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

GUIDELINE 2023

Endorsed August 2023
To be reviewed August 2026

Safer Care Victoria

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1. Introduction

Venous thromboembolism (VTE), a pathology that includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is a common cause of preventable mortality and morbidity among hospitalised patients.[1,2] Serious morbidity includes pulmonary hypertension and post-thrombotic syndrome. A previous history of VTE carries a higher risk of developing VTE during a subsequent admission to hospital or period of prolonged immobility. Approximately 50-75% of patients admitted to hospital have at least one risk factor for VTE, while 40% have three or more.[3]

There is good evidence to support the efficacy and safety of thromboprophylaxis. The principal modalities to prevent VTE are pharmacological and mechanical. Pharmacological prophylaxis is provided by agents such as low molecular weight heparin (LMWH). Mechanical methods include intermittent pneumatic compression (IPC) or graded calf compressive stockings.

It is important to note that most cases of VTE occur during an episode of hospitalisation, with some not being diagnosed until after discharge from hospital.

This guideline has been formatted to align with the Australian Commission on Safety and Quality in Health Care (ACSQHC) Venous Thromboembolism Prevention Clinical Care Standard.

1. Cohen AT, et al. Thromb Haemostasis 2007;98(4):756-64
2. Clagett GP, et al. (1998) Prevention of Venous Thromboelism Chest 114:531S-60S https://doi.org/10.1378/chest.114.5_Supplement.531S
3. Australian Commission on Safety and Quality in Health Care. Clinical Standards. Venous thromboembolism prevention clinical care standard January 2020 https://www.safetyandquality.gov.au/sites/default/files/2020-01/venous_thromboembolism_prevention_clinical_care_standard_-_jan_2020_2.pdf

1.1. PURPOSE

This guideline has been developed to provide recommendations and promote best practice, therefore minimising the risks and sequelae of VTE in adult hospitalised patients admitted to Victorian health services and may be adapted for local or health service partnership use.

This document may be used to assist health services in the development and audit of local VTE guidelines with alignment to the ACSQHC VTE Prevention Clinical Care Standard.

1.2. SCOPE

This guideline provides information intended for use by all Victorian health care clinicians and all Victorian health services and is intended to guide the provision of VTE prophylaxis in adult patients admitted to hospital.
For the purposes of this document, an adult is defined as 16 years of age and older.

This document does not include recommendations for the following:

- VTE prophylaxis in Paediatric patients (<16 years of age)
- Diagnosis or management of suspected or active VTE
- Therapeutic anticoagulation

1.3 CONTRIBUTIONS

To establish this piece of guidance, Safer Care Victoria (SCV) established an expert working group consisting of senior medical clinicians from various disciplines. This group reviewed existing statewide and local health service thromboprophylaxis guidelines to assess whether a current guideline could be endorsed as a state-wide guideline.

Twenty Victorian health services shared their current local thromboprophylaxis management guidelines. In addition, the Queensland Health – "Guideline for the Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients – 2018" was reviewed by the expert working group (EWG). All guidelines were reviewed and appraised utilizing the AGREE II tool and SCV's 'Endorsing guidance assessment tool' in accordance with the SCV 'Staff instruction – Endorsing Guidance' document.

The EWG decided to develop state-wide guidance for adult patients, using the guidelines shared by Alfred Health as a foundation. Modifications have been made based on current best practice at other health services and jurisdictions, along with expert clinician input.

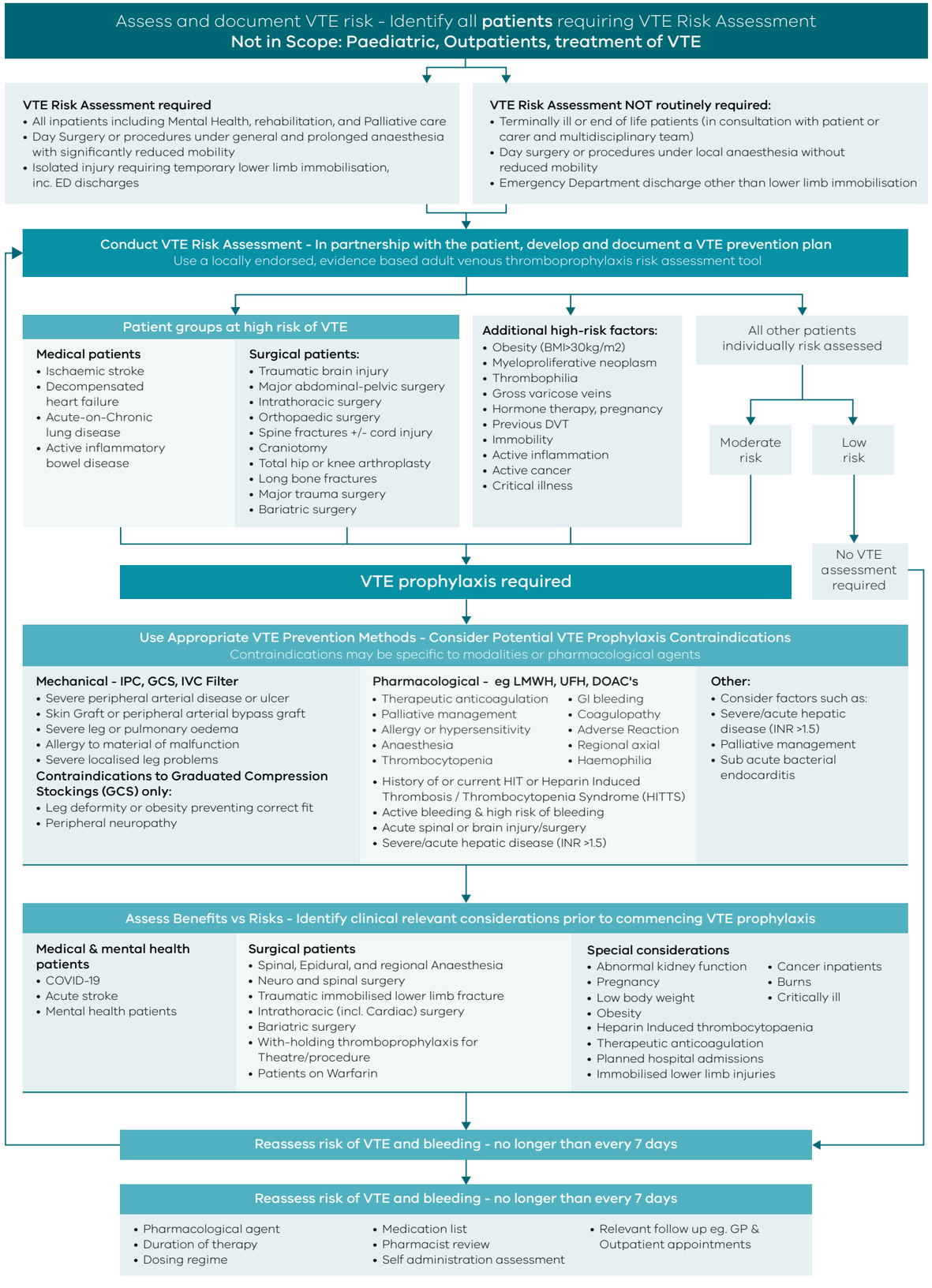
Table 1: The Expert Working Group consisted of the following clinicians:

Name	Speciality	Health Service
Professor David A Scott	Anaesthesia	St Vincent's Hospital Melbourne
Professor Wendy Brown	Bariatric	Alfred Health
Associate Professor Mark Horrigan	Cardiology	Austin Health
Professor Julian Smith	Cardiothoracic	Monash Health
Professor David Watters (Chair)	General surgery	Barwon Health
Professor Huyen Tran	Haematology	Alfred Health
Professor David Pilcher	Intensive Care	Alfred Health
Dr Nicky Zigouris	Mental Health	Alfred Health
Associate Professor Peter Mount	Nephrology	Austin Health
Dr Patrick Lo	Neurosurgery	Royal Children's Hospital
Dr Penelope Sheehan	Obstetrics & Gynaecology	Royal Women's Hospital
Professor Alexander Heriot	Oncology	Peter MacCallum Cancer Centre
Associate Professor Alasdair Sutherland	Orthopaedic	Southwest Health
Associate Professor Andrew Hardidge	Orthopaedic	Austin Health
Chantelle Barlett	Pharmacy	Safer Care Victoria
David Nguyen	Pharmacy	Department of Health
Dr Greg Weeks	Pharmacy	Barwon Health
Gina McLachlan	Pharmacy	Austin Health
Julian Ellis	Pharmacy	Safer Care Victoria –Author
Tim Tran	Pharmacy	Austin Health
Sigrid Badelka	Principal Project Officer	Safer Care Victoria
Amanda Gunn	Registered Nurse	Safer Care Victoria
Dermot Fitzgerald	Registered Nurse	Safer Care Victoria – Author
Associate Professor Ben Clissold	Stroke	Barwon Health
Lorraine Kwangwari	Social work	Safer Care Victoria
Associate Professor Joseph Mathew	Trauma	Alfred Health
Dr Matthew Hadfield	Vascular	Grampian Health

2. Key Summary Document

2.1 GUIDELINE OVERVIEW

Flowchart 1: Prevention of VTE in Adult Hospitalised Patients - Guideline Overview



2.2 THROMBOPROPHYLAXIS FLOWCHART

Flowchart 2: Thromboprophylaxis Flowchart (For patients 16 years and older admitted for overnight stay or longer)

PATIENT COHORT		RECOMMENDED VTE PROPHYLAXIS	DURATION OF VTE PROPHYLAXIS
HIGH RISK SURGICAL PATIENTS			
Intrathoracic surgery – cardiac, major thoracic and oesophageal		Intermittent Pneumatic Compression (IPC) until mobilising then enoxaparin 40mg*subcutaneously (Subcut) daily	Until ambulant/discharge
Craniotomy and spinal surgery			
Major Trauma	Ward patients	IPC until mobilising then enoxaparin 40mg* subcut daily	Until ambulant
	Lower limb immobilization post trauma	Enoxaparin 40mg* subcut daily/dalteparin 5000units subcut daily	Up to 42 days
	Orthopaedic trauma and/or surgery		Until hospital discharge or mobile
	ICU Patients	Refer to local ICU/Trauma Guidelines	Until ambulant
Hip replacement surgery		LMWH, DOAC or aspirin (enoxaparin 40mgs* daily/dalteparin 5000 units daily, rivaroxaban 10mg daily/apixaban 2.5mg BD/dabigatran 220mg daily/ aspirin 100-150mgs daily) whilst an inpatient and continue extended VTE *non-weight bearing with immobilised lower limb* OR have additional VTE risk	35 days (Hip) 14 days (Knee) (see table 8)
Knee replacement surgery			
Hip fracture surgery		LMWH (enoxaparin 40mgs daily or dalteparin 5000units daily)	28 days (see table 8)
Spinal surgery (Orthopaedic)		Enoxaparin 40mg subcut daily/dalteparin 5000 units subcut daily	Until hospital discharge or mobile
Urology		IPC until mobilising then enoxaparin 40mg* for open procedures	IPC until mobilising Enoxaparin for 30 days for open procedures
Cancer + surgery except head and neck surgery <45 mins (with no additional risks)		Enoxaparin 40mg* subcut daily	7-28 days
Caesarean section + 2 additional obstetric risk factors		Enoxaparin 40mg* subcut daily	7 days/until ambulant
Any surgical time lasting >45 mins			
PATIENT COHORT		**RECOMMENDED VTE PROPHYLAXIS**	**DURATION OF VTE PROPHYLAXIS**
HIGH RISK MEDICAL PATIENTS			
Aged >60 with additional risk factors and non-ambulant		Enoxaparin 40mg subcut daily*	Until mobility has returned to pre-morbid
Ischaemic Stroke			
History of VTE (DVT/PE)			
Decompensated heart failure			
Acute on chronic lung disease (unless no other risks)			
Acute inflammatory disease		(Apply IPC if enoxaparin contraindicated)	or clinically acceptable level, or discharge from hospital
Thrombophilia			
Sepsis			
Active Cancer			
At risk antenatal patients (≥ 3 obstetric risk factors)			
LOW RISK MEDICAL PATIENTS **None of the above factors**		Nil	Until ambulant
LOW RISK SURGICAL PATIENTS **Minor surgery**		Consider enoxaparin 40mg subcut daily if additional risk factors present	

*Doses of pharmacological prophylaxis will require adjustment for patients with abnormal kidney function, obesity, or low body weight – See section 4.1 Pharmacological Prophylaxis

Additional Notes: Consideration for Mechanical Prophylaxis		
HIGH RISK SURGICAL PATIENTS		
Intrathoracic surgery – cardiac, major thoracic and oesophageal	There may be case by case variations for cardiac and thoracic surgery patients based upon the bleeding risk – refer to your specialist team for advice.	
Other high risk surgical considerations:	**Apply IPC in OT prior to surgery for:** • Neurosurgical patients • Trauma patients • Urology patients **Also consider for:** • Patients with any contraindication preventing administration of enoxaparin in the first 12 hours post-surgery • Any patient where consultant deems VTE risk to be extreme	
HIGH RISK MEDICAL PATIENTS		
Contraindications to pharmacological prophylaxis?	• Current therapeutic anticoagulation • Adverse reaction – allergy/hypersensitivity • Active Bleeding (e.g., haemophilia, coagulopathy, Gastrointestinal (GI) bleeding, ESRF) • Thrombolysis within < 24hrs in acute	• Thrombocytopenia (platelet count< 50 x10*/L • Acute spinal or brain injury/surgery • Regional axial anesthesia • Others e.g., severe/acute hepatic disease (INR >1.5), palliative management
Low risk medical patients and low risk surgical patients (minor surgery)		
Contraindications to IPC?	• Presence of DVT • Severe peripheral arterial disease or arterial ulcers • Recent skin graft	• Severe peripheral neuropathy, diabetic neuropathy • Pressure injury/ulcer • Severe leg deformity/ trauma

