Venous Thromboembolism (VTE) Prophylaxis

Figure 1: WTD Infographics. (International Society of Thrombosis and Hemostasis [ISTH] 2014)

ACKNOWLEDGEMENTS

This document has been adapted by Alana Andrews RN, BN, Grad Cert - Cardiothoracic, Medtronic Senior Vascular Clinical Educator, for use by the ANMF for education purposes. The original document was devised and compiled by Vicki Smith RN, BN, Grad Dip Critical Care, MAP – HPE, Cert 1VTAA” With Special thanks to Allison Whiting and Travis Stephenson from Covidien.

This article may be used for personal or educational purposes, no part of this article may be reproduced without due acknowledge to Vicki Smith and Alana Trollope. No Responsibility is taken for the validity & accuracy of the contents, the information in this article was compiled in good faith from the referenced sources.
Welcome to the course ‘Venous Thromboembolism (VTE) Prophylaxis’.

This course will provide you with information to assist you in understanding the principles of VTE Prophylaxis.

Completion of both the course and assessment will count towards 4 hours (240 minutes) of your continuing professional development hours.
1. Overview

This section provides an overview of the course.

Figure 2: Anatomy pictures [Covidien n.d]

The purpose of this course is to present primary care providers with strategies to reduce morbidity and mortality that results from venous thromboembolism (VTE). VTE occur, in among 50 percent of some categories of hospital patients if prophylaxis is not used (Australia & New Zealand Working Party on the Management and Prevention of Venous Thromboembolism [ANZ] 2010). VTE is comprised of both Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE); these can occur either whilst in hospital or following discharge and at times can cause death.

Fortunately, there are effective prophylactic measures available that can decrease the likelihood of death or lasting complications caused by DVT and PE.

PE remains the most common form of preventable death in Australian Hospitals (ANZ 2010).

The prevention of VTE has been identified both nationally and internationally as a priority area for improving patient safety (Gibbs et al. 2011). However, many patients who are at risk are not being identified and those who do receive VTE prophylaxis may not be receiving the most appropriate form of preventative treatment for their particular circumstance and level of risk (National Health and Medical Research Council [NHMRC] 2009).

This course provides you with information and guidelines on VTE prophylaxis. These tools will help you ensure that your patients receive VTE risk assessment and appropriate prophylaxis to meet their needs.

Before we start please take this short questionnaire to test your existing knowledge of VTE.
1. DVT and PE can always be easily diagnosed by observing for clinical signs and symptoms. (true/false)

2. Calf clots are clinically insignificant because they do not embolise (break loose and travel) and do not cause any long term problems. (true/false)

3. Fatal PE is the most common, preventable cause of hospital deaths. (true/false)

4. Most hospitalised patients have multiple risk factors for VTE. (true/false)

5. Medical patients are at low risk for developing DVT and PE as compared to patients undergoing surgical procedures. (true/false)

(Answers Appendix 1)

Upon completion of this course, you should be able to:

- Understand definitions and development of VTE
- Explain clot formation and pulmonary emboli
- Describe the incidence of VTE in Australia and patient costs
- Identify procedural and patient risk factors and the assessment processes
- Describe the pharmacological and mechanical methods of VTE prophylaxis
- Identify methods for advocating for VTE prevention
- Understand best practice guidelines for VTE prevention and access online resources to guide you in the practice of VTE prophylaxis.

This course is divided into the following sections:

1. Overview
2. Definition and development of VTE
3. Incidence, cost and risk factors of VTE
4. VTE prophylaxis
5. VTE risk assessment
6. The role of healthcare professionals
7. Assessment
2. Definition and development of VTE

This section provides a definition of terms and explains how VTE can develop.

To be able to understand the principles of VTE prophylaxis there are certain definitions you need to be familiar with.

Familiarity with these common terms will assist your understanding why there is a need for VTE prophylaxis.

**Venous Thromboembolism**

**Deep Vein Thrombosis (DVT)**
DVT is also referred to as a blood clot. These occur when red blood cells, fibrin, platelets and leukocytes form a mass within a deep vein, typically of the lower extremities. A blood clot has the potential to break free and travel through the circulatory system to the lungs.

*Figure 3: DVT of the Right Leg. (Heilman 2009)*

**Pulmonary Embolism (PE)**
PE results when a piece of a blood clot, known as a thrombus, detaches from a vein wall travels to the lungs via the venous network and lodges within the pulmonary arteries. The majority of PE, including fatal PE, are found to have occurred in patients with asymptomatic proximal DVT (Nicolaides et al 2013).

