheter removal

Adapted from: Horlocker, et al. Regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy. *Reg Anesth Pain Med* 2018;43(3):263-309.(16)

[□] Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.

1.7.4 Surgical patients on therapeutic anticoagulation

For patients that are planned to have post-operative therapeutic bridging and have been assessed as needing VTE pharmacological prophylaxis post-operatively, continue prophylaxis until post-operative therapeutic bridging is started. Refer to local or [statewide guidelines](#) on peri-procedural management of anticoagulants.

For patients that are not planned to have post-operative bridging therapy but need VTE pharmacological prophylaxis, continue prophylaxis post-operatively until the patient has resumed their usual anticoagulation or until the therapeutic INR has been reached (in the case of patients resuming warfarin).

1.7.5 Dose adjustment for prophylaxis in specific patients

Patients with renal impairment

The following tables show the recommendations for pharmacological prophylaxis in patients with renal impairment. Careful clinical observation is required. For patients with acute kidney failure, end stage renal disease, dialysis dependent[‡] or conditions where eGFR may be inaccurate, use UFH; do not use LMWH for these patients. For obese patients with renal impairment, seek specialist advice.

[‡] Haemodialysis patients admitted to hospital should be assessed for their VTE risks and need for VTE prophylaxis as for all other hospitalised patients, irrespective of the use of anticoagulants in their extracorporeal circuits during haemodialysis days.

Table 8: Heparin-based VTE prophylaxis dose adjustments for patients with renal impairment

Renal function [§] (mL/min)	UFH	LMWH [¶]
30-50	No adjustment required	No adjustment required
15-29	No adjustment required	Enoxaparin: Reduce dose to 20 mg subcut daily Dalteparin[⊖]: No dose adjustment required
Less than 15	No adjustment required	Do NOT use LMWH

Source: MIMS Online 2018, (25); Micromedex 2, (28).

[§] References use CrCl (mL/min) as an indicator of renal function, however renal function can also be estimated in this situation using eGFR (mL/min/1.73m²). Seek advice for patients at extremes of body size.

[¶] Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.

[⊖] Consider dose reduction of dalteparin to 2500 units daily with low body weight, very elderly or severe renal impairment.

Table 9: DOAC VTE prophylaxis dose adjustments for THR/TKR patients with renal impairment

Renal function [§] (mL/min)	Rivaroxaban	Dabigatran	Apixaban
30-50	10mg once daily	Adjust dose to 150mg once daily	2.5mg twice daily
25-29	10mg once daily (Use with caution)	Contraindicated	2.5mg twice daily (Use with caution)
15-24	10mg once daily (Use with caution)	Contraindicated	Contraindicated
Less than 15	Contraindicated	Contraindicated	Contraindicated
Dialysis	Contraindicated	Contraindicated	Contraindicated

Source: MIMS Online 2018, (25)

[§] References use CrCl (mL/min) as an indicator of renal function, however renal function can also be estimated in this situation using eGFR (mL/min/1.73m²). Seek advice for patients at extremes of body size.

Patients at increased risk of bleeding

Patients at increased risk of bleeding include those that are critically ill, have undergone high bleeding risk surgical procedures or have other conditions associated with high bleeding risk (see [1.4.2](#)). Patients should be closely monitored for signs of bleeding complications and dose adjustment of anticoagulants should be made at the discretion of the treating physician.

Standard prophylactic dose UFH can be considered as an option instead of LMWH for patients with increased bleeding risk. Rivaroxaban is contraindicated by the manufacturer for high bleeding risk patients.(25) Caution should be taken when using other anticoagulants. Refer to the product information for further guidance.

Underweight patients (body weight less than 50 kg)

Evidence for use of LMWH in extremes of body weight is limited and careful clinical observation is required. Seek specialist advice for the use and monitoring of dose adjusted LMWH (e.g. dalteparin 2500 units subcutaneously once daily or enoxaparin 20 mg subcutaneously once daily).

Patients that are obese (BMI 30 kg/m² or greater)

Patients with body mass index (BMI) 30 kg/m² or greater have an increased risk of VTE and may not follow a predictable dose-response relationship.(29, 30) LMWH at standard prophylactic dose is unlikely to be sufficient in patients with BMI 40 kg/m² or greater.(29, 30) For obese patients with renal impairment, seek specialist advice.

Table 10: Recommendations for dose adjustment of LMWH in patients that are obese

BMI (kg/m ²)	VTE risk	Recommended dose
30 to 40	Low / Moderate	Use standard dose of LMWH [□] for VTE prophylaxis
	High	Consider dose adjusted LMWH [□] :
41 to 60	Low / Moderate / High	Dalteparin: 5000 units subcut twice daily OR 50 units/kg subcut once daily
		OR Enoxaparin: 40mg subcut twice daily OR 0.5mg/kg subcut once daily
Greater than 60	Low / Moderate / High	Seek specialist advice

Source: Dose recommendations for enoxaparin adapted from several references (29, 30) by the Statewide VTE Prevention Working Group; dalteparin dosing is based on expert opinion(31).

[□] Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.

1.8 Mechanical prophylaxis

1.8.1 Types of mechanical prophylaxis

When developing a plan that includes mechanical prophylaxis, consider the following:

- Specialist vascular advice if prescribing in peripheral arterial disease (or if suspected)
- Consideration of foot impulse technology as first preference in patients with peripheral arterial disease if mechanical compression is required after a vascular assessment.

Mechanical prophylaxis methods include:

- Intermittent pneumatic compression (IPC) or sequential compression device (SCD) including foot impulse devices
- Graduated compression stockings (GCS)

For the purposes of this guideline, IPC includes sleeves/cuffs applied to legs and garments wrapped around the foot (foot impulse devices) connected to an air pump that sequentially inflates to improve venous circulation in the limbs. IPC is more effective than GCS in preventing DVT in surgical patients. IPC is recommended over GCS in patients with moderate to high VTE risk that are not receiving pharmacological prophylaxis or in patients at very high VTE risk that are on combined mechanical and pharmacological prophylaxis.

GCS apply pressure on the leg muscles to squeeze the vein valves starting with the greatest degree of compression at the ankle and decreasing the level of compression up the leg. This helps ensure that blood flows upwards to the heart instead of refluxing downwards.

1.8.2 Timing of initiation and duration of mechanical prophylaxis

If mechanical prophylaxis is indicated:

- It should be commenced as soon as possible after the completion of the VTE risk assessment.
- Generally, mechanical prophylaxis will be required until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital.

1.8.3 Factors to consider on initiation of mechanical prophylaxis

Intermittent Pneumatic Compression or Sequential Compression Device

- Measure for the individual patient to ensure correct size of cuff
- Ensure inflation pad is located over the calf for maximum effectiveness
- Sleeves can be applied over bare legs or pyjama trousers or socks
- Ensure all connections are secure, Velcro® straps tightened and the pressure set at appropriate default settings
- The trailing tube of the IPC sleeves could be a falls risk for some patients (e.g. those with confusion etc.). This should be considered in the falls risk assessment.

Graduated compression stockings

- Measure and fit for the individual patient
- Refer to the manufacturer's recommendations for instructions on measuring
- Stockings should produce a calf pressure of 14 to 15 mmHg
- Knee length stockings should finish 3 cm below the popliteal fossa
- Use caution and clinical judgment when applying stockings over venous ulcers and wounds
- Ensure patients are shown how to use the stockings by trained staff
- Encourage patients to wear stockings continuously day and night until mobility is no longer significantly reduced or unless otherwise specified by the treating medical team
- Advise patients not to roll or fold the stocking for mobilising
- Advise patients to ensure footwear is worn due to the risk of slipping.

1.9 Inferior Vena Cava (IVC) filters

An IVC filter is a type of vascular filter, a medical device placed within the inferior vena cava to reduce the risk of PE. There is currently no strong evidence to support prophylactic IVC filter placement in patients with contraindications to both pharmacological and mechanical prophylaxis, with benefits potentially outweighed by complications resulting from the filter.⁽³²⁾ It is strongly recommended that temporary IVC filter placement is only reserved for use in exceptional circumstances (i.e. very high VTE risk patients that have absolute contraindications to both pharmacological and mechanical prophylaxis).