2.3 KEY DEFINITIONS

Table 2: Key definitions

AIS	Acute Ischaemic Stroke
AKI	Acute Kidney Injury
ACSQHC	Australian Commission on Safety & Quality in Health Care
ADR	Adverse Drug Reaction
Anticoagulated	Receiving an anticoagulant (i.e., unfractionated heparin, Low Molecular Weight Heparin (enoxaparin, dalteparin), warfarin with INR in therapeutic range, Direct Oral Anticoagulant (apixaban, dabigatran, rivaroxaban) danaparoid, fondaparinux
Antiplatelet agent	Medication that inhibits platelet aggregation – Available in Australia at the time of publication: aspirin, dipyridamole, clopidogrel, prasugrel, ticagrelor, ticlopidine, abciximab, eptifibatide and tirofiban
APTT	Activated Partial Thromboplastin Time
ARTG	Australian Register of Therapeutic Goods
BMI	Body Mass Index
BSA	Body Surface Area
Caprini Risk assessment / Caprini score	VTE risk assessment model commonly used in surgical patients. This is an individualised method of stratifying surgical patients into 4 different levels of VTE risk (very low, low, moderate, or high)
CrCl	Creatinine Clearance
DOAC	Direct-acting Oral Anticoagulant (also referred to a non-vitamin K antagonist oral anticoagulant (NOAC). Available at the time of publication: Direct thrombin inhibitor (dabigatran); and factor Xa inhibitors (apixaban, rivaroxaban)
DVT	Deep Vein Thrombosis
eGFR	Estimated Glomerular Filtration Rate
EMM	Electronic Medical Management
EMR	Electronic Medical Record
ESKD	End Stage Kidney Disease
FBC	Full Blood Count
GCS	Graduated Compression Stockings
Heparin-based VTE prophylaxis	Prophylactic dose of low molecular weight heparin or unfractionated heparin
HIT/HITT	Heparin—Induced Thrombocytopenia / Thrombosis
ICH	Intracerebral Haemorrhage
INR	International Normalised Ratio
IPC	Intermittent Pneumatic Compression
IVC filter	Inferior Vena cava Filter
LBW	Low Body Weight
LMWH	Low Molecular Weight Heparin
NICE	The National Institute for Health and Care Excellence
NIMC	National Inpatient Medication Chart
NOAC	Non-Vitamin K Antagonist Oral Anticoagulant
PBS	Benefits Scheme
PE	Pulmonary Embolism
RFT	Renal Function Test
TGA	Therapeutic Goods Administration
THR	Total Hip Replacement (Arthroplasty)
TKR	Total Knee Replacement (Arthroplasty)
SCD	Sequential Compression device
Subcut	Subcutaneously
UFH	Unfractionated Heparin
VTE	Venous Thromboembolism

2.4 KEY RELATED DOCUMENTS

The following documents have been used to inform the recommendations within this guideline.

Policies/Standards

Australian Commission on Safety and Quality in Health Care (ACSQHC) – Venous Thromboembolism Prevention Clinical Care Standard

Local procedures, guidelines, and protocols

Alterations to Anticoagulation Therapy in Surgical Patients – *Alfred Health*

Management of Intensive Care Trauma Patients Guideline – *Alfred Health*

Thromboprophylaxis – *Alfred Health*

Thromboprophylaxis in Patients Leaving the Emergency Department with Immobilised Lower Limb Injury – *Alfred Health*

Unit Specific VTE Prophylaxis for Surgical Patients – *Alfred Health*

VTE Prophylaxis for Patients with Burns 20% TBSA – *Alfred Health*

Venous Thromboembolism Prophylaxis Guideline for Acute Adult Inpatients – *Austin Health*

Perioperative application of Non-Pharmacological VTE Prophylaxis – *Barwon Health*

PreVent Protocol Venous Thromboembolism (DVTPE) Inpatient Risk Assessment and Prevention Plan – *Barwon Health*

VTE prevention in stroke Patients – *Barwon Health*

VTE Prophylaxis for Adult Surgical Orthopaedic Patients at UHG – *Barwon Health*

Venous Thromboembolism (VTE) Prophylaxis Guideline – *Eastern Health*

Prevention of Venous Thromboembolism (VTE) – *Goulburn Valley Health*

Venous Thromboembolism Prophylaxis for Adult Patients Policy – *Latrobe Regional Hospital*

Venous Thromboembolism (VTE) Prophylaxis Clinical Guideline – *Mercy Health*

Venous Thromboembolism- Risk Assessment & Prevention – *Monash Health*

Prophylaxis of VTE (DVT & PE in ICU Guidelines) – *Melbourne Health*

Haematology – Thrombosis & Haemostasis – *Northern Health*

Guideline for the Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients – *Queensland Health, Queensland Government*

Thromboprophylaxis Guideline – *Royal Children's Hospital Melbourne*

Venous Thromboembolism (VTE) Prophylaxis – Guideline – *Royal Women's Hospital*

Prevention, Diagnosis and Management of Venous Thromboembolism (VTE) Policy – *St Vincent's Hospital Melbourne*

Venous Thromboembolism (VTE) Risk Assessment Tool – *St Vincent's Hospital Melbourne*

Prevention of Venous Thromboembolism (VTE) – *Northeast Health Wangaratta*

Adult Venous Thromboembolism Risk Assessment Guide – *Southwest Healthcare Warrnambool*

Prevention of Venous Thromboembolism – *Southwest Healthcare Warrnambool*

Adult Venous Thromboembolism (VTE) Prevention – *Western Health*

3. Quality Statement 1 – Assess and document VTE risk

3.1 PATIENTS REQUIRING VTE ASSESSMENT

KEY RECOMMENDATION

- All patients admitted to hospital should receive a VTE prophylaxis risk assessment upon admission.
- A patient's risk of VTE should be re-assessed every 7 days, or if their clinical condition changes during hospitalisation.

Assess all patients for potential risk of VTE.
Perform a VTE Risk Assessment on patients who meet the following criteria:

- Acute adult inpatient (medical or surgical), mental health inpatient and sub-acute inpatients (rehabilitation and palliative care inpatients)
- Adult patients admitted for day surgeries or procedures receiving general and prolonged anaesthesia experiencing a significant mobility reduction
- Adult ambulatory patients with isolated injury who require temporary lower limb immobilisation (including those discharged from the emergency department (ED))
- Pregnant and post-partum women

The following patient groups do not routinely require VTE prophylaxis – therefore do not require a VTE assessment:

- Adult patients admitted for day surgeries or procedures receiving local anaesthesia without prolonged reduction/limitation in mobility
- Patients discharged from the ED – excluding patients with lower limb immobilisation
- Terminally ill or end of life patients who are on a palliative pathway. However, the views of the patient, family/carer and multidisciplinary must be considered in these decisions[4]. There may be individual cases where an exception to this guideline is made[5].

4. Queensland Health (2018) 'Guideline for the Prevention of Venous Thromboembolism (VTE) in Adult Hospitalised Patients' Medication Services Queensland

5. Clinical Excellence Commission. Adult Venous Thromboembolism (VTE) Risk Assessment Tool. [cited January 2017]; Available from: http://www. cec.health.nsw.gov.au/__data/assets/pdf_ file/0010/458821/Venous-ThromboembolismVTE-Risk-Assessment-Tool.pdf.

3.2 VTE RISK ASSESSMENT

KEY RECOMMENDATION

- VTE risk assessments should be standardised, using an evidence-based tool or checklist which has been endorsed by your health service, or health service partnership.

The VTE risk assessment should be conducted using a standardised approach. Use a locally endorsed, evidence-based tool or checklist which includes admission related factors in the assessment of the patient.

Document the identified risk factors and contraindications at the time of assessment. This should be in an easily accessible location, i.e., the evidence-based tool, patients medical record, medication chart (paper based or electronic) or other locations advised in your health service documentation policy. [3]
(See section 4 - Develop a VTE prevention plan)

Use the best possible medication history (BPMH) to identify current medications that may increase the patient's risk of clotting or bleeding.

Table 3: Available VTE risk assessment tools – ACSQHC Venous Thromboembolism Prevention Clinical Care Standard, January 2020.

CEC: Adult VTE Risk Assessment Tool
CEC: Maternal Venous Thromboembolism (VTE) Risk Assessment Tool (nsw.gov.au)
The UK Department of Health VTE risk assessment tool
The Royal College of Obstetrics and Gynaecologists VTE risk assessment tool
Caprini Risk Score

3.2.1 VTE RISK FACTORS

Table 4: Risk factors for consideration[5]

Age > 60 years
Obesity (BMI > 30kg/m2)
Moderate to major*surgery - *operating time > 45 minutes and/or involves abdomen
Prior history of VTE
Known thrombophilia (including inherited disorders)
Active malignancy or cancer treatment
Myeloproliferative neoplasms
Congestive heart failure
Acute myocardial infarction
Active infection
Active or chronic lung disease
Active rheumatic disease
Acute inflammatory bowel disease
Pregnant or < 6 weeks post-partum (see section 7.3.3 Thromboprophylaxis in pregnancy)
Oestrogen-based contraceptives
Nephrotic syndrome
Dehydration
Varicose veins/chronic venous stasis
Significantly reduced mobility relative to normal state
Hormonal replacement therapy
Sickle cell disease
Human Immunodeficiency Virus (HIV)
Hypoalbuminaemia

3.2.2 RISK STRATIFICATION

Practically speaking, patients are stratified as either HIGH risk (i.e., requiring VTE prophylaxis) or LOW risk (i.e., not requiring VTE prophylaxis).

Some risk assessment tools further risk stratify patients into low, moderate, and high risk. Although, these tools are still appropriate to use, it is recommended that patients who are at moderate risk of VTE who are staying in hospital overnight are still candidates for standard VTE prophylaxis unless there is an active decision to withhold prophylaxis for a clinical or individual patient reasons.

3.2.3 RISK OF VENOUS THROMBOEMBOLISM IN MEDICAL PATIENTS

High risk

Patients are deemed 'high risk' if they have an acute medical condition and any of the following:

- Age > 60 years. However, those who are otherwise well and ambulant may not be at high risk of VTE in the absence of additional risk factors e.g., thrombophilia, active inflammation, oestrogen therapy, strong history of VTE and/or obesity
- Ischaemic stroke
- History of VTE
- Active cancer
- Decompensated heart failure
- Acute-on-chronic lung disease. Younger patients may not be at high risk of VTE in the absence of additional risk factors
- Acute inflammatory disease – e.g., flare of inflammatory bowel disease (IBD)
- Thrombophilia
- Sepsis
- At risk antenatal patients (≥3 obstetric risk factors present)
- Also consider - obesity (BMI >30 kg/m2), gross varicose veins, hormone therapy, immobility, myeloproliferative disorders

Low risk

Medical patients without any of the above risk factors.

3.2.4 RISK OF VENOUS THROMBOEMBOLISM IN SURGICAL PATIENTS

High risk

MAJOR TRAUMA PATIENTS

Patients with any one of the following:

- Traumatic brain injury
- Long bone fracture
- Truncal trauma including intra-abdominal injuries
- Spine fracture +/- spinal cord injury
- Multi-trauma – serious injury across 2 or more body regions
- Burns requiring hospital admission

PLANNED (ALSO KNOWN AS ELECTIVE) SURGICAL & ORTHOPAEDIC PATIENTS

Patients with any one of the following:

- Hip or knee arthroplasty
- Intrathoracic surgery
- Major surgery or laparoscopic surgery and additional surgical risk factor* or other surgery >45 mins
- Cancer + surgery (except head & neck surgery <45 mins, with no additional risks)
- Other surgery with multiple additional risk factors
- For orthopaedic patients undergoing spinal surgery see section 7.2.6 for all other orthopaedic surgery patients refer to your local health service guideline or guidance provided within your Health Service Partnership

*Additional risk factors

- Obesity (BMI >30 kg/m2)
- Myeloproliferative neoplasm
- Thrombophilia
- Gross varicose veins
- Hormone therapy, pregnancy
- Previous VTE
- Immobility
- Active inflammation e.g., flare of inflammatory bowel disease (IBD)

Low risk

ALL OTHER SURGERY

All other Surgery & Trauma patients not included in the high-risk group above.

- Major surgery AND age<40 years without medical/patient risk factors
- Minor surgery AND age<60 years without medical/patient risk factors
- Minor surgery AND age>60 years but not requiring overnight stay and expected to be normally ambulant following surgery
- No surgery AND no medical/patient risk factors

4. Quality Statement 2 – Develop a VTE prevention plan

KEY RECOMMENDATION

- Each patient assessed as requiring VTE prophylaxis (VTE Risk Factors) should have a VTE prevention plan developed, balancing the risk of VTE against bleeding (Intracranial, Post-operative, Gastrointestinal). This should be performed using a locally endorsed, evidenced based risk assessment tool. See Table 3 - Available VTE risk assessment tools
- VTE prevention plans should be documented in the patient medical record/incorporated in electronic medical records

A VTE prevention plan should consist of the following:

- Type of VTE prophylaxis (pharmacological or mechanical)
- Date and time of commencement
- Duration
- Frequency of reassessment

The plan should be developed in conjunction with the patient, considering the consequences of VTE development and bleeding. Provide information brochures where available.