*Figure 4: Pulmonary Embolism CTPA (Myat & Ahsan 2007)*

**VTE Prophylaxis** refers to mechanical and pharmacological measures that are taken to prevent DVT and PE.

The following information will provide a brief overview of the role of the circulatory system and the blood components that play a role in clot formation.
First let's have a look at the human body’s normal circulation.

In normal circulation, oxygenated blood is pumped from the left side of the heart via the aorta to the coronary arteries and other arteries in the body.

Deoxygenated blood returns to the right side of the heart via the inferior and superior vena cava. Blood is then pumped to the lungs, via the pulmonary artery, to pick up oxygen, and then returns to the left side of the heart where the cycle begins again.

It is essential that blood remains fluid during circulation but, in the event of an injury, blood should be able to clot at the site of the injury to maintain haemostasis. However it should not occlude or clot within a blood vessel (arteries or veins).

The feet act as venous foot pumps for the body, the motion of weight bearing while walking activates a range of muscles in the feet and legs which assists in pumping blood to the deep leg veins of the calves.

Contractions of the calf muscles in a normal active person stimulate the flow of blood through the veins of the lower limbs and abdomen towards the heart. Valves are what prevent backflow and pooling of blood within veins.

**Figure 5**: WTD Infographics (ISTH 2014)

**Clot formation**

Blood flowing in the venous system is under lower pressure, and subsequently moves slower than blood flowing within arteries. Blood is therefore more likely to clot in veins than in arteries.

The blood in veins is constantly forming microscopic clots that are routinely broken down by the body. If the balance of clot formation and resolution is altered, significant clotting can occur and a DVT may develop.

**Role of platelets in clot formation**

As a result of injury to the body, platelets (a type of blood cell) begin to accumulate at the site of injury, then soluble proteins in your plasma (the liquid part of blood) begin to
form fast insoluble fiber’s which act as a mesh to bind platelets and red blood cells together in a soft lump. Typically, the body will dissolve the blood clot after the injury has healed.

Click on the link below to access a video that shows blood clot formation.

Blood clot formation video

The three main factors that cause blood to clot are known as Virchow’s Triad:

![Virchow's Triad](image)

Figure 6: Virchow’s Triad (Covidien n.d)

**Venous Stasis**

Alterations in blood flow that cause venous stasis include: Varicose veins, immobility, paralysis or fixation devices, laparoscopic surgery and patient positioning during surgical procedures, prior DVT, pregnancy, shock, CHF, obesity, malignancy and increasing age

**Vessel Wall Damage**

Damage to the endothelium lining of vein walls occurs with surgery, injury or trauma to a patient, as well with CVC/IV access and treatment with drug irritants. Venous dilatation or distension secondary to administration of anaesthetic agents or extra circulating volume in the body are also known to cause vessel wall damage.
Abnormalities in blood – coagulation changes

Abnormalities in blood – coagulation changes may be due to numerous risk factors including the following: Anaesthesia, increasing age, dehydration, inflammatory bowel disease, malignancy, polycythemia vera, pregnancy and the pueperium, primary or acquired hypercoagulability, DIC, HiT and hormone therapy.

Although DVT may form in any vein, it is more likely to occur in the veins of the lower limbs where blood flow is slower. This may not be life threatening or cause any inconvenience. However it has the potential to result in significant chronic issues, called Post Thrombotic Syndromes. These include: venous ulcers, skin discoloration, pain and swelling.

Figure 7: WTD Infographics (ISTH 2014)

If a DVT develops, grows large and a thrombus breaks free it can travel through the venous network and eventually reach the lungs. The thrombus can then block the lung vessels causing a serious and potentially fatal PE.

REMEMBER: PE remains the most common form of preventable death and is estimated to be responsible for 7% of hospital deaths each year in Australia (Access Economics, 2008).

Self-check your learning and see how you’re going.

1. Which of the following best describes a DVT?
   A. A blood clot that develops in the pulmonary artery
   B. A blood clot that develops in a vein
   C. A blood clot that develops in an artery
   D. A blood clot that develops in the leg
   E. Any blood clot that forms in the body.

2. Which two of the following relate to the term ‘venous thromboembolism’?
   A. Venous stroke
   B. Venous aneurysm
   C. Myocardial infarction
   D. Deep vein thrombosis.
   E. Pulmonary embolism.
3. What are the three components of Virchow’s Triad.