1.10 Monitor, reassess and update VTE prevention plan

1.10.1 General VTE prophylaxis monitoring

VTE prophylaxis reduces the patient's risk of developing VTE. However, VTE may still occur. Patients should be monitored daily for signs and symptoms of DVT (e.g. swelling, pain, redness or venous distension in a limb, as well as pleuritic chest pain or dyspnoea).

It is essential that patients are regularly monitored and encouraged to mobilise and ensure adequate hydration (unless clinically contraindicated).

1.10.2 Pharmacological VTE prophylaxis monitoring

VTE pharmacological prophylaxis should be reviewed daily by a medical officer and the following considered:

Over-anticoagulation and bleeding

Patients should be monitored for bleeding. Examples of where bleeding can occur include at the surgery site, from a gastric or duodenal ulcer, or at an injection site. If clinically significant bleeding occurs or is suspected or if any other absolute contraindication develops, the agent should be withheld or stopped and urgent consultant review organised. Refer to your hospital's guidelines on management of bleeding in anticoagulated patients.

Drug interactions

Close clinical monitoring is recommended, especially if risk factors for increased bleeding are present, during concomitant administration of VTE pharmacological prophylaxis and the following agents:

- other anticoagulants (e.g. bridging with warfarin until INR is therapeutic after a temporary interruption in therapy)
- antiplatelet agents
- thrombolytics/fibrinolytics (e.g. alteplase, tenecteplase)
- NSAIDs especially long half-life agents such as naproxen, piroxicam.
- drugs that interact with DOACs including the cytochrome P450 or P-glycoprotein inhibitors, inducers and substrates (e.g.azole-antibiotics, HIV protease inhibitors).

Full blood count and renal function

As thrombocytopenia and renal impairment are significant risk factors for bleeding, platelet count and renal function should be assessed at baseline and regularly throughout hospitalisation, especially during periods of acute illness or whenever the patient's clinical condition changes.

Heparin-induced thrombocytopenia or thrombosis (HIT/HITT)

HIT is an antibody-mediated adverse drug reaction to heparin which results in an increased risk of venous or arterial thrombosis and skin necrosis. Prompt diagnosis is important for prevention of thrombotic complications as it can have serious sequelae including life-threatening thrombosis or death. HIT usually develops after seven to ten days of therapy with either LMWH or UFH but can arise more rapidly if there has been previous heparin exposure in the last 100 days.⁽³³⁾ It is more common with UFH than with LMWH.

Patients that are receiving heparin-based VTE prophylaxis (UFH, LMWH) should have their platelet count measured regularly; at baseline and at least three times per week from day 4 to day 14. Seek specialist advice for confirmation of diagnosis, treatment/management options and a recommended alternative non-heparin based anticoagulant for VTE prophylaxis. Refer to local guidelines or the statewide guideline: [Management of Adult Acute Heparin Induced Thrombocytopenia/Thrombosis \(HIT\)](#).

If diagnosis is confirmed, this should be carefully documented as an ADR on the NIMC, in iPharmacy and in the patient's medical notes or ieMR to reduce the risk of re-exposure. Hospital protocol on adverse drug reactions should be adhered to. Future use of any heparin-based therapy must be avoided.

1.10.3 Mechanical VTE prophylaxis monitoring

Checks associated with mechanical prophylaxis should be documented on the NIMC where mechanical prophylaxis has been prescribed or in the ieMR or EMM as appropriate.

Intermittent Pneumatic Compression or Sequential Compression Device

- At each shift, remove the IPC sleeves to check skin integrity of the lower limbs and pressure areas.
- Monitor skin integrity with extra vigilance due to the potential increased risk of skin breaks.

Graduated compression stockings

- Remove stockings at least daily to assess skin condition, check leg swelling and for skin care and hygiene purposes.
- At each shift, check for correct placement, no restrictions to perfusion and satisfactory neurovascular status.
- In patients with significant reduction in mobility, poor skin integrity or any sensory loss, the skin should be inspected two or three times per day, especially over the heels and bony prominences.
- If there is marking, blistering or discolouration of the skin or if patient experiences pain or discomfort, discontinue the use of the stockings and alert the treating team. Offer an alternative mechanical prophylaxis if suitable.
- Ensure legs are re-measured and stockings refitted for patients that develop oedema or postoperative swelling.

1.10.4 Reassess for risks of VTE and bleeding

Patients should be reassessed for risks of VTE and bleeding:

- regularly as clinically appropriate
- as clinical condition changes (e.g. after surgery/procedure, with changes in mobility)
- when goals of care change
- at the request of the patient, their family or carer
- at transfer of care
- on discharge.(4)

1.10.5 Update VTE prevention plan

Best practice for updating the VTE prevention plan includes:

- informing and engaging the patient/carer of any changes in risks with reassessment and changes to the VTE prevention plan
- documenting the results from reassessment of risk and changes to the plan.(4)

1.10.6 Write discharge plan and ensure transfer of care

Upon the patient's discharge from hospital, ensure a plan for ongoing VTE prevention has been developed incorporating:

- summary of patient's reason for admission and VTE risk
- details of VTE prophylaxis received during their hospitalisation
- VTE prophylaxis prescribed at discharge including intended duration
- additional instructions about precautions
- ongoing monitoring and follow up requirements
- a current list of medications.(4)

The plan should be discussed and provided to the patient before they leave the hospital. It should also be communicated to the patient's general practitioner or ongoing clinical provider within 48 hours of discharge. Offer patients and/or their families or carers verbal and written information on VTE prevention.(4) (See [Appendix 1](#)).

2 VTE prophylaxis guideline for individual patient cohorts

2.1 Medical and Mental Health Patients

For the purposes of this guideline, medical patients have been categorised into the following patient cohorts:

- [Acute stroke](#)
- [Critically ill patients](#)
- [Adult medical cancer inpatients](#)
- [Acutely ill](#)
- [Mental health patients](#)
- For all other medical patients refer to statewide '[Adult Venous Thromboembolism Risk Assessment Tool](#)' (or [Appendix 3](#) Padua risk assessment) to undertake an individualised risk assessment. Refer to sections [1.7](#) and [1.8](#) for prophylaxis options.

The recommendations in the specific patient cohort tables for medical patients have been developed following a review of available evidence in 2018 and in consultation with the statewide VTE Prevention Working Party, as well as relevant statewide clinical networks and experts to achieve consensus. The principal guidelines and resources are:

- British Medical Journal: Best Practice VTE prophylaxis, 2017
- Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines (9th edition), 2012
- National Institute for Health and Care Excellence: Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism, 2018.

2.1.1 Acute Stroke

Table 11: VTE prophylaxis in acute stroke medical patients

Patient Cohort	ADULT MEDICAL PATIENTS – ACUTE STROKE		
NO prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level See Appendix 3 for Padua risk assessment	Low VTE risk (Padua score less than 4)	High VTE risk (Padua score 4 or more) Including patients admitted following acute stroke with significant reduction in mobility	
Prophylaxis	No VTE prophylaxis recommended Encourage patient to mobilise and maintain adequate hydration Reassess (and document) risks within 24 hours and whenever clinical condition or goals of care change	Haemorrhagic stroke	Ischaemic stroke
		Start IPC on admission	Start IPC on admission AND Consider LMWH ^{Ω#} : dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily See below if thrombolysed^α
Duration	N/A	Mechanical prophylaxis: Continue IPC for 30 days or until the patient is mobilising regularly or safe mobilisation is inhibited by the device. GCS should not be used for acute stroke patients; use IPC instead. Pharmacological prophylaxis: If LMWH used, continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital, whichever is sooner.	

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. Use of dalteparin for VTE prophylaxis in medical patients is currently off-label: however, its LAM listing for this indication is supported by its registration in the United States and the United Kingdom for VTE prophylaxis in medical patients, as well as its registration for VTE prophylaxis in surgical patients in Australia. This information is correct as at publication.