Patient factors that may influence choice of VTE prophylaxis: [6, 7, 8, 9]

- Impaired renal function
  - Reduced doses of low molecular weight heparin (LMWH) or direct-acting oral anticoagulants (DOACs) may be required in moderate to severe renal impairment.
  - Unfractionated heparin or warfarin may be preferred in patients with end-stage renal impairment (CrCl < 20 mL/min, or on dialysis)
- Extremes of body weight
  - Consider reduced dose LMWH in underweight patients (< 50 kg)
  - Consider adjusted dose LMWH in patients with a BMI > 40
- Current medications that may affect clotting (e.g., antiplatelets or anticoagulants)
- Prior history of heparin induced thrombocytopenia (HIT)
- Pregnancy
  - Consider LMWH or UFH
- Weight bearing status

Consider the following when developing a VTE prevention plan:

- Individual assessment of harm-benefit balance for risk of thrombosis and bleeding
- Pharmacological prophylaxis (e.g., LMWH) – this should be prescribed on the medication administration record/chart by the medical doctor
- Contraindications to pharmacological prophylaxis
- Contemporary clinical trials have shown that LMWH (e.g., enoxaparin, dalteparin) should be used as the standard-of-care in most at-risk patient groups in the absence of a high bleeding risk [10]
- LMWH should be prescribed when a contraindication has subsided and if the patient remains at risk for VTE
- LMWH should be used in preference to low dose unfractionated heparin (UFH), since UFH may be inferior to LMWH unless administered two to three times daily [11, 12, 13, 14]
- Unfractionated Heparin (UFH) imparts a significantly higher risk for heparin-induced thrombocytopenia (HIT) compared with LMWH. Use LMWH (e.g., enoxaparin) with caution in patients with severely abnormal kidney function. See section 7.3.2 Thromboprophylaxis when there is Abnormal Kidney Function
- UFH may be preferred when there is a potential need for anticoagulant reversal.
- Mechanical prophylaxis devices can be removed (e.g., IPC) once LMWH has started, unless the patient is deemed to be at extreme risk of VTE.
- Generally, continue prophylaxis until the patients' mobility has returned to the pre-morbid or clinically acceptable level, or has been discharged from hospital. See section 2.2 - Thromboprophylaxis Flowchart.
- Avoid dehydration in all patients
- Encourage early mobilisation whenever possible.
- Some patients will be candidates for post discharge thromboprophylaxis

Any decision not to provide pharmacological prophylaxis should be documented on the medication chart and in the patients' medical record with a timeframe for review (if appropriate).

6 NICE (National Institute for Health and Care Excellence) 2018 | Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism https://www.nice.org.uk/guidance/ng89/resources/venous-thromboembolism-in-over-16s-reducing-the-risk-of-hospi-talacquired-deep-vein-thrombosis-or-pulmonary-embolism-pdf-1837703092165

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14. Hillbom M et al. (2002) Enoxaparin vs heparin for prevention of deep-vein thrombosis in acute ischaemic

stroke: a randomized, double-blind study, Acta Neurol Scand.106:84-92

4.1 PHARMACOLOGICAL PROPHYLAXIS

KEY RECOMMENDATION

- Low Molecular Weight Heparin is the preferred pharmacological agent in VTE prophylaxis (e.g., enoxaparin, dalteparin) – administered daily at 2000hrs (unless advised otherwise by the treating consultant)
- Pathology including Full Blood Count (FBC), Renal Function Test (RFT) and coagulation profile should be performed prior to commencing Pharmacological VTE prophylaxis
- If there are any doubts about the appropriateness and timing of the VTE prophylaxis, consult the health service haemotologist or seek haematology advice
- If pharmacological prophylaxis is contraindicated, surveillance lower limb ultrasound should be performed twice weekly.

Pharmacological Prophylaxis dosing recommendations:

MEDICAL PATIENTS

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	40mg	Daily	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
	Dalteparin~	5000 units*	Daily	
UFH	Heparin	5000 units	8-12 hourly	

~Treatment for 5-7 days or until mobilising

*Dosage for high-risk medical patients. Consider 2500 units daily for low-risk patients

SURGICAL PATIENTS

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	40mg	Daily	Until ambulant or discharged from hospital
	Dalteparin^	5000 units~		Evening before the operation
	then	5000 units	Daily	5-7 days or until mobilised
UFH	Heparin	5000 units	8-12 hourly	2 hours preoperatively then every 8-12 hours

~Or 2500 units 1-2 hours preoperatively repeated 12 hours later, then 5000units daily

^Treatment may be continued for up to 5 weeks for prolonged prophylaxis in orthopaedic surgery

ABNORMAL KIDNEY FUNCTION

Drug Class	Agent	Standard VTE prophylaxis dose (normal kidney function)	Dose change with abnormal kidney function	Duration
UFH	Heparin	5000 units twice a day	No adjustment required	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
LMWH	Enoxaparin	40 mg daily	Cr Cl < 30 ml/min	
			- reduce to 20 mg daily	
	Dalteparin	5000 units daily	Cr Cl < 30 ml/min	
			- consider anti-Xa levels	
			Cr Cl < 15 ml/min: Avoid	
DOAC	Apixaban	2.5 mg twice a day	Cr Cl < 25 ml/min: Avoid	
	Rivaroxaban	10 mg daily	Cr Cl < 15 ml/min: Avoid	

LOW BODY WEIGHT (<50KG)

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	20mg	Daily	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital

Source: Mims online (https://www.mimsonline.com.au.acs.hcn.com.au) & Lexicomp (https://online.lexi.com.acs.hcn.com.au)

Table 5: Medicines commonly used to prevent VTE

(adapted from the Australian Commission on Safety and Quality in Health Care)[3]

Note: The information in this table is not exhaustive and was not current at the time of publication. Please refer to the latest version of the full Australian approved Product information when prescribing.

Medication class		Generic name (Trade name)	Elimination	Antidote to reverse bleeding	Side effects other than bleeding (Inc common and infrequent)	Monitoring requirements
Injectable anticoagulants (Administered subcutaneously)	**Low molecular weight heparin (LMWH)**	Dalteparin (Fragmin)	Renal	Partially reversible with protamine (60–75%)	• Bruising and pain at injection site • Hyperkalaemia • Mild reversible thrombocytopenia • Transient elevation of LFTs • Heparin induced thrombocytopenia (Note: from UFH or LMWH (incidence is higher with UFH). A non-heparinoid drug is often used as an alternative if this develops) e.g., danaparoid or fondaparinux	• Baseline CrCl prior to initiation then periodically for the duration of prophylaxis, particularly if baseline CrCl is abnormal. • Consider monitoring antifactor Xa levels in patients with kidney impairment or high risk of bleeding • Baseline platelets then periodically for the duration of prophylaxis • Signs of bleeding • Serum potassium
		Enoxaparin (Clexane)		Partially reversible with protamine (60%)		
		Nadroparin (Fraxiparine)		Partially reversible with protamine (60–80%)		
	Heparin sodium	Unfractionated heparin (UFH)	Liver and Reticulo-endothelial system	Reversible with protamine		• Baseline platelets then periodically for the duration of prophylaxis • Signs of bleeding
	Factor Xa inhibitors	Fondaparinux (Arixtra)	Renal	• Nil specific antidotes available in Australia (at time of publication) • Prothrombin complex concentrates or recombinant factor VIIa may be tried, however there are no human study results to support their use • Seek specialist advice		• Baseline CrCl prior to initiation then periodically for the duration of prophylaxis. • Consider monitoring anti-factor Xa levels in patients with kidney impairment where available • Baseline platelets then periodically for the duration of prophylaxis • Signs of bleeding • Serum potassium

Abbreviations: CrCl = Creatinine Clearance; LFT = Liver function tests, THR = Total hip replacement.

TKR = Total knee replacement; INR = International normalised ratio

4.1.1 LOW MOLECULAR WEIGHT HEPARIN

KEY RECOMMENDATION

- Unless contraindicated, the use of pharmacological agents is the preferred VTE prophylaxis for adult patients admitted to hospital with a moderate or high risk of developing VTE.

Enoxaparin or dalteparin is the preferred therapy –Dose adjustment is required for patients with abnormal kidney function or very low body weight. See section 4.1 Pharmacological Prophylaxis for dosing recommendations. Dose adjustments may also need to be considered in obese patients. See section 7.3.5 - Thromboprophylaxis in patients with obesity

4.1.2 UNFRACTIONATED HEPARIN

Prior to commencing VTE prophylaxis with heparin, blood pathology should be performed including FBC, RFT and coagulation profile – including International Normalised Ratio (INR) and Activated Partial Thromboplastin Time (APTT).

Unfractionated heparin is preferred in some circumstances for patients with abnormal kidney function or when rapid reversal may be required. See section 4.1 Pharmacological Prophylaxis for dosing recommendations.

4.1.3 DIRECT ORAL ANTI-COAGULANTS

KEY RECOMMENDATION

POST-OPERATIVE HIP OR KNEE ARTHROPLASTY

Drug Class	Agent	Dose	Frequency	Duration
DOAC's	*Apixaban	2.5mg orally	12hourly	Until mobility has returned to pre-morbid or clinically acceptable level, or dis-charge from hospital
	Dabigatran	110mg^ orally	1-4hrs post op	
	then	220mg# orally	Day 1 Post op onwards	
	Rivaroxaban	10mg orally	Daily	

* Avoid usage if CrCl <25 ml/min
^ for CrCl more than 50ml/min. (If not started on the day of surgery, start with 220mg once daily)
# For CrCl 30 to 50 ml/min. (If not started on the day of surgery, start with 150mg once daily)
Dabigatran is TGA approved, though not PBA funded.

DOAC's have emerged as a contemporary option in the management and prophylaxis of VTE and other thrombotic diseases[15]

Following surgery for hip or knee replacement, DOAC's including apixaban, dabigatran and rivaroxaban are effective and are administered orally[16].
As DOAC's undergo hepatic metabolism and renal excretion, careful dosing is required in patient's hepatic and/or renal impairment.

Rivaroxaban for thromboprophylaxis should be used cautiously in patients with creatinine clearance 15-29 mL/min. It is contraindicated in patients with creatinine clearance <15mL/min and should be avoided or only used with caution in the setting of AKI.

Apixaban for thromboprophylaxis is contraindicated in patients with creatinine clearance <25mL/min. and should be avoided in the setting of acute kidney injury (AKI).
When using DOACs for VTE prophylaxis, consideration must be given to the potential need for reversibility, and the timeframe required to reverse their effects.

15. Karcioglu, O., et al. Direct (New) Oral Anticogulants(DOACs): Drawbacks, Bleeding and Reversal, National Library of Medicine, PMID: 34521332 DOI: 10.2174/1871525719666210914110750

16. Therapeutic guideline; Venous Thromboembolism: prophylaxis, March 2018 (amended August 2022) https://tgldcdp.tg.org.au.acs.hcn.com.au/

4.1.4 ASPIRIN AS AN ALTERNATIVE TO ENOXAPARIN IN ORTHOPAEDIC PATIENTS

KEY RECOMMENDATION

- Aspirin is not suitable for use in patients at high risk of VTE
- Aspirin may be considered as an alternative for low-risk orthopaedic patients who are able to mobilise early
- Enoxaparin is the recommended agent for VTE prophylaxis during the patient's admission. See section 4.1 - Pharmacological Prophylaxis

This clinical guideline recommends LMWHs as the preferred pharmacological prophylaxis following surgery.

The decision as to what pharmacological agent to use may be determined by local protocol such as the use aspirin in low-risk orthopaedic patients, either for the full period of prophylaxis or at discharge from hospital. The decision as to what pharmacological agent is chosen should be clearly documented in the patient's medical history.

There is limited evidence from trials relating to the effectiveness and non-inferiority of aspirin versus enoxaparin for VTE prophylaxis for patients presenting with fractures or undergoing joint replacement. Thus, aspirin may be considered for low-risk patients who are able to mobilise early.

A randomised trial (CRISTAL) conducted in 2021 was published in JAMA following an interim review of data and early closure of the trial. The interim review determined that for patients undergoing hip or knee arthroplasty for osteoarthritis, aspirin compared to enoxaparin resulted in a significantly higher rate of symptomatic below knee DVT, but no difference in above knee DVT or pulmonary embolism[17].

4.1.5 CONTRAINDICATIONS TO PHARMACOLOGICAL PROPHYLAXIS

Where there is a contraindication to pharmacological prophylaxis, consider the use of mechanical prophylaxis. Mechanical prophylaxis should remain in place until such time that the contraindication to pharmacological prophylaxis is resolved.

Contraindications to pharmacological prophylaxis should be documented on the medication chart, where possible, or in the patient medical record.

Pharmacological contraindications include:

- Current therapeutic anticoagulation
- Adverse Reaction
  - Allergy or hypersensitivity
- Active bleeding
- High risk of bleeding/Coagulopathy
- Known bleeding disorder (e.g., haemophilia)
- Thrombolysis within < 24hrs in acute ischaemic stroke
- Thrombocytopenia (platelet count <50 $X10^9$/ L
- Acute spinal or brain injury/surgery
- Regional axial anaesthesia
- Other factors to consider:
  - Severe/acute hepatic disease (INR >1.5)
  - Palliative management
  - End Stage Kidney Disease (ESKD)
  - Subacute bacterial endocarditis
  - Heparin Induced Thrombosis / Thrombocytopenia Syndrome (HITTS)

17. Verinder S Sidhu et al. 2022 Effects of Aspirin vs Enoxaparin on Symptomatic Venous Thromboembolism in Patients Undergoing Hip or Knee Arthroplasty: The CRISTAL Randomised Trial, National Library of Medicine, 23;328(8): 719-727.doi: 10.1001/jama.2022.13416 https://jamanetwork.com/journals/jama/fullarticle/2795528#:~:text=The%20CRISTAL%20randomized%20trial%20was,undergoing%20hip%20or%20knee%20arthroplasty

4.2 MECHANICAL PROPHYLAXIS

If pharmacological prophylaxis is contraindicated, mechanical prophylaxis should be considered as the primary method of VTE prophylaxis where no contraindication to mechanical prophylaxis is present.