A. Venous stasis, smoking and surgery  
B. Vessel wall damage, cancer and immobility  
C. Abnormalities in blood – coagulation changes, anaesthesia and obesity  
D. Venous stasis, Vessel wall damage, Abnormalities in blood – coagulation changes

(Answers Appendix 2)

Let’s recap what we have covered so far.

In this section we learnt that human bodies have an effective way of circulating blood around the body. Blood can clot naturally at the site of an injury, however should not occlude or clot within a vessel.

Clot formation occurs all the time in our bodies, and when the balance of clot formation and resolution becomes altered, significant clotting can occur.

Remember Virchow’s Triad to assist you in understanding the risk factors that can cause blood clots

The next section looks at the incidence, cost and risk factors involved in VTE.
3. Incidence, cost and risk factors of VTE

Symptomatic VTE is a major health problem in Australia. The yearly incidences are as follows (ANZ 2010):

- 160/100,000 patients with DVT
- 20/100,000 with symptomatic non-fatal PE
- 50/100,000 with fatal autopsy detected PE.

### Incidence of VTE

A report compiled by Access Economics in 2008 found:

- An estimated 14,716 cases of VTE (5,466 males and 9,250 females)
- Of these cases, 8,253 (56%) were estimated for Pulmonary Embolism (PE) and 6,462 for Deep Vein Thrombosis (DVT)
- 30 (0.2%) were children aged up to 15 years
- 6,335 (43%) of the people were of working age (15-64 years)
- 3,232 (22%) were aged 65-74
- 3,544 (24.1%) were aged 75-84 and
- 1,575 (10.7 percent) were aged 85+.

Based on epidemiological evidence, VTE was estimated to be responsible for 5,285 deaths in Australia in 2008 (Access Economics 2008).

### The Cost of Venous Thromboembolism in Australia

Access Economics reported that in 2008, the financial cost of VTE was $1.72 billion. In per capita terms, this amounts to a financial cost of $116,970 per person with VTE. The breakdown of these costs is further defined below:

- 1.38 billion (80.0%) productivity lost primarily due to premature death
- 162 million (9.4%) efficiency loss from taxation forgone and government health expenditures
- 148 million (8.6%) direct health system expenditure
- 22 million (1.3%) bring-forward of funeral costs
- 12 million (0.7%) value of the informal care for people with VTE.
In terms of mortality, VTE causes more deaths in hospitalised patients than all transport accidents and falls combined. It is a bigger killer than bowel or breast cancer and over 40 times more deadly than AIDS (Access Economics 2008).

For the full report please download the following:

**Access Economics Report 2008: The Burden of Venous Thromboembolism in Australia**

**International Data**

The incidence of VTE related deaths is estimated at 300,000 annually in the U.S with national expenditures on DVT related events estimated at $1.5 billion (Access Economics 2008).

Recent studies from the U.S have listed the top five most prevalent hospital-acquired conditions in terms of cost to the healthcare institutions as:

1. Decubitis ulcers
2. Postoperative pulmonary embolism and deep vein thrombosis
3. Accidental puncture and laceration
4. Post operative respiratory failure
5. Infections related to medical care.

Together postoperative pulmonary embolism and deep vein thrombosis formed the second most prevalent category and the most expensive, costing a total of $564,000 each year. Both required $15,500 more in care expense per patient (Simmons 2010).

In the UK and across Europe 45-51 percent of patients undergoing orthopaedic surgery develop DVT (Access Economics 2008). In the UK alone PEs following DVT events, in hospitalised patients, cause between 25,000 and 32,000 deaths each year and it is estimated that across 25 EU countries, approximately 0.7 million DVT and 0.4 million PE events occur each year (Access Economics 2008).

In addition, post-mortems are not routinely performed and therefore VTEs are not always recognised as having been the cause of death.

The need for prevention applies regardless of ethnicity. If VTE prophylaxis is not used, and a patient develops a DVT: they risk associated complications, hospital stay is prolonged, increased drug and laboratory costs occur and potentially fatal PE can eventuate.
REMEMBER: PE remains the most common form of preventable death in hospitals, and 7% of all deaths in Australian hospitals are due to PE (Access Economics 2008).

VTE risk factors

Most patients have multiple risk factors, which make them more likely to have a VTE event. The more risk factors a patient has, the greater their risk of developing a VTE.

Known risk factors

Risk factors are cumulative; they may be either inherited or acquired.