[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with:

- eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min
- increased risk of bleeding
- body weight 50 kg or less
- BMI 30 kg/m² or greater

See [1.7.5](#) for more information

^α Pharmacological VTE prophylaxis is contraindicated for the first 24 hours after thrombolysis in ischaemic stroke. Commencement of pharmacological VTE prophylaxis is at the discretion of the treating clinician following the exclusion of a significant bleed by neuroimaging.

2.1.2 Critically ill patients

Table 12: VTE prophylaxis in critically ill medical patients

Patient Cohort	ADULT MEDICAL PATIENTS – CRITICALLY ILL		
NO prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level	Low VTE risk	High VTE risk All critically ill patients are considered high risk for VTE Regular assessment of VTE and bleeding risks is required	
Prophylaxis	No critically ill patients are at low VTE risk See high VTE risk column	High Bleeding Risk	Low Bleeding Risk
		Start IPC on admission VTE and bleeding risks should be reassessed and documented daily or more frequently whenever clinical condition or goals of care change When bleeding risk decreases, SUBSTITUTE or ADD pharmacological prophylaxis	LMWH ^Ω : dalteparin 5000 units subcut once daily OR enoxaparin 40mg subcut once daily OR UFH: 5000 units subcut twice daily OR 5000 units subcut three times daily Consider IPC in addition to pharmacological prophylaxis. VTE and bleeding risks should be reassessed and documented daily or more frequently whenever clinical condition or goals of care change.
Duration	N/A	Continue until mobility has returned to an anticipated or clinically acceptable level.	

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. Use of dalteparin for VTE prophylaxis in medical patients is currently off-label: however, its LAM listing for this indication is supported by its registration in the United States and the United Kingdom for VTE prophylaxis in medical patients, as well as its registration for VTE prophylaxis in surgical patients in Australia. This information is correct as at publication.

[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with:

- eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min
- increased risk of bleeding
- body weight 50 kg or less
- BMI 30 kg/m² or greater

See [1.7.5](#) for more information

2.1.3 Medical cancer inpatients

VTE in patients with cancer is associated with high morbidity and mortality. Some international guidelines recommend universal thromboprophylaxis in all hospitalised medical cancer patients whilst others are more discriminating and only recommend thromboprophylaxis in hospitalised cancer patients confined to bed or with an acute medical complication. No primary VTE prophylaxis trials have been conducted specifically in the medically ill cancer patient cohort and recommendations for universal thromboprophylaxis are based on extrapolation from trials showing the benefit of VTE prophylaxis in the general population of hospitalised medically ill patients. As the population of cancer patients admitted to hospital can be heterogeneous, there is a need for a validated risk assessment model for estimating the VTE risk of hospitalised patients with cancer.

The following table summarises the recommendations from major guidelines.

Table 13: VTE prophylaxis in medical cancer inpatients

Guidelines	Recommendations for VTE prophylaxis
American Society of Clinical Oncology (ASCO) 2013, 2014	Hospitalised cancer patients with medical illness or reduced mobility should receive prophylactic anticoagulation in the absence of contraindications. Hospitalised patients with cancer without additional risk factors may be considered for prophylactic anticoagulation in the absence of contraindications.
International Society on Thrombosis and Haemostasis (ISTH) 2012	Recommends prophylactic anticoagulation in hospitalised medical patients with cancer and reduced mobility
European Society for Medical Oncology (ESMO) 2011	Recommends prophylactic anticoagulation in hospitalised cancer patients confined to bed with an acute medical complication
National Comprehensive Cancer Network (NCCN)	Recommends prophylactic anticoagulation therapy for all hospitalised patients with cancer in the absence of contraindications

In the absence of a validated risk assessment model derived specifically for cancer inpatients, the Queensland Statewide VTE Prevention Working Group in consultation with the Queensland Statewide Cancer Clinical Network Executive Committee recommends that medical cancer inpatients are risk assessed for their VTE risk using the Padua risk assessment model as for all other medical patients. Using the Padua risk assessment model, VTE prophylaxis would be indicated for the hospitalised cancer patient if they have active cancer AND any of the following risk factors:

- previous VTE
- reduced mobility
- already known thrombophilic condition
- trauma or surgery within the last month
- age 70 or older
- heart and / or respiratory failure
- acute myocardial infarction or stroke
- acute infection and/or rheumatologic disorder
- obesity (BMI 30 kg/m² or greater)
- ongoing hormonal treatment.

For recommendations on VTE prophylaxis refer to: [2.1.1](#) Acute stroke, [2.1.2](#) Critically ill patients or [2.1.4](#) Acutely ill medical patients.

2.1.4 Acutely ill medical patients

Table 14: VTE prophylaxis in acutely ill medical patients

Patient Cohort	ADULT MEDICAL PATIENTS – ACUTELY ILL For patients admitted following acute stroke see Table 11 For critically ill patients see Table 12		
NO prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level See Appendix 3 for Padua risk assessment	Low VTE risk (Padua score less than 4)	High VTE risk (Padua score 4 or more) Including patients: <ul style="list-style-type: none"> hospitalised for decompensated heart failure with active inflammatory bowel disease 	
Prophylaxis	No VTE prophylaxis recommended Encourage patient to mobilise and maintain adequate hydration	High Bleeding Risk	Low Bleeding Risk
		Start IPC on admission Reassess and document risks throughout admission. When bleeding risk decreases and VTE risk persists, SUBSTITUTE mechanical prophylaxis with pharmacological prophylaxis.	LMWH ^Ω #: <ul style="list-style-type: none"> dalteparin 5000 units subcut once daily OR enoxaparin 40mg subcut once daily
Duration	N/A	Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital	

^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. Use of dalteparin for VTE prophylaxis in medical patients is currently off-label: however, its LAM listing for this indication is supported by its registration in the United States and the United Kingdom for VTE prophylaxis in medical patients, as well as its registration for VTE prophylaxis in surgical patients in Australia. This information is correct as at publication.

Dose adjustment of LMWH or alternative recommendations may be required in patients with:

- eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min
- increased risk of bleeding
- body weight 50 kg or less
- BMI 30 kg/m² or greater

See [1.7.5](#) for more information

2.1.5 Mental health patients

Awareness of VTE risk in mental health / psychiatric settings is poor. There is a lack of high quality studies especially around the benefits of VTE intervention in this area and there is need for further research. However, there is a growing body of evidence to indicate that atypical antipsychotics (particularly clozapine) confer an elevated risk of VTE. In addition, 'immobility' or 'reduced mobility', a recognised risk factor for VTE in medical and surgical patients should be considered in the context of psychiatric settings when assessing VTE risks in the mental health / psychiatric patient cohort. Immobility in psychiatric settings should be considered especially in catatonia, neuroleptic malignant syndrome, over-sedation, use of physical restraints, severe depression, bed rest in anorexia nervosa and other acute states of reduced activity.

In the absence of a validated risk assessment model derived specifically for mental health inpatients, the Queensland Statewide VTE Prevention Working Group recommends that mental health inpatients are risk assessed for their VTE risk using the Padua risk assessment model as for all other medical patients.

Table 15: VTE prophylaxis in mental health patients

ADULT MENTAL HEALTH PATIENTS		
Patient Cohort	Patients that are admitted to a psychiatric ward or mental health unit without any indications for medical admission. If there are indications for medical admission refer to specific medical tables: Table 11 : Acute stroke, Table 12 : Critically ill patients or Table 14 : Acutely ill medical patients	
NO prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk		
VTE Risk Level See Appendix 3 for Padua risk assessment	Low VTE risk (Padua score less than 4)	High VTE risk (Padua score 4 or more)
Prophylaxis	No VTE prophylaxis recommended Encourage patient to mobilise and maintain adequate hydration	LMWH ^{Ω#} : dalteparin 5000 units subcut once daily OR enoxaparin 40mg subcut once daily Ensure VTE risks are reassessed for prolonged admission
Duration	N/A	Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. Use of dalteparin for VTE prophylaxis in medical patients is currently off-label: however, its LAM listing for this indication is supported by its registration in the United States and the United Kingdom for VTE prophylaxis in medical patients, as well as its registration for VTE prophylaxis in surgical patients in Australia. This information is correct as at publication.		
[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information		

2.2 Surgical and orthopaedic patients

For the purposes of this guideline, surgical patients have been categorised into the following patient cohorts:

- [General and abdominal-pelvic surgery](#)
- [Major abdominal-pelvic surgery for cancer](#)
- [Total hip arthroplasty and total knee arthroplasty](#)
- [Fragility fractures of the pelvis, hip and proximal femur](#)
- [Ambulatory patients with isolated lower limb immobilisation](#)
- [Other orthopaedic procedures](#)
- [Major trauma](#) – traumatic brain injury, acute spinal cord injury, traumatic spinal injury and complex traumatic pelvic / lower extremity injury
- [Craniotomy](#)
- [Cardiac surgery](#)
- [Vascular surgery](#)
- [Thoracic surgery](#)
- [Elective spinal surgery](#)
- [Bariatric surgery](#)
- For all other surgical patients refer to statewide '[Adult Venous Thromboembolism Risk Assessment Tool](#)' (or [Appendix 4](#) for Caprini risk assessment) to undertake an individualised risk assessment. Refer to section [1.7](#) and [1.8](#) for prophylaxis options.