Mechanical VTE prophylaxis may be used in conjunction with pharmaceutical prophylaxis unless contraindicated, although there is a lack of robust evidence to support the efficacy of this practice. Once pharmacological prophylaxis has commenced, consider ceasing mechanical prophylaxis.

4.2.1 INTERMITTENT PNEUMATIC COMPRESSION/SEQUENTIAL COMPRESSION DEVICES

KEY RECOMMENDATION

- **Patients who are at risk of bleeding should have Intermittent Pneumatic Compression (IPC) applied upon admission, in theatre prior to surgery, or ICU as soon as possible after admission.**
- **IPC is contraindicated in the presence of deep vein thrombosis (DVT) and should not be used**

There is some evidence that the application of IPC devices are a useful adjunct in the prevention of VTE in high-risk surgical patients, in addition to LMWH. IPC devices should be applied in the operating suite prior to draping.

IPC devices are to remain in use until:

- the patient is ambulant

OR

- pharmacological prophylaxis can be safely administered (no longer contraindicated)

OR

- as indicated in the Thromboprophylaxis Flowchart

IPC use **must be discontinued when the patient is ambulant** to enable the patient to move freely, and to decrease the risk and potential injury from falls.

Venous duplex scans are not required prior to the application of IPC unless there is clinical evidence of DVT or there has been a period of immobility without pharmacological prophylaxis.

4.2.1.1 CONTRAINDICATIONS TO IPC/SCD

- Presence of DVT
- Severe peripheral arterial disease or arterial ulcers
- Recent skin graft
- Severe peripheral neuropathy, diabetic neuropathy
- Patients who have a pressure injury/ulcer
- Severe leg deformity/trauma
- Consider others - severe dermatitis, severe leg oedema, morbid obesity, lower leg inflammation.

4.2.2 GRADUATED COMPRESSION STOCKINGS (GCS)

There is limited evidence to support the efficacy of GCS. Similarly, there is a lack of research and evidence supporting the use of GCS in conjunction with pharmacological prophylaxis.

Contraindications should be considered if there is a decision to use GCS. See section 4.1.6 - Contraindications to Mechanical Prophylaxis

Where the decision has been made to use GCS, the following should be considered:

- Ensure the patient wears non-slip footwear for ambulation.
- Remove GCS at least every 8 hours and inspect skin for signs of trauma or pressure injury and re-apply.
- Regularly reassess if the size is still appropriate as stocking size may need to change with changing in fluid status (e.g., in lymphedema)
- GCS should **NOT** be worn under IPC/SCD

4.2.3 INFERIOR VENA CAVA (IVC) FILTERS

KEY RECOMMENDATION

- **An IVC filter should be placed if enoxaparin is contraindicated AND there is either:**
  - **(1) spinal cord injury**
  - **(2) major pelvic fractures/multiple lower limb long bone fractures, or**
  - **(3) known acute VTE**

In most patients pharmacological and/or mechanical thromboprophylaxis are sufficient to prevent the formation of VTE – pharmacological thromboprophylaxis is the option of choice for the prevention of VTE.

IVC filters are traditionally used for high-risk patients, in whom pharmacological prophylaxis is contraindicated or placed in patients with acute VTE with contraindication to therapeutic anticoagulation.

Following deployment, the patient should be assessed regularly/daily, reviewing the possible resumption or commencement of pharmacological prophylaxis.

A follow up plan for retrieval of IVC filters should be documented at the time of deployment. This should include a periodic assessment plan for filter integrity and complications.

IVC filters should be removed once there is confidence that the risk of PE has subsided and/or pharmacological prophylaxis can be safely commenced.

5. Quality Statement 3 – Inform and partner with patients

KEY RECOMMENDATION

- Patients should be informed about their risk of VTE.
- Education and information should be provided to inform the patient about the role they play in reducing the risk.

A VTE prevention plan should be developed in partnership with the patients (and carers where applicable), discussing the results of their VTE risk assessment.

Educating the patients:

- Highlight the importance of mobilisation and hydration.
- Provide information and discuss the decisions that inform balancing the risks of VTE and bleeding.
- Address factors such as bleeding, needle phobia, or other personal beliefs raised by the patient (e.g., religious beliefs) which may influence the choice of prophylaxis.
- Multilingual brochures should be provided where available.
- Allow time for questions.

Refer to the link attached from the Australian Commission on Safety and Quality in Health Care (ACSQHC) Venous Thrombosis Prevention Clinical Care Standard – Quick Facts for Consumers. ACSQHC - VTE Consumer fact sheet

6. Quality Statement 4 – Document and communicate the VTE prevention plan

KEY RECOMMENDATION

- Document the VTE risk assessment and prevention plan including appropriate prescribing of both mechanical and or pharmacological prophylaxis in the patients' medical notes AND on the patient's medication chart.

The patients risk assessment and VTE prevention plan should be documented on the health service approved evidence-based risk assessment tool (where applicable), in the patient's medical record, on the patient's medication chart and in the nursing care plan. This should occur at the time of risk assessment and prevention plan development.

Document the content of the discussion with the patient, carer, and/or family members in the patients' medical record. This should include any leaflets or references provided.

It is important to document the rationale, particularly when there is a modification to the recommended VTE prevention plan based on individual clinical circumstances.

7. Quality Statement 5 – Use appropriate VTE prevention methods

Following risk assessment, the patient should be offered either pharmacological and/or mechanical VTE prophylaxis. See section 4.1 Pharmacological Prophylaxis or section 4.2 Mechanical Prophylaxis.

The following address VTE prophylaxis considerations for specialised medical and surgical considerations.

7.1 VTE PROPHYLAXIS FOR PATIENTS WITH MEDICAL CONSIDERATIONS

7.1.1 THROMBOPROPHYLAXIS IN PATIENTS WITH COVID-19

KEY RECOMMENDATION

- Patients admitted to hospital with COVID-19 infection should receive a prophylactic dose of LMWH (e.g., enoxaparin 40mg once daily or dalteparin 5000 units once daily) in adults with moderate, severe, or critical COVID-19 unless contraindicated. See section 4.1 Pharmacological Prophylaxis

All patients admitted to hospital with COVID-19, diagnosed with COVID-19 as an inpatient, or experience an increased severity of symptoms should undergo a documented assessment of risk factors for VTE.

The use of pharmacological prophylaxis should be accompanied by other measures to prevent VTE, such as sequential compression devices.

Patients with COVID-19 in whom there are symptoms or signs of pulmonary embolism (PE) should be promptly investigated with CTPA imaging to confirm or exclude the diagnosis.

For further advice, refer to the **National Clinical Evidence Taskforce – COVID-19** website containing

Evidenced based clinical guidelines which are continually updated – see Living Guidelines[18]

18. Australian guidelines for the clinicals care of people with COVID-19, National Clinical Evidence Taskforce – COVID-19.
MAGICapp - Making GRADE the Irresistible Choice - Guidelines and Evidence summaries

7.1.2 THROMBOPROPHYLAXIS IN STROKE PATIENTS

KEY RECOMMENDATION

- All patients presenting with acute stroke are at high risk of VTE and should have some form of VTE prophylaxis (mechanical or pharmacological prophylaxis) commenced upon admission.

The risk of VTE is elevated in the first one to three months after stroke, due in part to stroke related immobility. DVT development may occur as early as the second day after stroke onset and has a peak incidence between two and seven days. Pulmonary embolism (PE), often associated with DVT, accounts for 13 to 25% of early deaths after stroke and is the most common cause of death, with the incidence peaking 2-4 weeks after the onset of the stroke. The incidence of PE in the first few months following stroke ranges from 1 to 3 percent [19 20].

Acute ischaemic stroke (AIS) – Medical Management (no thrombolysis or endovascular clot retrieval)

KEY RECOMMENDATION

- UPON ADMISSION - Commence pharmacological VTE prophylaxis, unless other contraindication – See Section 4.1 – Pharmacological Prophylaxis
- DURATION - Continue VTE prophylaxis for duration of acute hospital admission and inpatient rehabilitation if patient's ambulatory status is not back to base line.
- If acute haemorrhagic complication occurs, consider mechanical instead of pharmacological VTE

Acute ischaemic stroke (AIS) – Following Thrombolysis or Endovascular Clot Retrieval

KEY RECOMMENDATION

- FIRST 24hrs - Commence mechanical VTE prophylaxis upon admission until repeat brain imaging – See Section 4.2 Mechanical Prophylaxis
- AFTER 24hrs - if repeat brain imaging shows no haemorrhagic transformation, cease mechanical prophylaxis and commence pharmacological VTE prophylaxis unless other contraindications are present. – See Section 4.1 – Pharmacological Prophylaxis
- DURATION - Continue VTE prophylaxis for duration of acute hospital admission and inpatient rehabilitation if patient's ambulatory status is not back to base line.
- If an acute haemorrhagic complication occurs, consider mechanical instead of pharmacological VTE

19. Kelly J, Rudd A, Lewis R, Hunt BJ. Venous thromboembolism after acute stroke. Stroke2001; 32:262.

20. Rinde LB, Småbrekke B, Mathiesen EB, et al. Ischemic Stroke and Risk of Venous Thromboembolism in the General Population: The Tromsø Study. J Am Heart Assoc2016; 5

Haemorrhagic Stroke – With or without neurosurgical intervention

KEY RECOMMENDATION

- Commence **mechanical VTE prophylaxis** upon admission until repeat brain imaging – See Section 4.2 Mechanical Prophylaxis
- Once repeat brain imaging indicates intracerebral bleed has stabilised, cease mechanical prophylaxis, and commence pharmacological VTE prophylaxis unless other contraindications are present (this should be at consultant discretion) – See Section 4.1 – Pharmacological Prophylaxis
- DURATION - Continue VTE prophylaxis for duration of acute hospital admission and inpatient rehabilitation if patient's ambulatory status is not back to base line.

Patients who require therapeutic anticoagulation do not require additional VTE prophylaxis. However, if patients are commencing warfarin without bridging LMWH, consider continuing VTE prophylaxis until INR within therapeutic range.

Concurrent treatment with dual antiplatelet therapy is not a contraindication to, or a replacement for pharmacological VTE prophylaxis.

7.1.3 THROMBOPROPHYLAXIS IN MENTAL HEALTH PATIENTS

KEY RECOMMENDATION

- VTE prophylaxis should be considered in a patient with reduced mobility due to mental illness/ disorder. See section 4.1 - Pharmacological Prophylaxis for dosing recommendations.

Reduced mobility – a known risk factor in medical and surgical patients – should be considered when performing a risk assessment for mental health patients. Conditions and circumstances that can result in reduced mobility and increased risk of VTE include catatonia, oversedation, prolonged bed rest from mental health conditions such as depression, anorexia nervosa, neuroleptic syndrome and the prolonged use of mechanical restraints and seclusion.

Risk assessment should be performed using a standardised, evidence-based tool.

7.2 VTE PROPHYLAXIS FOR PATIENTS WITH SURGICAL CONSIDERATIONS

KEY RECOMMENDATION

- The cessation of anticoagulant therapy must be considered prior to surgery
- Pharmacological VTE prophylaxis should be administered after skin closure in surgical patients, on the evening of the day of surgery - unless there is an active decision or specific indication to delay administration to the following day.

For venous thromboprophylaxis information regarding general and abdominal surgery, please refer to the Thromboprophylaxis flowchart

The table in Appendix 2 provides suggested modalities for the initiation of VTE prophylaxis in additional surgical specialties.

These include Thromboprophylaxis in:

- Breast and Endocrine surgery
- Colorectal surgery
- Ear, Nose and Throat surgery
- Plastics and Reconstructive surgery
- Urology
- Vascular surgery

These suggestions should be considered in conjunction with the information provided in section 4.1 – Pharmacological Prophylaxis and Section 4.2 - Mechanical Prophylaxis

7.2.1 THROMBOPROPHYLAXIS IN SPINAL, EPIDURAL AND REGIONAL ANAESTHESIA

KEY RECOMMENDATION

- Prophylactic LMWH should be withheld a minimum of 12 hours prior to the insertion and removal of epidural and perineural catheters
- Apixaban and rivaroxaban should be ceased at least 3 days prior to spinal anaesthesia or epidural catheter placement
- Oral anticoagulants are contraindicated while the epidural catheter is in place

Consideration should be given to the patient's coagulation profile prior to regional and neuraxial (spinal and epidural) blocks, especially when a catheter will be left in situ - the exception being superficial local anaesthetic blocks or wound catheters.

Regional and neuraxial analgesic techniques may have serious complications in the presence of a pre-existing coagulopathy, such as epidural hematoma, and retroperitoneal haematoma from lumbar plexus blocks.

Laboratory investigations should be undertaken where appropriate, however it should be noted that potent antiplatelet medications, direct thrombin inhibitors and anti-factor Xa drugs are of particular concern because their effects are not readily reversible nor always evident on standard coagulation tests[21].

Similarly, the patient coagulation profile should be considered prior to catheter removal. The highest risk of complications from bleeding in the presence of anticoagulation is with neuraxial clocks (spinal and epidural) especially when a catheter is inserted or removed.

Communication regarding the analgesic technique used between treating medical units is essential, including potential complications and any specific implications for the surgery performed or any other management issues identified. Consultation with the health service pain management staff may be indicated[22].

Acute pain management:
Refer to the ANZCA-produced internationally respected reference (Acute Pain Management: Scientific Evidence, 5th edition 2020[17]) for aggregated evidence for Acute Pain Management - https://www.anzca.edu.au/safety-advocacy/advocacy/college-publications.