Known risk factors are listed below and their presence or absence should inform clinical decisions on the use of thromboprophylaxis. The risk factors are grouped into three categories:

1) Individual patient risk factors

- Age (the annual incidence of VTE rises with each decade over the age of forty)
- Pregnancy
- Active or occult malignancy
- Previous VTE
- Varicose veins
- Marked obesity
- Prolonged immobility (prolonged bed rest, immobilisation in a plaster cast/brace, paralysis or prolonged travel)
- Oestrogen-containing hormone replacement therapy or oral contraceptives
- Inherited or acquired thrombophilia.

2) Risks related to an acute medical illness

- Acute or acute on chronic chest infection
- Heart failure
- Myocardial infarction
- Stroke with immobility
- Some forms of cancer chemotherapy
- Acute inflammatory bowel disease
- Risks related to an acute medical illness.
3) Risks related to an injury or surgical procedure

- All surgical procedures increase risk, especially abdominal, pelvic, thoracic or orthopaedic surgical procedures
- Risk is determined by the type of surgery (major joint surgery carries a very high risk, as does surgery for cancer), the type of anaesthesia, the likely duration of immobility (including duration of surgery) and surgical complications
- Leg injury that requires surgery or prolonged immobilisation (NHMRC 2009).

For the full report please download the following:

**NHMRC - Clinical Practice Guidelines: For the Prevention of Venous Thromboembolism in Patients Admitted to Australian Hospitals 2009**

**Risk of DVT if no prevention methods are used**

If no prevention methods (pharmacological agents or mechanical compression devices) are implemented DVT develops in up to 50% of some categories of hospitalised patients (ed. Nicolaides et al. 2013).

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>DVT Incidence</th>
</tr>
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<tbody>
<tr>
<td>Stroke</td>
<td>56%</td>
</tr>
<tr>
<td>Elective Hip Replacement</td>
<td>51%</td>
</tr>
<tr>
<td>Multiple Trauma</td>
<td>50%</td>
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<tr>
<td>Total Knee Replacement</td>
<td>47%</td>
</tr>
<tr>
<td>Hip fracture</td>
<td>44%</td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>35%</td>
</tr>
<tr>
<td>Retro pubic prostatectomy</td>
<td>32%</td>
</tr>
<tr>
<td>ICU patients</td>
<td>25%</td>
</tr>
<tr>
<td>General Surgery</td>
<td>25%</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>22%</td>
</tr>
<tr>
<td>Gynae surgery for malignancy</td>
<td>22%</td>
</tr>
</tbody>
</table>

**Table 1:** DVT incidence without VTE prophylaxis (ANZ 2010)
Self-check your learning and see how you’re going.

1. In Australia in 2008, deaths relating to VTE numbered approximately:

   A. 1,285  
   B. 5,285  
   C. 10,657  
   D. 25,657.

2. Risk factors for VTE are cumulative? (true/false)

3. Identify which of the following is considered the highest risk factor for causing a patient to develop a venous thromboembolism:

   A. Facial surgery  
   B. Influenza  
   C. Previous VTE.

4. The National Health and Medical Research Council (NHMRC) in Australia provides guidelines on VTE prevention. (true/false)

   (Answers Appendix 3)

Let’s recap what we’ve covered so far.

In this section we have learnt that VTE is a major health problem in Australia. In 2008 deaths due to PE cost $1.72 billion.

The cost of VTE is covered by a combination of sources including:

- Individual  
- Family and friends  
- Federal government  
- State government  
- Community.

VTE is a recognised problem internationally, with similar trends to Australia.

There are a variety of identified risk factors which make a patient more likely to develop VTE. These risk factors can be inherited or acquired and range from individual patient risks, to acute medical illness and risk related to an injury or surgical procedures.

The next section explores the value of VTE prevention.
4. VTE Prophylaxis

In this section we explore VTE prophylaxis methods and the value of prevention in healthcare.

Evidence-based findings from well designed studies have clearly shown that prevention is possible. With a modest outlay, VTE incidence can be significantly reduced effectively and safely by using specific pharmacological agents and/or mechanical therapies. However, current data suggest that VTE prophylaxis is grossly underused in hospitals both in Australia and internationally.

Venous thrombosis may lead to pulmonary embolism, post-thrombotic syndrome and recurrent VTE events (National Institute of Clinical Studies [NICS] 2008). Reducing the burden of disease in the hospitalised patient due to VTE requires effective prevention in the form of mechanical and/or pharmacological prophylaxis depending on the patient’s individual risk and associated clinical conditions.