The recommendations in the specific patient cohort tables for surgical and orthopaedic patients have been developed following a review of available evidence in 2018 and in consultation with the statewide VTE Prevention Working Party, as well as relevant statewide clinical networks and other experts to achieve consensus. The principal guidelines and resources are:

- British Medical Journal: Best Practice VTE prophylaxis, 2017
- Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines (9th edition), 2012
- National Institute for Health and Care Excellence: Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism, 2018
- Arthroplasty Society of Australia guidelines for VTE prophylaxis for hip and knee arthroplasty, 2018
- European Society of Anaesthesiology – European guidelines on perioperative venous thromboembolism prophylaxis, 2017
- Guidelines in Emergency Medicine Network (GEMNet) – Guideline for the use of thromboprophylaxis in ambulatory trauma patients requiring temporary limb immobilisation, 2012.

2.2.1 General and abdominal-pelvic surgery

Table 16: VTE prophylaxis in general and abdominal-pelvic surgery (non-cancer) patients

Patient Cohort	ADULT SURGICAL PATIENTS – GENERAL AND ABDOMINAL-PELVIC SURGERY				
	Includes general, gynaecological, urological, gastrointestinal, plastic or reconstructive, oral, maxillofacial, and ear, nose, throat surgery For major abdominal-pelvic surgery for cancer see Table 17				
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk					
VTE Risk Level See Appendix 4 for Caprini risk assessment	Low VTE risk (Caprini Score 1-2)	Moderate VTE risk (Caprini Score 3-4)		High VTE risk (Caprini Score 5 or more)	
Prophylaxis	Start IPC on admission OR GCS	High bleeding risk	Low bleeding risk	High bleeding risk	Low bleeding risk
		Start IPC on admission	After surgery, use: LMWH ^Ω #: dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily OR IPC	Start IPC on admission After surgery, reassess (and document) risks. When bleeding risk decreases, ADD pharmacological prophylaxis.	Start IPC or GCS on admission AND After surgery, use LMWH ^Ω #: dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily
Duration	Continue until mobility has returned to an anticipated or clinically acceptable level			Treat for 5 to 10 days ^β or until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital	
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication. [#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min increased risk of bleeding body weight 50 kg or less BMI 30 kg/m² or greater See 1.7.5 for more information					
^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.					

2.2.2 Major abdominal-pelvic surgery for cancer

Table 17: VTE prophylaxis in major abdominal-pelvic surgery for cancer patients

Patient Cohort	ADULT SURGICAL PATIENTS – MAJOR ABDOMINAL-PELVIC SURGERY FOR CANCER										
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk											
VTE Risk Level	Low VTE risk	Moderate VTE risk	High VTE risk All major abdominal-pelvic surgery for cancer patients can be considered high risk of developing VTE								
Prophylaxis	No major abdominal-pelvic surgery for cancer patients are at low or moderate VTE risk. See high VTE risk column.		<table border="1"> <thead> <tr> <th>High bleeding risk</th> <th>Low bleeding risk</th> </tr> </thead> <tbody> <tr> <td>Start IPC on admission</td> <td>Start IPC or GCS on admission</td> </tr> <tr> <td colspan="2" style="text-align: center;">AND</td> </tr> <tr> <td>After surgery, reassess (and document) risks.</td> <td>After surgery, use LMWH^Ω: dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily</td> </tr> </tbody> </table>	High bleeding risk	Low bleeding risk	Start IPC on admission	Start IPC or GCS on admission	AND		After surgery, reassess (and document) risks.	After surgery, use LMWH ^Ω : dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily
High bleeding risk			Low bleeding risk								
Start IPC on admission	Start IPC or GCS on admission										
AND											
After surgery, reassess (and document) risks.	After surgery, use LMWH ^Ω : dalteparin 5000 units subcut once daily OR enoxaparin 40 mg subcut once daily										
Duration	<p>Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital</p> <p>Pharmacological prophylaxis – Consider extending prophylaxis up to 4 weeks^β after surgery</p>										
<p>^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.</p> <p>[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with:</p> <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater <p>See 1.7.5 for more information</p> <p>^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.</p>											

2.2.3 Total hip arthroplasty and Total knee arthroplasty

Table 18: VTE prophylaxis in total hip arthroplasty and total knee arthroplasty

ADULT ORTHOPAEDIC PATIENTS – Total hip arthroplasty and total knee arthroplasty	
This guideline is based on recommendations from ACCP(6), NICE(7), ESA(34) and ASA(10). All patients in this cohort require thromboprophylaxis.	
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk	
TOTAL HIP ARTHROPLASTY	TOTAL KNEE ARTHROPLASTY
Start IPC or GCS [‡] on admission and continue until patient is discharged AND LMWH for 28 days ^β OR Rivaroxaban 10 mg daily for 35 days ^β OR LMWH for 10 days, then aspirin [±] 100 mg daily for 28 days ^β	Start IPC or GCS [‡] on admission and continue until patient is discharged AND LMWH for 14 days ^β OR Rivaroxaban 10 mg daily for 14 days ^β OR Aspirin [±] 100 mg daily for 14 days ^β
Refer to 1.7.2 , Table 5 and 6 for standard pharmacological prophylactic doses in surgical patients. See 1.7.5 for dose adjustments in specific patient populations. This guideline recommends aspirin 100mg as the VTE prophylaxis dose due to increased risk of bleeding with higher doses.	
<p>± Evidence for aspirin in this patient cohort This guideline considers patients with any of the risk factors below as very high VTE risk. LMWH or DOAC is the preferred choice over aspirin (monotherapy/multimodal therapy) for pharmacological VTE prophylaxis. Risk factors that place these patients at very high VTE risk (adapted from ASA(10)):</p> <ul style="list-style-type: none"> • Hypercoagulability conditions * • Metastatic cancer • Stroke (occlusion/stenosis with infarction) • Chronic obstructive pulmonary disease • Sepsis • Immobility ** • History of VTE (PE and proximal DVT) • Tamoxifen/estrogen therapy in last 4 weeks • Medical comorbidities: Charlson index ≥ 3, cardiac failure, advanced renal impairment • Lymphoma, myeloproliferative disorder • Obesity: BMI 30 kg/m² or greater • Severe weight loss • Acute myocardial infarction <p>NICE recommends aspirin as prophylaxis either as monotherapy in TKR or as multimodal therapy in THR(7). ESA recommends aspirin as an option in THR/TKR patients without high VTE risk, with increased bleeding risk and in a rapid recovery (fast-track) programme.(34) ASA does NOT recommend aspirin as an option for THR/TKR patients with high VTE risk.(10)</p>	
<p>*Type of mechanical prophylaxis for this patient cohort – IPC versus GCS ESA recommends use of IPC over GCS in high risk patients; and if aspirin is the pharmacological prophylaxis used, then IPC should be used in combination.(34) NICE recommends GCS in combination with LMWH as a VTE prophylaxis option. Other than the option mentioned, NICE does NOT specify that this patient cohort should be prescribed a combination of mechanical and pharmacological prophylaxis.(7) ASA recommends IPC in combination with pharmacological VTE prophylaxis.(10) All three guidelines recommend IPC as the prophylaxis of choice if contraindication to pharmacological prophylaxis or high bleeding risk except for in THR where NICE recommends considering GCS.(7, 10, 34)</p>	
<p>^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence. * Hypercoagulability conditions (antithrombin III deficiency, protein C or protein S deficiency, factor V Leiden mutation, prothrombin gene 20210A mutation, lupus anticoagulant, antiphospholipid antibodies [anticardiolipin and beta 2 glycoprotein 1 antibody]). ** Immobility: institutionalised patients, prolonged bed rest, severe pain, ileus, fracture, older than 80 years (controversial). Consider frail elderly as a risk.</p>	