To summarise the recommendations for heparins, warfarin and NOACs with respect to neuraxial blockade (spinal and epidural) (which also applies to deep regional blocks such as paravertebral and lumbar plexus blocks):

Table 6: Heparins, warfarin and NOAC's - neuraxial blockade

Medication	Dosing	Pausing anticoagulant prior to Spinal block or Epidural Insertion	Delay to restart while Epidural catheter in place	Pausing anticoagulant prior to Epidural catheter removal	Restarting anticoagulant post-removal
UFH	Prophylactic	6h	1h	6h	1h
	Therapeutic s/c	24h + APTT	1h	24h + APTT	1h
	Therapeutic IV	6h + APTT	1h	6h	2h
LMWH	Prophylactic	12h	12h	12h	4h
	Therapeutic	24h	12h	24h	4h
Fondaparinux	Prophylactic	2d (low dose)	C/I	C/I	6h
Warfarin	Therapeutic	5d + INR<1.5	C/I	INR < 1.5	4h
Rivaroxaban	≤ 20mg/d	≥ 3d	C/I	C/I	≥ 6h
Apixaban	≤ 5mg/bd	≥ 3d	C/I	C/I	≥ 6h
Dabigatran		≥ 3d	C/I	C/I	≥ 6h

NB: The scope of this guideline is limited to VTE prophylaxis only, however therapeutic dosing has been provided within the above table for ease of use.

Noting that individual risk must be assessed e.g., renal impairment resulting in delayed LMWH and NOAC clearance

21. "ANZCA: PG03(A) Guideline for the management of major regional analgesia 2014. PG03(A)-Guideline-for-the-management-of-major-regional-analgesia (anzca.edu.au) https://www.anzca.edu.au/safety-advocacy/standards-of-practice/policies,-statements,-and-guidelines
22. Schug SA, Palmer GM, Scott DA, Alcock M, Halliwell R, Mott JF; APM:SE Working Group of the Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine (2020), Acute Pain Management: Scientific Evidence (5th edition), ANZCA & FPM, Melbourne. https://www.anzca.edu.au/safety-advocacy/advocacy/college-publications

Fibrinolytic/thrombolytic therapy creates a very high-risk situation and if administered while an epidural catheter is in place, close neurologic monitoring is required, and individual follow-up of coagulation is needed before catheter removal[22].

For further information refer to the National library of Medicine article 'Regional anaesthesia in patients at risk of bleeding (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7892354/), and to the Society for Obstetric Anaesthesia and Perinatology Consensus Statement on the Anaesthetic management (https://pubmed.ncbi.nlm.nih.gov/29099429/)

7.2.2 THROMBOPROPHYLAXIS IN NEURO AND SPINAL SURGERY (ALL NEUROSURGICAL PATIENTS)

KEY RECOMMENDATION

- All patients should have mechanical prophylaxis applied until they can ambulate or can receive pharmacological prophylaxis with LMHW
- IPC should be applied intra-operatively, and continued until mobile
- If IPC is not available or contraindicated, Graduated Compression Stockings (GCS) should be applied. GCS and IPC should not be in place at the same time.
- LMHW should be started 24-48 hours post-operatively (at Consultant discretion) and continued for period of hospitalisation. Mechanical prophylaxis can be removed once chemoprophylaxis has commenced .

Neurosurgical patients are among the most at risk for VTE. Some sources quote a risk as high as 50%. This is thought to be due to the following factors:

- Longer operating times than other surgical procedures
- Prolonged bed rest
- Limb paresis in some patients (some develop upper limb DVT)
- Hypercoagulable states – cerebral neoplasms which secrete thromboplastins (particularly meningiomas) and increased blood viscosity due to hypovolaemia caused by cerebral salt wasting in some subarachnoid haemorrhage (SAH) patients.

However, the possible complication of haemorrhage associated with pharmacological thromboprophylaxis among patients with recent cranial or spinal surgery can be devastating, therefore careful evaluation is necessary.

It may be necessary to obtain a venous ultrasound of the lower limbs to first rule out DVT before applying IPC if there has already been a period of immobilisation or if there is clinical evidence of DVT - see section 4.2 Mechanical Prophylaxis

Where possible, patients should be encouraged to ambulate or do exercises in bed.

Apply principles as above i.e., IPC intra-operatively, continue until mobile; LMHW commenced 24-48 hours post-operatively and continued for period of hospitalisation for patient who undergo spinal surgery.

Cease LMWH 24 hours prior to surgery pre-operatively.

Thromboprophylaxis in cranial surgery

KEY RECOMMENDATION

- **Start subcutaneous LMHW no earlier the 48hours post-operatively, and once considered safe.**

STARTING ENOXAPARIN IN RELATION TO EXTERNAL VENTRICULAR DRAINS (EVD) AND ICP MONITORS:

Removing an EVD or ICP monitor has the potential to cause either intraparenchymal or extradural/subdural haemorrhage. This risk is thought to be low, but generally, the use of LMHW should be avoided when a patient still has an EVD/ICP monitor in-situ, and not started until the device is removed. Mechanical prophylaxis should be continued. Every case is different, so ask a registrar for advice if you are unsure.
In patients with head injury/intracranial bleed/other contraindication to pharmacological prophylaxis, withhold LMHW and review daily.

The table below provides suggested modalities for the initiation of VTE prophylaxis in neurosurgery. This should be considered in conjunction with the information provided within this section (7.2.2 – Thromboprophylaxis in neuro and spinal surgery).

Table 7: Thromboprophylaxis in Neurosurgery (NSURG)

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY*	RECOMMENDED PROPHYLAXIS		NOTES
		<24Hrs Post operatively	**>24Hrs Post operatively**	
Anterior cervical discectomy and fusion (ACDF), Posterior cervical spinal procedures	**MODERATE / HIGH**	IPC intraoperatively	LMWH: Period of hospitalisation	
Insertion of Ventriculoperitoneal (VP) shunt / Acoustic neuroma removal	**MODERATE / HIGH**	IPC intraoperatively	LMWH: Period of hospitalisation - Commence 48-72hrs post-operatively	
Lumbar thoracic extradural spinal procedures (laminectomy, microdiscectomy)	**HIGH**	IPC Intraoperatively	LMWH: Period of hospitalisation	IPC can be removed once LMWH has commenced, unless very-high risk for VTE.
Craniotomy for tumour (glioma, meningioma) / Aneurysm clipping / Evacuation of Subdural Haematoma (SDH) or Extradural Haematoma (EDH) / Intradural spinal procedure	**HIGH**	IPC Intraoperatively	LMWH: Period of hospitalisation - Commence 48-72hrs post-operatively	Consider extended thromboprophylaxis for patients with active cancer/immobility

7.2.3 THROMBOPROPHYLAXIS IN ORTHOPAEDIC SURGERY – INCLUDING TOTAL JOINT ARTHROPLASTY (HIP/KNEE)

KEY RECOMMENDATION

- **Administer LMWH, DOAC or aspirin (enoxaparin 40mgs daily/ dalteparin 5000 units daily/rivaroxaban 10mg daily/apixaban 2.5mg BD/ dabigatran 220mg daily/ aspirin 100-150mgs daily) whilst an inpatient and continue extended VTE prophylaxis on discharge for a total of 14 days for TKR/ 35 days for THR.**

LMWH/DOACs are the preferred agents for patients who:

- **are "non-weight bearing with immobilised lower limb" OR**
- **have additional VTE risk factors (e.g., prior VTE, active malignancy, current oestrogen therapy, obesity)**

For practice-based thromboprophylaxis considerations in other orthopaedic surgical procedures, refer to your specialist Medical/surgical team, local health service guideline or guidance, or specialist recommendations provided within your Health Service Partnership.

VTE risk factors following orthopaedic surgery

Consider patient and procedure factors to evaluate the risk of VTE and bleeding in your patient and to choose the best option for VTE prophylaxis. VTE risk may need to be reassessed during the admission due to surgical complications or patient clinical condition changes.

Patient factors associated with a higher risk of VTE see section 3.2.1
Patient factors that may influence choice of VTE prophylax see section 4

PROCEDURES ASSOCIATED WITH A HIGHER RISK OF VTE: [6, 7]

Orthopaedic surgery is generally associated with a higher risk of VTE. The type of anaesthesia can also influence the risk of VTE, with neuraxial anaesthesia showing lower risk than general anaesthesia.

Factors associated with a higher degree of risk include:

- Procedures under general anaesthesia lasting for greater than 90 minutes
- Total hip or knee arthroplasty, simultaneous bilateral joint replacements, hip fracture fixation and surgery due to major trauma

Timing/commencement of VTE prophylaxis: [6, 23]

Consider administering parenteral VTE prophylaxis if there are delays in orthopaedic surgery and the patient is a hospital inpatient, with the last dose being given no less than 12 hours (for low molecular weight heparin) or 6 hours (unfractionated heparin) before surgery.

Following orthopaedic surgery, VTE prophylaxis should commence 6-hours post-operatively unless the patient has had orthopaedic spinal surgery or has had a spinal, epidural, or deep plexus regional anaesthesia. For spinal, epidural or deep regional plexus anaesthesia, VTE prophylaxis can commence from 12-hours after needle or catheter placement in consultation with the anaesthetist In the event of a bloody or traumatic needle or catheter insertion, VTE prophylaxis can commence from 24-hours after in consultation with the anaesthetist. – see section 7.2.1 Pharmacological prophylaxis following orthopaedic spinal surgery should generally be started 24-48 hours after the procedure.

Mechanical compression: [8, 24]

Mechanical prophylaxis for VTE can be effective alone in low-risk Orthopaedic patients and has an additive effect when added to pharmacological prophylaxis for higher risk patients. It is particularly useful in patients in whom the risk of bleeding outweighs the risk of VTE. Prophylaxis should continue until the patient is fully mobile. Methods of mechanical prophylaxis include graduated compression stockings, intermittent pneumatic compression devices and pneumatic foot compression or pump.

PHARMACOLOGICAL THROMBOPROPHYLAXIS OPTIONS FOR VTE PREVENTION IN ORTHOPAEDIC SURGERY

See table 8 for a summary of prophylaxis options in different patient groups. This table assumes that the risk of VTE for the patient outweighs the risk of bleeding and that the patient is between 40 -100 kg and without renal impairment.

For practice-based thromboprophylaxis considerations in other orthopaedic surgical procedures, refer to your specialist Medical/surgical team, local health service guideline or guidance, or specialist recommendations provided within your Health Service Partnership.

6. NICE guideline. Venous Thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism. Published March 2018. National Institute for Health and Care Excellence (UK) [accessed on 19/7/23]. Accessible at: https://www.nice.org.uk/guidance/ng89

23. The ICM-VTE Spine Delegates*. Recommendations from the ICM-VTE: Spine. The Journal of Bone and Joint Surgery 104(Suppl 1): 309-328, March 16, 2022. | DOI: 10.2106/JBJS.21.01518

8. Venous Thromboembolism (VTE) prophylaxis [published June 2023]. In Therapeutic Guidelines. Melbourne: Therapeutic Guidelines limited; accessed 09/08/2023. www.tg.org.au

24. Australian Commission on Safety and Quality in Health Care. Venous Thromboembolism Prevention Clinical Care Standard, January 2020. https://www.safetyandquality.gov.au/publications-and-resources/resource-library/venous-thromboembolism-prevention-clinical-care-standard-2020

Table 8: Thromboprophylaxis in Orthopaedic surgery (ORTH)

Patient Group	Pharmacological thromboprophylaxis options		Duration
Total knee or hip replacement	Enoxaparin [a]	40mg SUBCUT daily	14 Days: Knee 35 Days: Hip
	Dalteparin [a]	5000 units SUBCUT daily	
	Rivaroxaban [b]	10mg PO daily	
	Apixaban [b]	2.5mg PO BD	
	Dabigatran [b]	220mg PO daily	
	Aspirin [c]	100-150mg PO daily – see section 4.1.4	
Fragility fractures of the pelvis, hip and proximal	Enoxaparin [d]	40mg SUBCUT daily	28 Days
	Dalteparin [d]	5000 units SUBCUT daily	
Lower limb immobilisation post trauma	Enoxaparin [e]	40mg SUBCUT daily	Up to 42 days
	Dalteparin [e]	5000 units SUBCUT daily	
Orthopaedic trauma and/or surgery	Enoxaparin [f]	40mg SUBCUT daily	Until hospital discharge or mobile
	Dalteparin [f]	5000 units SUBCUT daily	
Knee arthroscopy	Enoxaparin [g]	40mg SUBCUT daily	14 days (for high-risk patients)
	Dalteparin [g]	5000 units SUBCUT daily	
Upper limb surgery	Consider patient factors to assess VTE risk and choice of agent [h]		
Orthopaedic Spinal surgery	Enoxaparin [i]	40 mg SUBCUT daily	Until hospital discharge or mobile
	Dalteparin [i]	5000 units SUBCUT daily	

a. Based on NICE guidelines and CRISTAL study. The CRISTAL study found that enoxaparin when compared with aspirin, had lower rates of symptomatic VTE with no significant increase in risk of bleeding.

b. Based on NICE guidelines, ASH guidelines. Rinaldi 2022 meta-analysis of 5 RCTs in any orthopaedic surgery showed reduced rates of VTE and all-cause mortality with rivaroxaban compared to enoxaparin (included major and non-major surgery studies).

c. Based on ICM-VTE: hip & knee. The main support for this recommendation was a network meta-analysis that included mainly observational and retrospective studies and did not distinguish between symptomatic and non-symptomatic VTE. Duke et al 2023 showed that low dose aspirin is equally effective compared to high dose, and with a lower risk of bleeding. The EPCAT II study demonstrated that a hybrid model can be used where rivaro aban is used for 5 days with aspirin used for the remainder. The Arthroplasty Society of Australia recommend aspirin as an option for VTE preventio post hip or knee surgery in combination with mechanical compression where there are no additional risk factors for VTE or postoperative bleeding.

d. Based on NICE guidelines.

e. Based on NICE guidelines. ICM-VTE states that VTE prophylaxis is not required for low-risk patients with non-surgical lower limb immobilisation.

f. Based on ICM-VTE: trauma. The risk of VTE increases in the lower limb from the ankle to the pelvis with the risk highest in more proximal surgeries. Length of surgery and post-operative mobility also need to be considered when evaluating VTE risk.

g. NICE guidelines recommend therapy for high-risk patients. Cochrane review in 2022 [Perotta 2022] found no significant benefit of LMWH, aspirin, or rivaroxaban compared to placebo in the evidence available in low-risk patients following knee arthroscopy.

h. There is little evidence to support the use of any particular agent in pharmacological prophylaxis in upper limb surgery. Fracture related shoulder pro cedures carry the highest risk of VTE. All others are considered minor risk (ICM-VTE).

i. Based on NICEguidelines, ICM-VTE: spine. Start 24-48 hours after surgery according to individual risk assessment of bleeding vs VTE.