**FIRST** even before mechanical and/or pharmacological prophylaxis is used, healthcare workers can apply three simple measures as standard practice to prevent VTE.

1. Adequate hydration
2. Gently exercising feet and legs in bed
3. Mobilisation as soon as possible

In combination with these interventions pharmacological and/or mechanical prophylaxis should be utilised where clinically indicated.

**Mechanical prophylaxis**

The three methods of mechanical prophylaxis options available are:

- Graduated Compression Stockings (GCS)
- Intermittent Pneumatic Compression (IPC)
- Venous Foot Pump (VFP)

Let’s have a closer look at each of these:
1. Graduated Compression Stockings

Knee or thigh length Graduated Compression Stockings (GCS)

GCS provide graduated pressure pattern to the legs, delivering 18mmHg at the ankle which decreases to 8mmHg at the upper thigh (thigh length GCS), or decreases from 18mmHg at the ankle to 14mmHg at the popliteal vein (knee length GCS). This gradient pressure helps to increase blood flow back to the heart. Additionally, GCS reduce venous distension and the damaging effects that occur as a result of it during surgery and hospitalisation.

GCS come in two lengths, knee length and thigh length. Thigh length GCS have been shown to be more effective than knee length GCS, and are recommended for hospitalised patients (Joanna Briggs Institute 2008). It’s important to be aware that DVT’s which occur in femoral veins of the thigh are responsible for the majority of fatal PE.

- GCS should be worn continuously (except when showering) until the patient returns to full ambulation. This may include some time after discharge.

- Research has shown that when thigh length GCS are used on moderate risk surgical patients they reduce the risk of a DVT by 68 percent (Wells et al. 1994).

- GCS on a background of another method of prophylaxis are more effective than when GCS are used on their own (Sachdeva et al. 2010).

To ensure that the GCS work effectively, they must be measured and fitted correctly.

When fitted and used correctly, GCS boost venous blood flow velocity, prevent venous wall dilation and subsequent endothelial tears and also improve venous valve function; all leading to a reduced risk of DVT.

Fitting should always follow the manufacturer’s instructions. To ensure correct fit, correct measurement is essential. The following points are especially important:
1. Measure upper thigh circumference at the buttock fold. When thigh circumference measures greater than 91.4 cm, select knee length style.

2. Measure calf circumference at greatest portion to determine size.

3. Measure distance from base of heel to determine length. (If possible, measure length in standing position).

<table>
<thead>
<tr>
<th>1 Thigh Circumference</th>
<th>2 Calf Circumference</th>
<th>3 Length</th>
<th>Description</th>
<th>Code</th>
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<td>&gt;83.8 cm</td>
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**Fitting Knee Length**

1. Measure calf circumference at greatest portion to determine size.

2. Measure the distance from bend of knee to bottom of heel to determine length. If possible, measure length in standing position.

<table>
<thead>
<tr>
<th>1 Calf Circumference</th>
<th>2 Length</th>
<th>Description</th>
<th>Code</th>
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**GCS Sizing scenario**

1. Thigh circumference 60cm, calf circumference 40cm, length 75cm. What size thigh length GCS will fit this patient?
2. Calf circumference 33cm, length 46cm. What size knee length GCS will fit this patient?
3. Now guess your own size then check if you are correct?

(Answers Appendix 4).

**REMEMBER:** Never guess your patients size, always measure
Contraindications for GCS (Covidien n.d).

- Morbid obesity where correct fitting of stocking cannot be achieved
- Inflammatory conditions of the lower leg
- Diabetic neuropathy
- Severe edema of the legs
- Severe lower limb deformity
- Peripheral arterial disease or arterial ulcers.

GCS Application

1. Insert hand into stocking as far as the heel pocket.
2. Grasp centre of heel pocket and turn stocking inside out to heel area.
3. Carefully position stocking over foot and heel. Be sure patient’s heel is centred in heel pocket.
4. Pull stocking up and lift around ankle and calf; working up to final position (top of stocking is positioned approximately 2.5cm to 5cm below the bottom of knee cap). Make sure heel and toe are positioned correctly. Smooth out any excess material between top of stocking and ankle. Pull toe section forward to smooth ankle and instep area and allow for patient toe comfort.