2.2.4 Fragility fractures of the pelvis, hip and proximal femur

Table 19: VTE prophylaxis in fragility fractures of the pelvis, hip and proximal femur

ADULT ORTHOPAEDIC PATIENTS – Fragility fractures of the pelvis, hip and proximal femur
This guideline is based on recommendations from ACCP(6), NICE(7) and ESA(34). All patients in this cohort require thromboprophylaxis.
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk
Start IPC* on admission and continue until patient is discharged AND
<p>Start LMWH 6 -12 hours after surgery and use for a month^β If surgery is likely to be delayed beyond the day after admission, consider giving LMWH pre-operatively. Give the last LMWH dose no less than 12 hours before surgery.</p> <p>OR Aspirin[±] 100 mg daily (see below for duration)^β If surgery is likely to be delayed beyond the day after admission, consider giving aspirin pre-operatively</p>
Refer to 1.7.2 , Table 5 for standard LMWH prophylactic doses in surgical patients. See 1.7.5 for dose adjustments in specific patient populations. This guideline recommends aspirin 100mg as the VTE prophylaxis dose due to increased risk of bleeding with higher doses.
<p>[±] Evidence for aspirin in this patient cohort This guideline considers patients with any of the risk factors below as very high VTE risk and recommends they should NOT be prescribed aspirin (monotherapy/multimodal therapy) for VTE pharmacological prophylaxis. LMWH is the recommended VTE pharmacological prophylaxis of choice for these patients.</p> <p>Risk factors that place these patients at very high VTE risk (adapted from ESA(11)):</p> <ul style="list-style-type: none"> • Active or in-treatment cancer • Thrombophilia or personal / family history of VTE • Current pregnancy or puerperium • Surgery lasting at least 120 minutes • Age 60 years or older • BMI 40 kg/m² or greater • Pre-operative immobilisation at least 4 days • Chronic venous insufficiency <p>NICE does NOT recommend aspirin for fragility fractures(7). ESA only recommends the use of aspirin as an option in patients undergoing hip fracture surgery without high VTE risk and with an increased bleeding risk(34).</p>
<p>Duration of pharmacological prophylaxis for this patient cohort ESA states no recommendation can be made concerning dose and duration of aspirin therapy.(34) ACCP recommends a minimum of 10 to 14 days pharmacological prophylaxis (including LMWH and aspirin) for hip fracture surgery.(6) NICE recommends VTE prophylaxis (including LMWH) for one month in patients with fragility fractures.(7)</p>
<p>*Type of mechanical prophylaxis for this patient cohort – IPC versus GCS Both NICE and ESA guidelines recommend use of IPC over GCS if a patient is contraindicated to pharmacological prophylaxis or has high bleeding risk.(7, 34) ESA recommends use of IPC over GCS in high risk patients; and if aspirin is the pharmacological prophylaxis used, then IPC should be used in combination.(34) NICE does not recommend GCS in their guidelines for this patient cohort and does not specify use of the combination of mechanical and pharmacological prophylaxis.(7)</p>
<p>^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.</p>

2.2.5 Ambulatory patients with isolated lower limb immobilisation

There is a lack of guidance and consensus decision making for this patient cohort regarding VTE prevention. Recommendations from The National Institute for Health and Care Excellence (NICE) are to consider pharmacological VTE prophylaxis (i.e. LMWH) for people with lower limb immobilisation whose risk of VTE outweighs their risk of bleeding and stop if lower limb immobilisation continues beyond 42 days.(7)

The College of Emergency Medicine – Guidelines in Emergency Medicine Network (GEMNet) state that the actual incidence of VTE in patients with temporary plaster immobilisation is estimated anywhere between 5%-39% depending on type of patient and type of immobilisation.(12) The following risk stratification is based on the GEMNet guidelines.

Table 20: VTE prophylaxis in ambulatory patients with isolated lower limb immobilisation

Patient Cohort	ADULT AMBULATORY PATIENTS WITH ISOLATED LOWER LIMB IMMOBILISATION		
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level	Low VTE risk Patients with non-rigid, weight bearing immobilisation	Increased VTE risk Patients with rigid immobilisation, non-weight bearing status or acute severe injury (dislocation, fracture or complete tendon rupture)	
		Is patient temporarily immobilised with above/below knee cast or backslab?	
		NO	YES
		Does patient have 2 or more of the VTE risk factors below? <ul style="list-style-type: none"> • Age older than 60 years • BMI greater than 30 kg/m² • Active cancer • Active smoker • Taking hormone replacement therapy or tamoxifen or oral contraceptive pill • Pregnant or immediately post-partum • Personal (or first degree relative) history of VTE • Known thrombophilia • Varicose veins • Any serious medical comorbidities (congestive cardiac failure, chronic obstructive pulmonary disease, inflammatory bowel disease, chronic renal failure) • Any recent hospital admission or major surgery 	
		NO (i.e. less than 2 VTE risk factors)	YES (i.e. 2 or more VTE risk factors)
Prophylaxis	No VTE prophylaxis recommended. Encourage mobilisation and adequate hydration	Consider VTE prophylaxis on an individual patient basis	Strongly consider VTE prophylaxis LMWH ^{Q#} : dalteparin 5000 units subcut daily OR enoxaparin 40 mg subcut daily
Duration	N/A	Use prophylaxis until lower limb immobilisation is stopped. Consider stopping prophylaxis if lower limb immobilisation continues beyond 42 days.(7)	
^Q Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication. [#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information			

2.2.6 Other orthopaedic procedures

Table 21: VTE prophylaxis in other orthopaedic procedures

Other orthopaedic procedures in this guideline are orthopaedic procedures other than total hip/knee arthroplasty, fragility fractures of the pelvis, hip and proximal femur, and ambulatory patients with lower limb immobilisation.

ADULT ORTHOPAEDIC PATIENTS – OTHER ORTHOPAEDIC PROCEDURES For total hip arthroplasty and total knee arthroplasty see Table 18 For fragility fractures of the pelvis, hip and proximal femur see Table 19 For ambulatory patients with isolated lower limb immobilisation see Table 20	
There is a lack of evidence for recommendations for ‘non-major’ orthopaedic procedures in ambulatory or fast track surgery. This guideline is based on recommendations from ESA(11) for day and fast track surgery which are derived from Caprini data for non-ambulatory surgery.	
NO pharmacological prophylaxis is required if patient is: <ul style="list-style-type: none"> • already anticoagulated • undergoing day surgery under local anaesthesia without any limitation of mobility 	
Before prescribing, review contraindications and/or bleeding risk	
Low VTE risk	Moderate to High VTE risk
Patients undergoing other orthopaedic procedures under local anaesthesia without any limitation of mobility OR without any of the risk factors listed under Moderate/High VTE risk column	Patients undergoing other orthopaedic procedures with one or more of the following risk factors (adapted from ESA(11)): <ul style="list-style-type: none"> • Active or in-treatment cancer • Thrombophilia or personal / family history of VTE • Current pregnancy or puerperium • Surgery lasting at least 120 minutes • Age 60 years or older • BMI 40 kg/m² or greater • Pre-operative immobilisation at least 4 days • Chronic venous insufficiency
No VTE prophylaxis recommended Encourage patient to mobilise and maintain adequate hydration	Start IPC or GCS* on admission and continue until patient is discharged AND/OR Consider LMWH or Aspirin* 100 mg daily (See below for duration)
Refer to 1.7.2 , Table 5 for standard LMWH prophylactic doses in surgical patients. See 1.7.5 for dose adjustments in specific patient populations. This guideline recommends aspirin 100mg as the VTE prophylaxis dose due to increased risk of bleeding with higher doses.	
± Evidence for aspirin in this patient cohort NICE does not specifically mention aspirin as an option.(7) ESA suggests aspirin for VTE prevention after low-risk orthopaedic procedures in patients with high VTE risk.(11)	
Duration of pharmacological prophylaxis for this patient cohort ESA recommends a minimum of 7 days over shorter protocols although in (undefined) selected fast-track surgery cases, thromboprophylaxis for the duration of hospitalisation could be an option.(11) NICE recommends LMWH for 14 days if VTE prophylaxis is considered for arthroscopic knee surgery.(7) Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.	
*Type of mechanical prophylaxis for this patient cohort – IPC versus GCS NICE does not mention the option of mechanical prophylaxis in non-arthroplasty orthopaedic knee surgery, foot and ankle orthopaedic surgery or upper limb orthopaedic surgery.(7) ESA recommends use of IPC over GCS in high risk patients; and recommends against routine use of GCS without pharmacological thromboprophylaxis in patients at intermediate and high risk. If patients are not at very high risk for VTE and are receiving pharmacological thromboprophylaxis ESA recommends against routine use of mechanical thromboprophylaxis.(11)	