7.2.4 THROMBOPROPHYLAXIS IN TRAUMATIC IMMOBILISED LOWER LIMB FRACTURES

See section 7.3.9 - Thromboprophylaxis in patients leaving the Emergency department with immobilised lower limb injury

KEY RECOMMENDATION

- For any adult patient with prolonged immobilisation after lower limb fractures and any major VTE risk factor(s), extended pharmacological thromboprophylaxis is recommended.

Refer to Pharmaceutical prophylaxis for dosing advise for patients with traumatic lower limb factures

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	40mg	2000hrs	until ambulant or discharged from hospital
	Dalteparin	5000 units		
DOAC	Rivaroxaban	10mg	0800hrs	For the period of immobility for a maximum of 6 weeks on discharge

*Applies to all lower limb fractures with prolonged immobilisation where the patient is not usingtheir soleal pump

**Based on NICE guidelines. ICM-VTE states that VTE prophylaxis is not required for low-risk patients with non-surgical lower limb immobilisation.

7.2.5 THROMBOPROPHYLAXIS IN TRAUMA PATIENTS

KEY RECOMMENDATION

- Standard pharmacological VTE prophylaxis in trauma patients is enoxaparin – See section 4.1 Pharmacological Prophylaxis
- In patients with solid organ injuries - including liver, spleen, or kidney lacerations - pharmacological prophylaxis should be discussed with the Trauma surgeon and should generally be delayed at least 48 hours
- Mechanical prophylaxis should be used in conjunction with Pharmacological prophylaxis.

Trauma patients have an increased risk of VTE due to immobility resulting in decreased venous blood flow and activated clotting due to tissue injury. In general, prophylactic enoxaparin should be commenced within 24hrs of admission unless contraindicated. It is uncommon for pharmacological prophylaxis to be delayed greater than 7 days without a rationale including a high risk of active bleeding.

Commencement of pharmacological VTE prophylaxis should be discussed with the treating specialty team. E.g., Neurosurgical consultation for patients with a traumatic brain injury.

Mechanical prophylaxis is commonly used in the trauma setting due to its ease of use and inherently low risk of associated bleeding[25]. See section 4.2 – Mechanical Prophylaxis

For further guidance, refer to local health service guideline or guidance provided within your Health Service Partnership.

25. Datta I, Ball CG, Rudmik L, Hameed SM, Kortbeek JB. Complications related to deep venous thrombosis prophylaxis in trauma: a systematic review of the literature. Journal of Trauma Management & Outcomes. 2010;4(1) [PMC free article] [PubMed] [Google Scholar]

7.2.6 THROMBOPROPHYLAXIS IN PATIENTS WITH BURNS

KEY RECOMMENDATION

Burns >20% TBSA - eGFR >30ml/min/1.73m²

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	20mg*	12 hourly	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
		40mg^	12 hourly	
		0.5mg/kg-	12 hourly	

*<50kgs
^ 50-100kgs
BMI >30kg/m² – Max dose 80mg 12 hourly

Burns >20% TBSA - eGFR <30ml/min/1.73m²

Drug Class	Agent	Dose	Frequency	Duration
LMWH	Enoxaparin	20mg*	Daily	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
		40mg^	Daily	
		0.5mg/kg-	Daily	

*<50kgs
^ 50-100kgs
BMI >30kg/m2 – Max dose 80mg daily

Patients with severe burns are in the high-risk category for VTE due to the presence of profound systemic hypercoagulable state, prolonged bed rest, performance of repeated surgical procedures, femoral venous catheter insertion and recurrent bouts of sepsis[26].

The incidence is highest in those with major burns (≥20%), full thickness burns, advanced age, concurrent inhalational injury, increased weight (≥100kg, BMI ≥30kg/m2), ICU stay and mechanical ventilation[27].

Pharmacological VTE prophylaxis dosing for this patient cohort may require approval from your specialist Haemotologist/ Haematology team. Seek advice regarding appropriate pharmacological VTE prophylaxis from within your health service or health service partnership.

Table 9: Thromboprophylaxis for patients with burns

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY*	RECOMMENDED PROPHYLAXIS	
		<24Hrs Post operatively	>24Hrs Post operatively
Excisional debridement of non- viable tissue	HIGH	LMWH alone commenced on admission Continue until mobile	
Grafting – wound closure procedures			
Scar excision / revision procedures			
Skin grafts			

Note: Consider IPC if feasible (i.e., no lower limb burns) and without contraindications

26. Holden, D. et al. VTE prophylaxis for patients with burns > 20% TBSA – guideline. Alfred Health. Prompt Doc No: AHG0181255 v1.0

27. 27: Lu P, Harms KA, Paul E, Bortz H, Lo C, Cleland H. Venous thromboembolism in burns patients: Are we underestimating the risk and underdoing our prophylaxis? J Plast Reconstr Aesthet Surg. 2020 Dec 13:S1748-6815(20)30678-1.

7.2.7 THROMBOPROPHYLAXIS IN INTRATHORACIC SURGERY – INCLUDING CARDIAC SURGERY

KEY RECOMMENDATION

- **Thromboprophylaxis for cardiac surgery patients should usually be commenced within 24 hours after surgery.**
- **Thromboprophylaxis should commence 6-8 hours after oesophageal surgery, with consideration and assessment of risk factors.**

All patients undergoing intrathoracic surgery including cardiac, major thoracic and oesophageal surgery are at high risk of VTE.

Treatment should be individualised and based on risk stratification. The potential benefits must be balanced against the individual's risk of bleeding. This should be assessed and used to guide individual prophylaxis decisions.
Refer to section 4.1 - Pharmacological prophylaxis for standard dosing recommendations and 4.2 - Mechanical Prophylaxis.

For further guidance, refer to your local health service guideline or guidance provided within your Health Service Partnership

7.2.8 THROMBOPROPHYLAXIS IN BARIATRIC SURGERY

KEY RECOMMENDATION

- **The decision to use total/actual, ideal, adjusted, lean body weight, or body mass index (BMI) in the risk assessment and VTE prophylaxis plan should be clearly documented in the patients' medical record.**

There is currently insufficient evidence to conclusively determine how the standard LMWH regimens for VTE prophylaxis should be adapted to provide both sufficient efficacy and minimizing bleeding risk. See section 7.3.5 - Thromboprophylaxis in patients with obesity - which provides for further information and recommendations regarding VTE prophylaxis management in patients with obesity.

In morbidly obese patients undergoing bariatric surgery, lean body weight and renal clearance appear to be the main determinants of whether anti-Xa levels have been achieved[28]. However, any definitive relationship between the anti-Xa activity achieved by a prophylaxis regime on the actual incidence of VTE remains unclear.

Individual health services should consider if monitoring these levels is required for the management of VTE prophylaxis and the rationale for this decision should be document in the patients' medical record.

28. Gaborit B, Moulin PA, Bege T, Boullu S, Vincentelli C, Emungania O, Morange PE, Berdah S, Salem JE, Dutour A, Frere C. Lean body weight is the best scale for venous thromboprophylaxis algorithm in severely obese patients undergoing bariatric surgery. Pharmacol Res. 2018 May;131:211-217. doi: 10.1016/j phrs.2018.02.012. Epub 2018 Feb 13. PMID: 29452290

7.2.9 WITHHOLDING THROMBOPROPHYLAXIS FOR A PATIENT UNDERGOING AN OPERATION OR PROCEDURE

KEY RECOMMENDATION

- **Pharmacological prophylaxis should be withheld on the day of surgery**
- **If withholding therapeutic or prophylactic anticoagulation prior to surgery, there must be a plan for recommencement clearly documented in the patients' medical record.**

Pharmacological VTE prophylaxis should be **withheld on the day of surgery** or procedure unless it is specifically ordered by the medical officer.

If an operation is cancelled, the default approach is to prescribe a dose of prophylactic enoxaparin, to be given immediately that evening (surgery can still proceed the following day).

LMWH can be routinely administered 6 hours post-surgery, unless specified otherwise by the medical officer.

The first dose can be given at any time (immediately when ordered) during the first 24 hours, following that it will be administered subcutaneously at 2000hrs daily.

Patients on DOACs

Common indications for long-term DOAC therapy include a history of unprovoked, recurrent, or life-threatening VTE episodes and prophylaxis against cardio-embolism in patients with atrial fibrillation.
It is **essential** that a plan for resumption of therapy is documented and actioned prior to hospital discharge.
Refer to your local health service guideline or guidance provided within your Health Service Partnership regarding interrupting dabigatran, rivaroxaban or apixaban prior to surgery.

Patients on warfarin

Surgery can be conducted with minimal increased risk of bleeding if International Normalised Ratio (INR) ≤ 1.5.
Refer to your local health service guideline, or guidance provided within your Health Service Partnership for management of patients on therapeutic anticoagulation.

7.3 PATIENTS WITH SPECIFIC CONSIDERATIONS

7.3.1 THROMBOPROPHYLAXIS IN PATIENTS ON THERAPEUTIC ANTI-COAGULATION PRIOR TO HOSPITALISATION

KEY RECOMMENDATION

- VTE prophylaxis should not be prescribed to patients who are on therapeutic anticoagulation.
- VTE prophylaxis should be considered if therapeutic anticoagulation is interrupted (e.g., for surgical procedures)
- Any interruption to anticoagulation should be routinely reviewed during the hospital stay and should be recommenced as soon as possible.

Therapeutic anticoagulation, regardless of indication, provides protection against the development of VTE.

- Therapeutic anticoagulation is defined as therapeutic doses of LMWH, DOACs (apixaban, rivaroxaban, dabigatran) heparin dosing with an APTT level of 1.5 to 2.5 times the control value (refer to local heparin protocol) or warfarin dosing with an INR > 2.

NB - Anti-platelet drugs (e.g., aspirin, prasugrel, ticagrelor) whether used as monotherapy or dual-antiplatelet therapy are not considered a contraindication to pharmacological VTE prophylaxis.

VTE prophylaxis should be considered when therapeutic anticoagulation is interrupted prior to surgery or when usual anticoagulation medication cannot be recommenced immediately post-surgery. In these cases, VTE prophylaxis should be continued until therapeutic anti-coagulation has can be safely resumed.

Patients for elective admission should have current anticoagulation therapy assessed at pre-admission clinic. A plan should be established for management prior to admission, in line with local or Health Partnership guidelines and documented in the patients' medical history.

Patients who are therapeutically anticoagulated and admitted to hospital via the emergency department should be assessed by the managing team. Decisions regarding ongoing anticoagulant therapy may require consultation with specialist units.

Should recommencement of full dose therapeutic anticoagulation not be commenced prior to discharge, a clear transition of care plan and follow up should be documented – See Section 9 Transitions from hospital & ongoing care

7.3.2 THROMBOPROPHYLAXIS WHEN THERE IS ABNORMAL KIDNEY FUNCTION

KEY RECOMMENDATION

- Where creatinine clearance* is less than 30ml/min, reduce the dose of enoxaparin to 20mg daily.
- Enoxaparin should be avoided or only used with caution in the setting of acute kidney injury (AKI)
- Unfractionated heparin may be used for VTE prophylaxis in patients with kidney disease without a need for dose adjustment.

Use of VTE prophylaxis in patients with abnormal kidney function

Drug Class	Agent	Standard VTE prophylaxis dose (normal kidney function)	Dose change with abnormal kidney function	Duration
UFH	Heparin	5000 units twice a day	No adjustment required	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
LMWH	Enoxaparin	40 mg daily	Cr Cl < 30 ml/min - reduce to 20 mg daily	
	Dalteparin	5000 units daily	Cr Cl < 30 ml/min - consider anti-Xa levels Cr Cl < 15 ml/min: Avoid	
DOAC	Apixaban	2.5 mg twice a day	Cr Cl < 25 ml/min: Avoid	
	Rivaroxaban	10 mg daily	Cr Cl < 15 ml/min: Avoid	

*Creatinine clearance (ml/min) rather than eGFR (ml/min/1.73m^2) is the recommended method for estimating kidney function for the purposes of drug dosing. Creatinine clearance is estimated by the Cockroft-Gault equation** and not corrected for Body Surface Area.

Enoxaparin is renally eliminated and dose adjustment is required in patients with poor kidney function.

Whilst measuring anti-Xa levels is not routinely recommended, it can be considered to help assess accumulation and minimise bleeding risk in patients with abnormal kidney function who require thromboprophylaxis in the short, medium or longer term.

**Males = (140-age) x weight (kg) / 0.814 x plasma creatinine (umol/L) Creatinine clearance (mL/min).
Females = 0.85 x (140-age) x weight (kg) / 0.814 x plasma creatinine (umol/L). Using ideal body weight from patient height in obese patients
can be considered.
Online calculators for creatinine clearance are widely available.
eg.https://www.mdcalc.com/calc/43/creatinine-clearance-cockcroft-gault-equation

Kidney function is difficult to measure in the setting of AKI. eGFR or creatinine clearance calculations based on serum creatinine levels are inaccurate measures of kidney function in the setting of AKI.