Figure 10: T.E.D application (Covidien n.d)

GCS Frequently asked questions

- Can GCS be removed at night? No, GCS should be worn throughout the hospital stay and may even need to be sent home with the patient on discharge. DVT does not discriminate between day and night therefore 24 hours protection is required.
- How long should patients wear GCS after they are discharged? GCS should be worn until the patient returns to their normal level of mobility.
- How long do GCS last for? The Covidien Anti-Embolism Stockings will retain their unique pressure profile for up to 30 washes.
- Should GCS be worn when ambulating? Yes, if the patient remains at risk of developing a DVT stockings must be worn continuously.
- What if my patient’s legs are too large for the GCS our ward has? Obesity increases a patients VTE risk. The Covidien Anti-Embolism Stockings will fit a calf
circumference of up to 66cm! Never squeeze a patient into a size that won’t fit them use either an intermittent compression device or a venous foot pump as an alternative.

- What if my patient’s legs are different sizes, for example after hip surgery? Measure each leg individually and if required apply mismatched sized stocking to the patient’s legs.
- Why is there an inspection hole at the toe? To provide easy access for nurses and healthcare professionals to inspect neurovascular observations.

2. Intermittent Pneumatic Compression (IPC)

Covidien’s knee or thigh length Intermittent Pneumatic Compression (IPC) is referred to as a Sequential Compression Devices (SCD).

The SCD consists of garments with three compartments, tubing and a pump. The disposable garments are applied to the legs, usually over GCS. The pump inflates the individual compartments of the garment with air in a sequential, gradient, circumferential sequence. This applies pressure to the large muscles of the legs which milk the deep veins of the legs. After the compression cycle, the controller measures the time it takes the veins to refill with blood and waits that period of time before initiating the next compression cycle. This feature is called Vascular Refill Detection (VRD) it is unique to the Covidien SCD compression device. VRD customizes the compression cycle to the patient’s venous return and ensures more effective blood clearance from the lower extremities (Kakkos 2001).

The compression of the muscles (and veins) mimics the action of walking and results in moving blood through the deep venous network back to the heart, preventing pooling of blood in the lower limbs.
REMEMBER: Pooling of blood in the lower limbs increases stasis and this increases risk of developing a DVT.

In addition to preventing stasis, the SCD assists in preventing abnormal coagulation changes within the blood. The action of the SCD milks large muscles of lower limbs which stimulates an increase in antithrombotic activity. This also occurs when we walk around and ultimately works to break down clots naturally before they become problematic.

- In comparison to no prophylaxis, IPC devices have been shown to reduce the risk of DVT by 60% in post-operative patients (Urbankova et al. 2005).
- IPC is an effective method of reducing the risk of DVT and possibly improving survival in a wide variety of patients who are immobile after stroke (Dennis et al. 2013).

REMEMBER: Ensure that the SCD is fitted correctly; complications may arise from ill-fitting devices.

**THIGH LENGTH SCD**
- Measure the mid-thigh circumference

**KNEE LENGTH SCD**
- Measure the mid-calf circumference
  # Bariatric sizes available for calf circumference of <81cm

Contraindications for the SCD include: (Covidien n.d).

- Severe arteriosclerosis or other vascular disease
- Massive oedema of the legs
- Extreme deformity of leg
- Pulmonary oedema from congestive heart failure
- Suspected pre-existing DVT/Acute DVT, thrombophlebitis or PE
- Any local leg condition in which device would interfere, such as: dermatitis, vein ligation (immediate postoperative), gangrene, or recent skin grafts
- Conditions where an increase in fluid back to the heart may be detrimental, including some patients with congestive heart failure.

It is important to also note that SCD can be beneficial, even if it is only attached to one leg. For example the knee replacement patient where it may not be physically possible...
to apply the device on the surgical leg as a Zimmer split is on the limb. An alternative option to the SCD that can be easily applied to both limbs for this scenario is to use a venous foot pump, explained next.

IPC Frequently Asked questions

- How long can IPC be left off, and then reapplied? The devices are fine to reapply after any period of time unless you suspect that there is an acute DVT. Please remember that if the device is not on your patient then they are not receiving recommended VTE prophylaxis.
- What if the IPC sleeves are not large enough for my patient? Obesity increases a patients VTE risk. The Covidien SCD will fit a calf circumference of up to 81cm! If the calf circumference is larger than this use a venous foot pump as an alternative.
- Is the tubing disposable? No, the tubing is not disposable hospitals will be charged for replacement tubing if they are thrown away.
- Can IPC be applied when patients are sitting out of bed in a chair? Yes, DVTs don’t only occur when patients are lying down. If a patient is at risk of a DVT they require continuous use of preventative measures.
- Is IPC only indicated for surgical patients? No, they are also indicated for immobile medical patients and maternity patients.
- Can you use GCS and IPC together? Yes, you will provide the patient with more prophylaxis by combining compression modalities.