2.2.7 Major trauma

Traumatic brain injury, acute spinal cord injury, traumatic spinal injury and complex traumatic pelvic / lower extremity injury

Table 22: VTE prophylaxis in major trauma surgical patients

Patient Cohort	ADULT SURGICAL PATIENTS – MAJOR TRAUMA Including traumatic brain injury, acute spinal cord injury, traumatic spinal injury and complex traumatic pelvic / lower extremity injury		
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level	Low VTE risk	Moderate VTE risk	High VTE risk All major trauma surgical patients are considered at high risk of developing VTE
Prophylaxis	No major trauma patients are at low or moderate VTE risk. See high VTE risk column.		Start IPC [□] on admission AND After surgery [¥] reassess (and document) risks daily or more frequently if required. ADD UFH when bleeding risk decreases and satisfactory haemostasis is achieved. Consider replacing with LMWH ^{Ω#} after 3 days or as soon as bleeding risk decreases further. Refer to section 1.7.2 for standard dosing of pharmacological VTE prophylaxis.
Duration			Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital Pharmacological prophylaxis – Use for 7 days ^β minimum. If acute spinal cord injuries and traumatic brain injuries result in significant mobility issues, continue pharmacological VTE prophylaxis for 3 months after surgery ⁽⁵⁾ or until mobility has returned to an anticipated or clinically acceptable level
[□] Due to the types of injuries sustained, mechanical prophylaxis may be contraindicated in patients with traumatic lower extremity injury. However, if no other contraindications, mechanical prophylaxis should be used in the uninjured leg. Assess case by case and consider foot impulse device if appropriate.			
[¥] In traumatic brain injury, the timing of initiation of pharmacological prophylaxis should be discussed with the neurosurgical team. Generally: <ul style="list-style-type: none"> • in patients with no intracranial haemorrhage, pharmacological prophylaxis can be started immediately • in patients with intracranial haemorrhage, defer pharmacological prophylaxis until satisfactory haemostasis is achieved (typically after 48 hours) Intracranial pressure monitoring alone is not a contraindication to pharmacological prophylaxis			
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.			
[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information			
^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.			

2.2.8 Craniotomy

Table 23: VTE prophylaxis in craniotomy

Patient Cohort	ADULT SURGICAL PATIENTS – CRANIOTOMY			
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk				
VTE Risk Level	Low VTE risk	Moderate VTE risk	High VTE risk	Very High VTE risk
			Craniotomy patients without any of the risk factors listed under Very High VTE risk column	Craniotomy with one or more of the following risk factors (from ESA(13)): <ul style="list-style-type: none"> • malignancy • prolonged operative time • reduction in mobility
Prophylaxis	No craniotomy patients are at low or moderate VTE risk. See high or very high VTE risk column.		Start IPC on admission	Start IPC or GCS on admission Consider pre-operative pharmacological prophylaxis [£] AND After surgery, reassess (and document) risks. Beyond the post-operative day (24-48 hours after surgery) and when bleeding risk decreases and satisfactory haemostasis is achieved [£] , ADD: UFH 5000 units subcut twice daily or three times daily OR LMWH ^{Ω#} dalteparin 5000 units subcut daily or enoxaparin 40 mg subcut daily
Duration	N/A		Mechanical prophylaxis – Continue for 30 days or until patient is mobile or discharged, whichever is sooner Pharmacological prophylaxis – Use for 7 days ^β minimum	
[£] Regarding pharmacological prophylaxis, give the last dose no less than 24 hours before surgery for patients whose risk of VTE outweighs their risk of bleeding. Do not offer pharmacological prophylaxis to patients with ruptured cranial vascular malformations or patients with intracranial haemorrhage until the lesion has been secured or the condition has stabilised.(7)				
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.				
[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information				
^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation based on consensus expert opinion due to lack of evidence.				

2.2.9 Cardiac surgery

Table 24: VTE prophylaxis in cardiac surgery

Patient Cohort	ADULT SURGICAL PATIENTS – CARDIAC SURGERY	
NO pharmacological prophylaxis is required if patient is already anticoagulated ^ϕ Before prescribing, review contraindications and/or bleeding risk		
VTE Risk Level	Low VTE risk	Moderate to High VTE risk Mechanical valve surgery and those with pre- and/or postoperative atrial fibrillation are a specific entity at high VTE risk. They will mostly require post-operative therapeutic bridging prior to long term anticoagulation. Refer to your hospital's local guidelines as this table does not give guidance to pre/post-operative therapeutic bridging. ^δ
Prophylaxis	No cardiac surgery patients are at low VTE risk.	Start IPC or GCS on admission AND After surgery, reassess (and document) risks. ADD UFH when bleeding risk decreases and satisfactory haemostasis is achieved. Consider replacing with LMWH ^{Ω#} as soon as bleeding risk decreases further. Refer to section 1.7.2 for standard dosing of pharmacological prophylaxis.
Duration	N/A	Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital Pharmacological prophylaxis – Use for a recommended minimum duration of 7 days ^β or until discharge
<p>^ϕ Anticoagulated is defined as receiving an anticoagulant (i.e. unfractionated heparin, low molecular weight heparin [dalteparin, enoxaparin, nadroparin], warfarin with INR in therapeutic range, direct oral anticoagulant [apixaban, dabigatran, rivaroxaban], danaparoid, bivalirudin, fondaparinux).</p> <p>^δ VTE prophylaxis may be given to patients assessed as high VTE risk (depending on bleeding risk), prior to resuming anticoagulation and/or starting post-operative therapeutic bridging.</p> <p>^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.</p> <p>[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with:</p> <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater <p>See 1.7.5 for more information</p> <p>^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.</p>		

2.2.10 Vascular surgery

Table 25: VTE prophylaxis in vascular surgery

Patient Cohort	ADULT SURGICAL PATIENTS – VASCULAR SURGERY	
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk		
VTE Risk Level	<p>Low VTE risk Including patients undergoing peripheral vascular surgery, varicose vein surgery, toe amputation, carotid endarterectomy WITHOUT other risk factors listed under Moderate to High VTE risk column</p>	<p>Moderate to High VTE risk(14) Abdominal aortic aneurysm repair surgery OR Patients with one or more of the following risk factors (adapted from ESA(14)):</p> <ul style="list-style-type: none"> • BMI 30 kg/m² or greater • Pre-operative dyspnoea • Chronic steroid usage • Ruptured aneurysm • Open surgery • Operative duration over 5 hours • Transfusion greater than 5 units red blood cells • Post-operative mechanical ventilation over 48 hours • Post-operative complication (e.g. acute kidney injury, infection/sepsis) • Return to theatre
Prophylaxis	Start IPC or GCS [€] on admission	<p>After surgery, reassess (and document) risks.</p> <p>Use UFH when bleeding risk decreases and satisfactory haemostasis is achieved. Consider replacing with LMWH^{Ω#} as soon as bleeding risk decreases further. Refer to section 1.7.2 for standard dosing of pharmacological prophylaxis.</p> <p style="text-align: center;">OR</p> <p style="text-align: center;">Start IPC on admission</p>
Duration	<p>Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital</p> <p>Pharmacological prophylaxis – Use for a minimum of 7 days^β</p>	
<p>[€]For varicose vein surgery or any procedure involving vein stripping, GCS is recommended over IPC.</p>		
<p>^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.</p>		
<p>[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with:</p> <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater <p>See 1.7.5 for more information</p>		
<p>^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.</p>		