7.3.3 THROMBOPROPHYLAXIS IN PREGNANCY

KEY RECOMMENDATION

- All women should have their risk of VTE documented in early pregnancy and again upon any admission to hospital for any reason including labour and birth. (Refer to section 3.2 VTE risk Assessment)
- Any pregnant woman hospitalised with severe COVID-19 infection is recommended to complete 14 days of VTE prophylaxis. For severe COVID infection requiring respiratory support, consider full anticoagulation if birth is not expected within 24 hours. An extended period of VTE prophylaxis up to 6 weeks may be considered if other risk factors for VTE are present or until COVID morbidity resolves
- Low Molecular Weight Heparin (LMWH) is the preferred method of VTE prophylaxis in pregnancy.
- Following caesarean section, pharmacological VTE prophylaxis should be prescribed for all women unless contraindicated.

Antenatal & postnatal VTE prophylaxis

Drug Class	Agent	Dose	Timing	Duration
LMWH	Enoxaparin	<50kg = 20mg's	Daily	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from hospital
		50-120kg = 40mg's	Daily	
		<120kg = 60mg's	Daily	
	Dalteparin	<50kg = 2500units	Daily	
		50-120kg = 5000units	Daily	
		<120kg = 7500units	Daily	

In addition to pregnancy, risk factors can be grouped into:

1. **PRE-EXISTING** - including previous history of VTE or underlying thrombophilia
2. **PREGNANCY-RELATED** - including prolonged labour, Caesarean Section or post-partum haemorrhage of greater than 1Litre as well as less common multiple pregnancy, preterm birth and stillbirth
3. **TRANSIENT CONDITIONS REQUIRING ADMISSION TO HOSPITAL** – including any surgical procedure in pregnancy, hyperemesis, or current systemic infection, noting that the latter includes COVID-19.

For pregnant women assessed as high risk of VTE, prophylaxis should begin in early pregnancy. The risk for VTE increases with:

- Gestational age, reaching a maximum just after delivery
- Caesarean section is a significant risk factor - though women having vaginal deliveries are also at risk. The relative risk of VTE postpartum is five-fold higher compared to antepartum[29].

We recommend that you refer to the Obstetrics Consultant / Team within your health service or health service partnership or refer to the guideline below prior to commencing pharmacological and/or mechanical prophylaxis.

Reducing the Risk of Venous Thromboembolism during Pregnancy and the Puerperium - Royal College of Obstetricians and Gynaecologists

29. Heit JA, Kobbervig CE, James AH, Petterson TM, Bailey KR, Melton LJ 3rd. Trends in the incidence of venous thromboembolism during pregnancy or postpartum: a 30-year population-based study. Ann Intern Med 2005;143:697–706 as sited in Nelson-Pearcy, C. et al. Reducing the Risk of Venous Thromboembolism during Pregnancy and the Puerperium, Royal College of Obstetricians & Gynaecologists, Green-top Guideline No. 37a, April 2015

7.3.4 THROMBOPROPHYLAXIS IN LOW BODY WEIGHT

At present there is not strong evidence relating to the appropriate dosing of apixaban, rivaroxaban and dabigatran in patients at extremes of body weight, particularly relating to clinical outcomes.

Low body weight patients should be closely monitored for risk of bleeding, and dose adjustments discussed with the health service specialist haematology team or haemotologist within or health service partnership.

KEY RECOMMENDATION

- Expert consensus from available evidence is that for patients weighing <50kg, reduce the dose of enoxaparin to 20mg. see section 4.1 – Pharmacological prophylaxis

7.3.5 THROMBOPROPHYLAXIS IN PATIENTS WITH OBESITY

KEY RECOMMENDATION

- The decision to use total/actual, ideal, adjusted, lean body weight, or body mass index (BMI) in the risk assessment and VTE prophylaxis plan should be clearly documented in the patients' medical record.
- All admitted patients with obesity and without contraindications, should receive VTE prophylaxis with at least LMWH.
- Renal function should be considered when establishing the required dose of pharmacological prophylaxis in patients with obesity.
- Consultation with your health service haematology team is strongly recommended for dosing advice.

An increasing number of patients are obese, defined as a BMI > 30kg/m2[30], with morbid obesity defined as > 40kg/m2 and super obesity > 50kg/m2.

30. World Health Organisation – Obesity - https://www.who.int/health-topics/obesity#tab=tab_1

Although obesity is a recognised risk factor for VTE, the appropriate dose of LMWH is unclear. Enoxaparin doses based on total body weight (mg/kg) in obese patients increases the risk of toxicity, therefore doses are often capped at 100mg. Conversely this may result in sub therapeutic anti-Xa concentration, as clearance increases with body size[31]. A dose based on lean body weight may be warranted in these situations and a dose of 1.5mg/kg has been proposed[32]

An increased dose of pharmacological prophylaxis may be considered reasonable. An appropriate regime may reflect the following:

Drug Class	Agent	Dose	Timing	Duration
LMWH	Enoxaparin	40mg's	Daily	Until mobility has returned to pre-morbid or clinically acceptable level, or discharge from Hospital
		60mg's	Daily	
		40mgs	12 hourly	
	Dalteparin	5000 units	8-12 hourly	
UFH	Heparin	5000 units	8 hourly	

Some studies, and some health services in Victoria, support giving a standard dose of LMWH, basing their recommendations on a lack of contrary evidence and that the VTE prophylaxis dosing should be based on lean body mass, not total body weight or BMI.

7.3.6 THROMBOPROPHYLAXIS IN CRITICALLY ILL PATIENTS

KEY RECOMMENDATION

- All critically ill patients are considered high-risk for VTE.
- All patients admitted into the Intensive Care Unit (ICU) should be prescribed pharmacological VTE prophylaxis unless there is a high-risk contraindication.
  See section 4.1 Pharmacological Prophylaxis

Critically ill patients have an increased risk of VTE due to pre-morbid conditions, reduced mobility, invasive intravascular catheters, and surgical procedures.

VTE and bleeding risk should be assessed on admission.

The need for prophylaxis should be reviewed **daily** and documented on the patient's care plan at the time of assessment. The plan should be discussed with the appropriate visiting medical teams.

31. Barras, M., Legg, A,. Drug dosing in obese adults. Aust Prescr 2017;40:189-93, 3 October 2017, DOI: 10.18773/austprescr.2017.053

32. Green, B., Duffull, SB., Development of a dosing strategy for enoxaparin in obese patients. Br Journal clinical pharmacology as sited in Barras, M. et al Drug dosing in obese adults. Aust Prescr 2017;40:189-93, 3 October 2017, DOI: 10.18773/austprescr.2017.053

Patients assessed as being at high risk of bleeding should have mechanical prophylaxis (IPC) commenced upon admission to the Intensive Care Unit. See section 4.2 – Mechanical Prophylaxis.
IPC should be considered in addition to pharmacological prophylaxis.

Pharmacological prophylaxis dosing may require adjustment in patients with abnormal kidney function, low body weight, obesity or patients with an increased risk of bleeding. Clearance of low molecular weight and unfractionated heparins can be altered in critically ill patients. This may require necessitate therapeutic monitoring to avoid under or over-dosing.

Pharmacological prophylaxis should be withheld on the day of surgery or procedures unless specifically ordered by the ICU medical officer.

Prophylaxis can be administered 6 hours post operatively, unless specified by the treating ICU medical officer.

7.3.7 THROMBOPROPHYLAXIS IN CANCER INPATIENTS[4]

KEY RECOMMENDATION

Enoxaparin is the preferred VTE prophylaxis of patients with Cancer. See section 4.1 – Pharmacological Prophylaxis for dosing recommendations.

Malignancy is an independent risk factor for VTE. The increasing incidence of VTE is possibly due to longer survival of patients with cancer, administration of prothrombotic systemic therapies, and improved VTE diagnostic measures. The high frequency of recurrent VTE and bleeding cannot be explained by over- or under-anticoagulation

VTE in patients with cancer is associated with high morbidity and mortality. All medical oncology patients who are overnight stays should receive venous thromboprophylaxis with enoxaparin or an alternative unless there is a contraindication.

Pharmacological VTE prophylaxis dosing for this patient cohort may require discussion with your specialist Haemotologist/ Haematology team. Seek prophylaxis advice from within your health service or health service partnership.

7.3.8 THROMBOPROPHYLAXIS IN PATIENTS WITH A HISTORY OF HEPARIN INDUCED THROMBOCYTOPENIA (HIT)

KEY RECOMMENDATION

- LMWH and UFH should not be used for VTE prophylaxis in patients with a history of HIT.
- Seek specialist advice from the Haematology team for confirmation of diagnosis, treatment/ management options and a recommended alternative non-heparin-based anticoagulant for VTE prophylaxis e.g., Danaparoid or Fondaparinux

HIT is an adverse drug reaction caused by the emergence of antibodies that activate platelets in the presence of heparin. Despite thrombocytopenia, bleeding is rare and is strongly associated with thromboembolic complications involving both the arterial and venous systems[33].

HIT usually develops after five 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. It is more common with UFH than with LMWH[4].

Therapeutic options are focused on inhibiting thrombin formation or direct thrombin inhibition20 and include fondaparinux or danaparoid[34].

Laboratory test available to diagnose HIT include heparin - PF4 antibody, Enzyme-linked immunosorbent assay (ELISA). If diagnosis is confirmed, ensure this is document in the patients' medical history, any adverse drug reaction form in use at your health service, and on the medication chart – electronic or paper based.

Seek specialist Haemotologist/Haematology team advice for appropriate pharmacological VTE prophylaxis alternatives from within your health service or health service partnership.

33. Ahmed I., Majeed,A, Powell, R. Heparin Induced Thrombocytopenia: diagnosis and management update. National Library of medicine. Postgrad Med J. 2007 Sep; 83(983): 575–582.doi: 10.1136/pgmj.2007.059188

34. Bortz, H., Corallo, C., Tran, H. Anticoagulants used at Alfred Health for patients with heparin induced thrombocytopenia – Guideline. Alfred Health v5.7, Prompt Doc No: AHG0079637

7.3.9 THROMBOPROPHYLAXIS IN PATIENTS LEAVING THE EMERGENCY DEPARTMENT WITH IMMOBILISED LOWER LIMB INJURY

KEY RECOMMENDATION

- VTE prophylaxis is not recommended for patients with isolated, uncomplicated lower limb injury in the absence of additional patient-related risk factors.

Patients with lower limb injuries who require immobilisation and/or who are non-weight bearing are at increased risk of developing deep vein thrombosis (DVT) in the affected limb. However, the risk of developing DVT is generally low[35]. The risk-benefit analysis for prescribing VTE prophylaxis (i.e., balancing bleeding against DVT and/or PE) in these patients is complicated and challenging[36 6].

The available clinical evidence for generally healthy patients with uncomplicated lower limb injuries* does not suggest a benefit for VTE prophylaxis.

We do not recommend VTE prophylaxis for patients with isolated uncomplicated lower limb injury in the absence of additional patient-related risk factors.

However, if patients with additional baseline risk factors for thrombosis are immobilised, then these risks accumulate, leading to a significantly higher risk for developing VTE[37].

Flowchart 3 below has been developed to outline a standardised approach to patients with lower limb immobilisation, who are non-weight bearing and who are discharged home from the ED. The risk stratification tool provided will help determine recommendations for thromboprophylaxis indications, and choices for pharmacological prophylaxis.

Patient-related VTE risk factors are stratified as 'major' and 'other'.

**For the scope of this document, 'uncomplicated lower limb injuries' refers to typical low-grade, non-displaced fractures or sprains without signs of neurovascular or soft tissue compromise.*

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PHARMACOLOGICAL THROMBOPROPHYLAXIS

To date, the optimal agent for thromboprophylaxis in this setting is not known and has been based mainly on subcutaneous low-molecular weight heparin (LMWH) (e.g., enoxaparin). Direct-acting oral anticoagulants (DOACs) are included as an option due to ease of administration, given they have evidence for prophylaxis in other scenarios (e.g., hip/knee arthroplasty). We acknowledge, however, the evidence for DOACs in isolated lower limb injuries is currently limited. See section 4.1 Pharmacological Prophylaxis

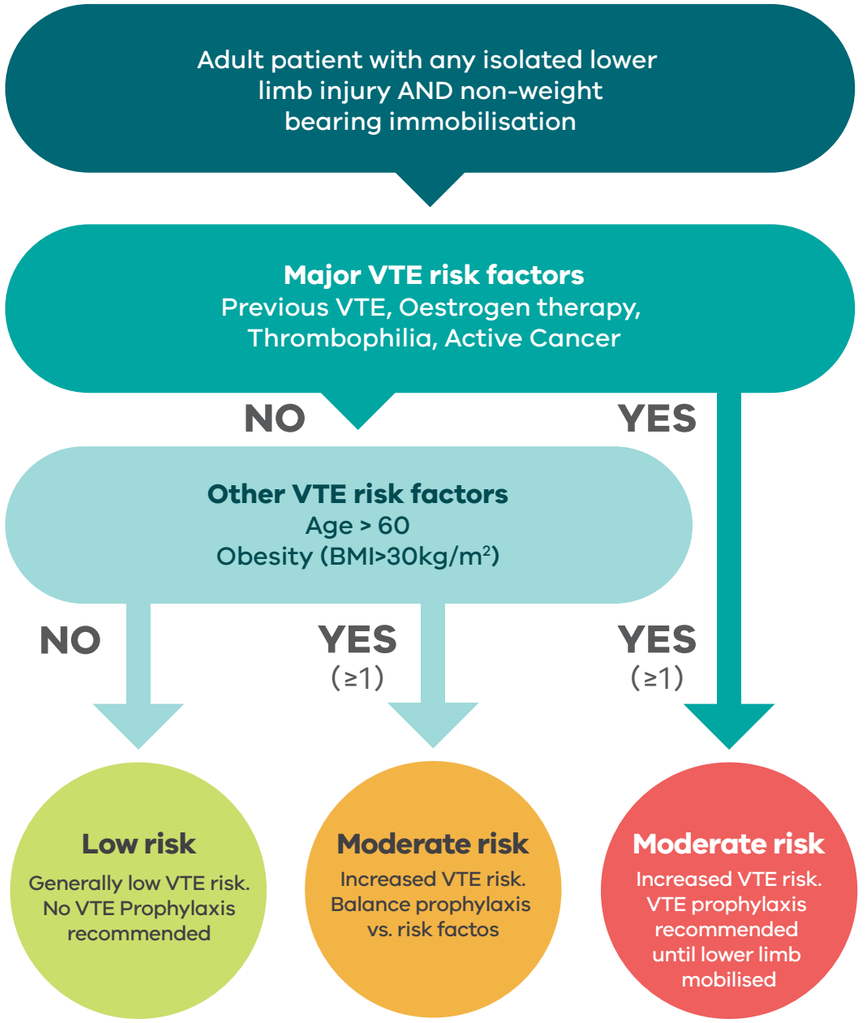
The agent and dose of anticoagulation should be individualised according to the patient's comorbidities and/or risk factors.
The recommended duration of pharmacological thromboprophylaxis is generally for the period of immobilisation (i.e., until lower limb mobilised).