3. Venous Foot Pump (VFP) – Rapid Foot Inflation

![Figure 13: Marketing material A-V Impulse](Covidien n.d)

The most widely used rapid inflation venous foot pump (VPF) is the A-V Impulse foot pump.
The A-V Impulse foot pump is designed to mimic the action of weight bearing for immobilised patients. The pulsatile action within the foot pump enhances venous blood flow through the deep veins of the legs, preventing stasis.

In addition to enhancing venous blood flow, using the A-V Impulse stimulates the body to release a substance known as Endothelial Derived Relaxing Factor (EDRF). EDRF is released when we walk; it helps to prevent platelet aggregation and the formation of clots amongst other things.

A-V impulse mimics the natural hemodynamic action of normal ambulation

A-V Impulse operating parameters (Covidien n.d).

- 0.4 second rapid inflation simulates weight bearing
- 1 or 3 second impulse hold time
- 20 second deflation between impulses, allows for complete refilling of the plantar venous plexus
- 130 mmHg impulse pressure balances efficacy and patient comfort.
Indications for use of the A-V Impulse (Covidien n.d).

- DVT and PE Prophylaxis
- Circulation enhancement (arterial and venous)
- Lymphoedema
- Acute Oedema
- Chronic Oedema
- Extremity Pain Associated with Incident, Trauma or Surgery
- Leg Ulcers.

Contraindications for the A-V Impulse include (Covidien n.d).

- Pulmonary oedema from congestive heart failure
- Suspected pre-existing DVT/Acute DVT, thrombophlebitis or PE
- Any local leg condition in which device would interfere, such as: dermatitis, vein ligation (immediate postoperative) gangrene, or recent skin graft
- Conditions where an increase in fluid back to the heart may be detrimental, including some patients with congestive heart failure.

As with all mechanical devices ensure compliance to manufactures recommendations are adhered to.

Application of the A-V Impulse
A-V Impulse frequently asked questions

- How long can the A-V Impulse be left off, and then reapplied? The devices are fine to reapply after any period of time unless you suspect that there is an acute DVT. Please remember that if the device is not on your patient then they are not receiving recommended VTE prophylaxis.
- Is the tubing disposable? No, the tubing is not disposable hospitals will be charged for replacement tubing if they are thrown away.
- Can the A-V Impulse be applied when patients are sitting out of bed in a chair? Yes, DVTs don’t only occur when patients are lying down. If a patient is at risk of a DVT they require continuous use of preventative measures.
- Is the A-V Impulse used for its other indications in the home environment? Yes, the pumps are available for the general public to purchase for chronic use. Please contact your local sales representative for further information.
- Can you use GCS and the A-V Impulse together? Yes, you will provide the patient with more prophylaxis by combining compression modalities and also ensure that the foot is protected against sheering forces created by the device inflating.
Pharmacological prophylaxis

Pharmacological agents work by reducing the ability for blood to clot within the vessels of the body. They prevent clots from forming by producing low levels of anticoagulant factors, which act to prevent clotting factors from working.

Figure 16: Heparin Sodium Sample (LhcheM 2012)

So, what is recommended for use?

Subcutaneously administered Unfractionated Heparin (UFH) or Low Molecular Weight Heparins (LMWH) are considered effective in preventing VTE in a wide range of high risk medical and surgical patients. Fondaparinux is not used as commonly, however it is indicated for certain categories of hospitalised patients. Rivaroxaban and Dabigatran Etexilate are newer oral anticoagulants which have been approved for VTE prophylaxis for elective hip and knee replacement surgeries amongst other indications.

The NHMRC Clinical Practice Guideline (2009) for the Prevention of Venous Thromboembolism in Patients Admitted to Australian Hospitals, provide chemical prophylaxis guidelines for a wide variety of medical and surgical patients.

Click here to access the NHMRC clinical evidence based guideline summary:

NHMRC Prevention of Venous Thromboembolism (VTE) in Patients Admitted to Australian Hospitals: Guideline Summary

Pharmacological prophylaxis is not without its risks. Contraindications for pharmacological prophylaxis include: (NHMRC 2009).