2.2.11 Thoracic surgery

Table 26: VTE prophylaxis in thoracic surgery

Patient Cohort	ADULT SURGICAL PATIENTS – THORACIC SURGERY Note: Patients with primary or metastatic cancer are high VTE risk ⁽¹⁴⁾		
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level See Appendix 4 for Caprini risk assessment	Low VTE risk (Caprini Score 1-2)	Moderate VTE risk (Caprini Score 3-4)	High VTE risk (Caprini Score 5 or more) Includes thoracic surgery patients with primary or metastatic cancer ⁽¹⁴⁾
Prophylaxis	Start IPC on admission	Start IPC on admission After surgery, reassess (and document) risks. When bleeding risk decreases and satisfactory haemostasis is achieved, SUBSTITUTE with LMWH ^{Ω#} : dalteparin 5000 units subcut once daily or enoxaparin 40 mg subcut once daily	Start IPC or GCS on admission AND After surgery, reassess (and document) risks. When bleeding risk decreases and satisfactory haemostasis is achieved, ADD LMWH ^{Ω#} : dalteparin 5000 units subcut once daily or enoxaparin 40 mg subcut once daily
Duration	Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital Pharmacological prophylaxis – Use for a minimum of 7 days ^β		
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication. [#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information			
^β Elderly patients undergoing inpatient rehabilitation: Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation is based on consensus expert opinion due to lack of evidence.			

2.2.12 Elective spinal surgery

Table 27: VTE prophylaxis in elective spinal surgery

Patient Cohort	ADULT SURGICAL PATIENTS – ELECTIVE SPINAL SURGERY	
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk		
VTE Risk Level	Low to Moderate VTE risk Elective spinal surgery with none of the risk factors listed under High VTE risk	High VTE risk Elective spinal surgery in patients where hospital stay is over 2 days with one or more of the following risk factors (adapted from ACCP and ESA(6, 13)): <ul style="list-style-type: none"> • malignancy • motor deficits • prolonged reduction in mobility • complex surgical procedure • surgery with combined anterior-posterior approach
Prophylaxis	Start IPC on admission	Start IPC or GCS on admission AND After surgery, reassess (and document) risks. After 24-48 hours post-surgery(7), when bleeding risk decreases and satisfactory haemostasis is achieved [¶] , ADD LMWH^{Ω#}: dalteparin 5000 units subcut once daily or enoxaparin 40 mg subcut once daily
Duration	Mechanical prophylaxis - Continue for 30 days or until the patient is mobile or discharged, whichever is sooner.(7) Pharmacological prophylaxis – Continue for 30 days or until the patient is mobile or discharged, whichever is sooner.(7)	
[¶] Further delay is recommended if there are intraoperative or postoperative circumstances that substantially increase bleeding risk. If there is a need to commence earlier than 24 hours after surgery, base the decision on multidisciplinary or senior opinion.		
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.		
[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • body weight 50 kg or less • BMI 30 kg/m² or greater See 1.7.5 for more information		

2.2.13 Bariatric surgery

All patients undergoing bariatric surgery are at moderate to high VTE risk. Use the table below to further risk stratify patients. Seek specialist advice if BMI is greater than 60 kg/m². Refer to [1.7.5](#) for dose adjustments in obese patients who are not undergoing bariatric surgery.

Table 28: VTE prophylaxis in bariatric surgery

Patient Cohort	ADULT SURGICAL PATIENTS – BARIATRIC SURGERY		
NO pharmacological prophylaxis is required if patient is already anticoagulated Before prescribing, review contraindications and/or bleeding risk			
VTE Risk Level	Low VTE risk	Moderate VTE risk Bariatric surgery in patients without any of the risk factors listed under High VTE risk	High VTE risk Bariatric surgery in patients with one or more of the following risk factors (adapted from ESA(15)): <ul style="list-style-type: none"> • Open bariatric procedure • Age older than 55 years • BMI greater than 55 kg/m² • Personal or family history of thrombophilia / thrombosis • Venous disease • Sleep apnoea • Pulmonary hypertension
Prophylaxis	No bariatric surgery patients are at low VTE risk.	Start IPC on admission OR After surgery, reassess (and document) risks. When bleeding risk decreases and satisfactory haemostasis is achieved, use LMWH ^{Ω#} : dalteparin 5000 units subcut twice daily or enoxaparin 40 mg subcut twice daily	Start IPC on admission AND After surgery, reassess (and document) risks. When bleeding risk decreases and satisfactory haemostasis is achieved, ADD LMWH ^{Ω#} : dalteparin 5000 units subcut twice daily or enoxaparin 40 to 60 mg subcut twice daily
Duration	N/A	Mechanical prophylaxis - Continue until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital Pharmacological prophylaxis – Moderate VTE risk - Use for a minimum of 7 days ^β High VTE risk – Consider using for 10-15 days ^β after surgery	
^Ω Dalteparin is the preferred LMWH for VTE prophylaxis on the LAM. This information is correct as at publication.			
[#] Dose adjustment of LMWH or alternative recommendations may be required in patients with: <ul style="list-style-type: none"> • eGFR less than 30 mL/min/1.73m² or CrCl less than 30 mL/min • increased risk of bleeding • BMI 30 kg/m² or greater See 1.7.5 for more information			
^β Elderly patients undergoing inpatient rehabilitation- Consider extending duration of prophylaxis beyond minimum recommended duration until mobility has returned to an anticipated or clinically acceptable level or when the patient is discharged from hospital. Recommendation based on consensus expert opinion due to lack of evidence.			

Appendices

Appendix 1: Patient and/or carer engagement

Patient-centred care and shared decision making

- Involve the patient and/or carer in shared decision making during all stages of VTE prevention from advance-planning to when the discharge plan is written
- Ensure the patient or carer understands the reason for assessing VTE and bleeding risks
- Inform the patient or carer about the patient's risk factors for developing VTE, as well as their bleeding risks or other contraindications to prophylaxis. Provide an assessment of their risks and the benefits of VTE prophylaxis
- Take account of individual patient beliefs, needs, values and preferences when choosing VTE prophylaxis and developing a VTE prevention plan
- Continue to keep the patient informed when their risks are re-assessed and if adjustments are made to the VTE prevention plan because of altered risk factors, clinical condition and/or patient or carer concerns
- Be responsive to patient or carer concerns; reassess risk factors and the VTE prevention plan accordingly.

General VTE information and education

Offer patients, their families or carers verbal and written information in a format they can understand regarding:

- signs and symptoms of VTE and bleeding
- risks and possible consequences of VTE
- the importance of VTE prophylaxis and its possible side effects
- correct use of VTE prophylaxis (e.g. GCS, IPC)
- ways to reduce the risk of VTE:
 - all patients should be encouraged to mobilise as soon as possible
 - all patients should be advised to maintain adequate hydration unless otherwise clinically indicated
- the importance of continuing prophylaxis for the recommended duration
- ongoing care needed to prevent VTE after the patient is discharged
- signs and symptoms of adverse events related to VTE prophylaxis
- the importance of seeking help and who to contact if patients have problems with their VTE prophylaxis after discharge.

Ensure appropriate documentation

Ensure the following are appropriately documented and kept in a place that is easily accessible to all clinicians involved in the patient's care:

- advance-planning conducted for planned hospitalisation
- VTE risk assessment, assessment of bleeding risk and contraindications, and overall assessment of risks versus benefits of VTE prophylaxis. Documentation should be completed at the time of the assessment.
- VTE prevention plan
- reassessment of risks and adjusted VTE prevention plan if applicable
- patient or carer engagement, involvement and education at all relevant stages
- VTE discharge plan and transfer of care.