Patients should be referred to the Orthopaedic outpatient department for clinic follow-up, as indicated. All other patients should be referred to their general practitioner (GP) by the ED.

Provide education regarding the risks of developing VTE, along with preventative measures. It is essential that patients are educated about signs and/or symptoms of DVT (e.g., pain, swelling, redness, heat of the affected limb) and PE (e.g., dyspnoea, chest pain).

Flowchart 3: Risk assessment tool and VTE prophylaxis recommendations

Aim: To identify patients with lower limb injury who are at high risk of developing DVT/Pulmonary Embolism (PE) and have no significant contraindications to pharmacological thromboprophylaxis



Risk	Recommendation	Duration
Low	NO VTE prophylaxis	*Not applicable*
Moderate	Consider VTE prophylaxis on an individual basis (Consider treating this patient group as High risk)	
High	VTE prophylaxis recommended if no major contraindications	Until lower limb mobilised

8. Quality Statement 6 –

Reassess risk & monitor the patient for VTE-related complications

KEY RECOMMENDATION

- Reassess the risk of VTE and bleeding at intervals no longer than every 7 days

  Or

  Whenever there is a change in the patient's clinical condition or goal of care, and on discharge from hospital.

Reassessments should include a review of any VTE-related complications that may have occurred (such as a clot or bleed), and any problem related to the use of medicines to prevent VTE.

Routine monitoring anti-Xa levels in VTE prophylaxis has not been shown to improve clinical outcomes and is not recommended. (Extract from the RWH VTE Prophylaxis guideline)

Any modifications to the VTE prophylaxis plan based on risk reassessment should be clearly documented in the patients' medical record.

Monitoring for signs or symptoms indicative of development of VTE should be performed routinely by medical and staff.

Refer to Therapeutic Guidelines or local health service guidelines for diagnosis and treatment of suspected or established VTE.

9. Quality Statement 7 –

Transition from hospital and ongoing care

KEY RECOMMENDATION

- Reassess patients for VTE risk and the need for ongoing VTE prophylaxis upon discharge from hospital
- Patients on therapeutic anticoagulation prior to hospitalisation and/or requiring new anticoagulation upon discharge from hospital must have a clear anticoagulation plan.

For patients requiring extended prophylaxis (e.g., following pelvic and abdominal surgery, hysterectomy / ovariectomy, patients with cancer, patients with a previous history of VTE or PE), a plan must be documented in the patients discharge summary clearly indicating the agent, dosing regimen and duration of therapy. It should be clearly documented and communicated to the patient and primary care provider when, and with whom any follow up should occur. The patient should be ideally provided with medications prior to discharge along with any relevant safety tools (e.g., sharps container). If medications cannot be provided, the patient should be provided with a prescription.

An assessment of VTE prophylaxis self-administration should be performed, including the safe disposal of sharps. A referral to in-home care providers may be required. Document the findings of this assessment in the patients' medical record.

Where feasible, a pharmacist review should be undertaken prior to discharge for all patients going home on extended VTE prophylaxis, who are being discharged on therapeutic anticoagulation (new or re-commencing) or who have had any changes made to their medications while inpatient.

All patient should be educated regarding how to monitor for VTE symptoms or relevant bleeding symptoms after discharge.

Provide the patient and their ongoing clinical care provider with a clear discharge plan including a list of current medication upon discharge. The discharge plan should be sent to the patient's general practitioner within 48hrs of discharge[3].

Relevant outpatient appointments should be arranged to review mobility and update VTE prophylaxis plans. All other patients should be referred to their general practitioner for ongoing review.

10. Appendix

APPENDIX 1 - MEDICINES THAT AFFECT BLEEDING RISK[3]

(Adapted from Venous Thromboembolism Prevention Clinical Care Standard, Australian Commission on Safety and Quality in Health Care)

MEDICATION CLASS	GENERIC NAME (TRADE ANME(S))	
Anti-platelets	Glycoprotein IIb/IIIa inhibitors	• Abciximab (ReoPro) • Eptifibatide (Integrilin) • Tirofiban (Aggrastat)
	$P2Y_{12}$ antagonists (thienopyridines)	• Clopidogrel (Clovix, Iscover, Piax, Plavicor, Plavix, Plidogrel) • Clopidogrel + Aspirin (CoPlavix, DuoCover, DuoPlidogrel, Piax Plus Aspirin) • Prasugrel (Effient) • Ticagrelor (Brilinta)
	Other antiplatelets	• Aspirin (Aspro, Astrix, Cardasa, Cardiprin, Cartia, Disprin, Spren, Solprin) • Dipyridamole (Persantin, Persantin-SR) • Dipyridamole + Aspirin (Asasantin)
Parenteral anticoagulants	Low molecular weight heparin	• Dalteparin (Fragmin) • Enoxaparin (Clexane, Clexane Forte) • Nadroparin (Fraziparine, Fraxiparine Forte)
	Low molecular weight heparinoid	• Danaparoid (Orgaran)
	Heparins	• Unfractionated heparin (Heparin, Heparin Sodium)
	Factor Xa inhibitors	• Fondaparinux (Arixtra)
	Direct thrombin inhibitors	• Bivalirudin
Direct oral anticoagulants (DOAC)	Factor Xa inhibitors	• Apixiban (Eliquis) • Rivaroxaban (Xarelto)
	Direct thrombin inibitors	• Dabigatran (Pradaxa)
Other oral anticoagulants	Vitamin K antagonists	• Warfarin (Coumadin, Marevan)
Thrombolytics		• Alteplase (Actilyse) • Reteplase (Rapilysin) • Tenecteplase (Metalyse) • Urokinase
Other medicines affecting haemostasis		• Tranexamic acid (Cyklokapron)
Medicines for reversing anticoagulation		• Idarucizumab (Praxbind) • Protamine (Protamine Sulphate BP) • Vitamin K_1 also known as phytomenadione (Konakion MM) • Prothrombin Complex Concentrate
Non-steroidal anti-inflammatory drugs (NSAIDs)	COX 1 and COX 2 inhibitors	• Diclofenac (Eg: Clonac, Fenac, Imflac, Viclofen, Voltaren, Voltfast) • Ibuprofen (Eg: Advil, Bugesic, Nurofen, Rafen, Tri-Profen, Brufen) (NB: Also available in combination with paracetamol containing products) • Indomethacin, also known as indometacin (Arthrexin, Indocid) • Ketoprofen (Orudis, Oruvail SR) • Ketorolac (Ketoral, Toradol) • Mefenamic acid (Mefic, Ponstan) • Naproxen (Inza, Naprofen, Naprosyn, Proxen) • Naproxen Sodium (Anaprox, Crysanal, Naprogesic) • Piroxicam (Feldene, Mobilis) • Sulindac (Aclin)
	Selective COX-2 Inhibitors	• Celecoxib (Celaxib, Celebrex, Celexi) • Etoricoxib (Arcoxia) • Meloxicam (Meloxiaurio, Meloxibell, Mobic, Movalis, Moxicam) • Parecoxib (Dynastat)

APPENDIX 2 – UNIT SPECIFIC VTE PROPHYLAXIS FOR SURGICAL PATIENTS

Table 10: Thromboprophylaxis in Breast and Endocrine surgery

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY*	RECOMMENDED PROPHYLAXIS	
		<24Hrs Post operatively	>24Hrs Post operatively
Excision lipomas	LOW	NONE	
Lymph node biopsy (sentinel)			
Wide local excision breast			
Inguinal / Umbilical hernia repair	INTERMEDIATE	LMWH alone for the duration of hospitalisation	
Breast lumpectomy / mastectomy	INTERMEDIATE	IPC alone until mobile	
Thyroidectomy / Hemi-thyroidectomy / Parathyroidectomy / Removal thyroid cyst			

Table 11: Thromboprophylaxis in Colorectal surgery

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY*	RECOMMENDED PROPHYLAXIS	
		<24Hrs Post operatively	>24Hrs Post operatively
Abscess incision / drainage	LOW	NONE	
Anal skin tags			
Flexible colonoscopy			
Haemorrhoidectomy			
Sigmoidoscopy / EUA			
Laparoscopic appendectomy	INTERMEDIATE	LMWH alone starting 6-8hrs post-operatively for the period of hospitalisation	
Loop ileostomy closure			
All small and large bowel resections or laparotomy	HIGH	IPC Intra-operatively and continued until mobile LMWH starting 6-8 hours post-operatively and continued for the period of hospitalisation	
Anterior resection rectum +/- stapling			
Right hemicolectomy			

Table 12: Thromboprophylaxis in Ear, Nose and Throat surgery (ENT) & Oral Maxillofacial surgery

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY	RECOMMENDED PROPHYLAXIS	
		<24Hrs Post operatively	>24Hrs Post operatively
Panendoscopy / biopsy	LOW	NONE	
Functional Endoscopic Sinus Surgery (FESS) / Septoturbinoplasty	INTERMEDIATE	LMWH alone for the period of hospitalisation	
Myringoplasty			
Parotidectomy (excision of submandibular gland)			
Tonsillectomy /			
Uvulopalatopharyngoplasty			
Tracheostomy			
Head / neck dissection	HIGH	IPC until mobile & LMWH for the period of hospitalisation	
Mastoidectomy / Major middle ear surgery			

Table 13: Thromboprophylaxis in Plastics and Reconstructive surgery (PRS)

ELECTIVE PROCEDURES	SURGICAL VTE RISK CATEGORY	RECOMMENDED PROPHYLAXIS	
		<24Hrs Post operatively	>24Hrs Post operatively
Free flap procedure, replantation partial limbs	HIGH	UFH intraoperatively	LMWH alone: Nocte until mobile

Table 14: Thromboprophylaxis in Urology

ELECTIVE PROCEDURES	SURGICAL VTE RISK	RECOMMENDED PROPHYLAXIS		NOTES
		<24Hrs Post operatively	**>24Hrs Post operatively**	
Flexible cystoscopy	**LOW**	NONE		Pharmacological prophylaxis contraindicated for endoscopic surgery
Rigid cystoscopy + biopsy				
Rigid cystoscopy + stent change				
Rigid cystoscopy + laser	**MODERATE**	IPC alone – intraoperatively and until mobile		High bleeding risk surgery – if inpatient for >72hours, consider starting LMWH
Trans Urethral Resection of Blabber Tumour / Trans Urethral Resection of Prostate (TURBT / TURP)				
Nephrectomy# (open / laparoscopic)	**HIGH**	IPC until mobile & LMWH for the period of hospitalisation or at the discretion of the surgeon		Consider extended prophylaxis if ongoing risk factors (e.g., active cancer/immobility)
Prostatectomy (open / laparoscopic)				#Donor nephrectomy: consider total 2 weeks prophylaxis if patient has HIGH-risk factors
Radical cystectomy				

Table 15: Thromboprophylaxis in Vascular Surgery

ELECTIVE PROCEDURES	SURGICAL VTE RISK	RECOMMENDED PROPHYLAXIS		NOTES
		<24Hrs Post operatively	**>24Hrs Post operatively**	
Arteriovenous AV fistula formation	**MODERATE**	LMWH alone – Intraoperatively and for the period of hospitalisation		If high bleeding risk (intravascular), commence 24hrs post-operatively
Excision, ligation and stripping of varicose				
Carotid endarterectomy	**HIGH**	LMWH alone for the period of hospitalisation		If high bleeding risk (intravascular), commence once haemostasis achieved
Femoral endarterectomy				
Femoral popliteal bypass				
Major amputation (Below Knee Amputation (BKA))				
Toe amputation / debridement				
Abdominal Aortic Aneurysm (AAA) repair / thoracotomy	**HIGH**	UFH intraoperatively (with Protamine) THEN LMWH alone starting 24hrs post-operatively, and continued for the period of hospitalisation		

Table 16: Thromboprophylaxis in Gynaecology and Invitro Fertilisation (IVF) [38]

ELECTIVE PROCEDURES	SURGICAL VTE RISK	RECOMMENDED PROPHYLAXIS
Hysteroscopy, hysteroscopic resection, laparoscopy	**LOW**	NONE
Major gynaecological surgery	**INTERMEDIATE**	Consider LMWH for up to one week or until fully mobile Individualise management depending on risk factors such as hormone treatments containing estrogen
Major abdominal or pelvic surgery for gynaecological cancers	**HIGH**	Consider LMWH for 3 -4 weeks post procedure
Ovarian Hyperstimulation Syndrome	**HIGH**	LMWH should be prescribed for moderate to severe OHSS managed either as an inpatient or outpatient. If conception occurs prophylaxis should continue through the first trimester. Individualised management should include a risk assessment and consultation with a specialist haematologist

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