Appendix 2: Advance-planning for planned hospitalisation

Patients on estrogen-containing medication

Medical officers should review current evidence to assess whether patients should discontinue their estrogen-containing oral contraception or hormonal replacement therapy prior to admission if clinically appropriate. They should discuss with the patient the VTE risks associated with the medication versus the risks of unplanned pregnancy (in the case of temporarily stopping estrogen-containing oral contraceptives). If discontinuation of oral contraceptives is thought to be appropriate, adequate alternative contraception should be arranged until the patient's usual oral contraceptive can be restarted.

If discontinuation of estrogen-containing medication is considered appropriate, patients assessed as high risk of VTE should cease hormonal replacement therapy or oral contraceptive four weeks prior to major surgery.(7)

Patients on other medications that increase the risk of VTE

There are other medications that may increase the risk of VTE and medical officers should consider temporary interruption prior to admission or prior to the surgical procedure where appropriate. These medications include (but are not limited to):

- tamoxifen
- strontium ranelate
- raloxifene
- epoetin alfa
- testosterone (if newly started)

Anaesthesia and VTE risk

Regional anaesthesia should be considered for individual patients if appropriate as it carries a lower risk of VTE than general anaesthesia. This should be done taking into consideration individual patient's preference, appropriateness for regional anaesthesia and the other method/s of VTE prophylaxis being used/planned.

Patients already receiving anticoagulation

Patients who are already receiving anticoagulation (i.e. warfarin or DOAC) and needing surgery or a procedure will require a peri-operative management plan in relation to their anticoagulant therapy. They should be managed on a case by case basis in consultation with the treating physician (and treating cardiologist if relevant), anaesthetist and the surgeon. The aim of the management plan is to reach a balance between reducing the risk of thromboembolism (associated with their indication for anticoagulation) and preventing excessive bleeding for the patient.

These patients should be assessed at least one week before the planned surgery/procedure and the following should be assessed:

- The patient's risk for thromboembolism (as determined by their indication for anticoagulation)
- The patient's risk of bleeding from the surgery/procedure and other comorbidities that may increase bleeding risk

The main issues that will need addressing before surgery include:

- Can surgery be deferred until anticoagulation therapy is completed (for patients on short-term anticoagulant therapy) or when the patient's thromboembolic risk has returned to baseline?
- If surgery cannot be deferred, is temporary cessation of anticoagulation required?
- If anticoagulation is to be temporarily stopped, what is the anticipated duration without anticoagulation including timing of cessation and resumption?
- If anticoagulation is to be temporarily stopped, is bridging therapy required?
- If bridging therapy is required, when it should be used; pre-operative, post-operative or both and at what dose?

If a decision has been made to temporarily interrupt a patient's anticoagulation, a VTE risk assessment should be undertaken to assess the need for VTE prophylaxis.

Refer to your hospital's guidelines on peri-procedural management of oral anticoagulants for guidance on interrupting anticoagulants and guidance on bridging therapy.

Patients on regular antiplatelet agents

Surgeries/procedures that carry a significant risk of bleeding may require temporary cessation of the patient's antiplatelet therapy (e.g. clopidogrel, prasugrel, ticagrelor, aspirin). Therefore, these patients should be assessed at least one week before the planned surgery. The decision to temporarily discontinue the antiplatelet therapy should be made on a case by case basis, taking into account the arterial thrombotic risk and weighing the risk of cessation against the risk of bleeding associated with the surgical procedure. Generally, antiplatelet therapy should not be ceased in patients that have coronary stents unless advised otherwise by the cardiologist.

Whilst antiplatelet agents are first-line therapy in preventing cardiovascular thrombotic events, they are not adequate to prevent VTE in the majority of patients undergoing surgery. The exception to this is the use of aspirin in specific orthopaedic patients without additional VTE risk factors. A VTE risk assessment will still need to be undertaken for patients already on antiplatelet agents, irrespective of whether there is a temporary interruption to their antiplatelet therapy or not, to assess the need for VTE prophylaxis. VTE prophylaxis is still required in patients who are to continue with their antiplatelet agents and who are at moderate to high risk of developing VTE, whilst taking account of their bleeding risk.

Patients that have had a temporary interruption in their dual antiplatelet therapy should resume both antiplatelet agents shortly after the procedure unless otherwise instructed by the cardiologist.

Appendix 3: Padua VTE Risk Assessment Model

Padua Risk Assessment Model(8) for Medical Patients	
Baseline Features	Score
Active Cancer *	3
Previous VTE (excluding superficial vein thrombosis)	3
Reduced mobility [∞]	3
Already known thrombophilic condition [±]	3
Recent (less than or equal to 1 month) trauma and/or surgery	2
Elderly age (70 years or older)	1
Heart and/or respiratory failure	1
Acute myocardial infarction or ischaemic stroke	1
Acute infection and/or rheumatologic disorder	1
Obesity (BMI 30 kg/m ² or greater)	1
Ongoing hormonal treatment	1
Total score	

*Patients with local or distant metastases and/or chemotherapy or radiation therapy in the last 6 months.

[∞]Bed rest with bathroom privileges (either due to patient limitation or physician order) for at least 3 days.

[±]Carriage of defects of antithrombin, protein C or S, factor V Leiden, G20210A prothrombin mutation, antiphospholipid syndrome.

The total Padua Prediction Score is calculated by adding all points for the patient. The corresponding VTE risk level can be interpreted using the table below which also shows recommendations for VTE prophylaxis.

Total Score and VTE Risk Level for non-surgical patients based on Padua model		
Total Score	VTE Risk Level	VTE Prophylaxis recommended?
Less than 4	Low	No
4 or more	High	Mechanical prophylaxis or Pharmacological prophylaxis

Appendix 4: Caprini VTE Risk Assessment Model

Caprini's Risk Assessment Model(9) for Surgical Patients			
Apply 1 POINT for each of the following statements that apply now or within the past month	Apply 2 POINTS for each of the following statements	Apply 3 POINTS for each of the following statements	Apply 5 POINTS for each of the following statements that apply now or within the past month
Age 41 to 60 years	Age 61 to 74 years	Age 75 years or older	Elective major lower extremity arthroplasty
Minor surgery (less than 45 mins) planned	Arthroscopic surgery	History of DVT or PE	Hip, pelvis or leg fracture within the last month
History of major surgery (longer than 45 minutes) within the last month	Malignancy (present or previous)	Family history of thrombosis	Stroke within the last month
Varicose veins	Major surgery (longer than 45 minutes)	Positive Factor V Leiden	Multiple trauma within the last month
History of inflammatory bowel disease	Laparoscopic surgery (longer than 45 minutes)	Positive Prothrombin 20210A	Acute spinal cord injury (paralysis) within the last month
Swollen legs (current)	Confined to bed for at least 72 hours	Elevated serum homocysteine	
Obesity (BMI 25 kg/m ² or greater)	Immobilising plaster cast less than one month	Positive lupus anticoagulant	
Acute myocardial infarction	Central venous access	Elevated anticardiolipin antibodies	
Congestive heart failure within the last month		Heparin-induced thrombocytopenia (HIT)	
Sepsis within the last month		Other congenital or acquired thrombophilia	
Serious lung disease (incl. pneumonia) within the last month			
Abnormal pulmonary function (e.g. chronic obstructive pulmonary disease)			
Patient currently at bed rest			
Oral contraceptives or hormone replacement therapy			
Pregnancy or postpartum less than one month			
History of unexplained stillborn infant, recurrent spontaneous abortion (3 or more), premature birth with toxemia or growth restricted infant			
Other risk factors			
Total Points:	Total Points:	Total Points:	Total Points:
Total Score:			

The Total Caprini VTE Risk Score is calculated by adding all points for the patient. The corresponding VTE risk level can be interpreted using the table below which also shows recommendations for VTE prophylaxis.

Total Score and VTE Risk Level for surgical patients based on Caprini model		
Total Score	VTE Risk Level	VTE prophylaxis recommended?
0	Very low	No
1-2	Low	Mechanical prophylaxis
3-4	Moderate	Pharmacological and/or Mechanical prophylaxis
5 or more	High	Pharmacological and Mechanical prophylaxis

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