- Active bleeding or high risk of bleeding e.g. Haemophilia, thrombocytopenia (platelet count <50 x 109/L)
- History of GI bleeding
- Severe hepatic disease (INR > 1.3)
- Adverse reaction to heparin
- Patients on current anticoagulation
- Very high risk of falls and palliative management
- Renal impairment (see manufacturer’s product information for LMWH).
**Duration of VTE prophylaxis**

While optimal length of VTE prophylaxis for all categories of patients is uncertain, it should be considered for at least the duration of hospital stay. It’s recommended that pharmacological prophylaxis continues for an extended duration for selected patients who are at high risk of VTE (NHMRC 2009).

- Up to 35 days for hip arthroplasty
- Up to 14 days for knee arthroplasty
- Up to 28 days for abdominal / pelvic surgery for cancer.

**BE AWARE:** Patients who have had a prolonged hospital stay may not be very mobile even when they are discharged, therefore individual assessment for ongoing VTE prophylaxis should be considered.

Let’s see how both mechanical and pharmacological methods of VTE prophylaxis impact the three causal factors in Virchow’s Triad to prevent clots from forming.

**REMEMBER:** Virchow’s Triad covers the three main causal factors that contribute to blood clot development.

**Stasis**

Mechanical methods of prophylaxis, which include GCS, IPC or VFP decrease pooling of blood in the deep venous system and this increases venous blood flow and venous return to the heart, ultimately preventing stasis.

**Vessel Wall Damage**

GCS work by preventing venous distension caused by the relaxation of vascular smooth muscle (veins) during anaesthesia or due to loss of muscle tone; both results in dilation of veins and venous blood pooling. Applying GCS prevents venous distension and as a result prevents micro vascular damage to the endothelial lining of veins.

**Coagulation Changes**

Anticoagulants work by interrupting part of the process involved in the formation of blood clots. Consequently blood clots are less likely to form when they are not needed however can still form when they need to in response to injury.

The major advantage of mechanical prophylaxis over pharmacological methods of prophylaxis is that mechanical methods do not increase the risk of bleeding. For a
patient who is at high risk of VTE, and has a high risk of bleeding use of mechanical compression is recommended (Guyatt 2012).

The decision to select the most appropriate choice of thromboprophylactic agent for a patient should be made in consultation with the patient to increase acceptability and improve compliance.

Self-check your learning and see how you’re going.

1. What three simple measures can be adopted to assist in VTE prevention in hospital patients?
   
   A. Adequate hydration
   B. Jogging
   C. Gently exercising feet and legs in bed
   D. Immobilisation
   E. Mobilisation as soon as possible.

2. When fitting graduated compression stockings, size and fit matters. (true/false)

3. One of the main complications from the use of pharmacological prophylaxis is considered to be:
   
   A. Bleeding
   B. Persistent coughing
   C. Fever
   D. No complications.

4. When using any mechanical device for VTE prophylaxis, you should ensure compliance with manufacturers recommendations are adhered to. (true/false)

(Answers Appendix 4)
Let's recap what we've covered so far.

Research shows that the incidence of VTE can be reduced with the use of specific pharmacological agents and/or mechanical devices. Currently VTE prophylaxis is grossly underused in hospitals in both Australia and internationally.

Mechanical prophylaxis includes:

- Graduated Compression Stockings
- Intermittent Pneumatic Compression
- Venous Foot Pump.

Pharmacological approaches rely on producing low level of anticoagulation.

In addition to these interventions healthcare workers can practice these three simple measures to help prevent VTE:
1. Ensuring adequate hydration
2. Gently exercising feet and legs of patients in bed
3. Mobilising patients as soon as possible and regularly.

In the next section we consider the value and importance of VTE risk assessment.
5. VTE Risk assessment

This section discusses the value and importance of VTE risk assessment.

It’s essential to perform and record a VTE risk assessment on each patient to ascertain what the most appropriate measures to use to prevent VTE are.

VTE risk factors are cumulative, so the presence of multiple risk factors leads to a higher risk of developing VTE. The presence of multiple risk factors may signal the need for a more extensive VTE prophylactic regimen.

The final decision to provide thromboprophylaxis is a clinical decision based on number and type of risk factors balanced against risk of bleeding and any contraindications to mechanical prophylaxis. All admitted patients should have a VTE risk assessment as part of their hospital admission, and they should receive optimal VTE prophylaxis according to their level of risk, and existing contraindications to prophylaxis.

![Figure 17: VTE risk factors weighed up against VTE event and possible complications (Covidien n.d)](image)

**Risk assessment tool**

Use of an effective evidence based risk assessment tool will aid the healthcare professional in compiling adequate information about their patients, especially during admission to hospital.
This information may include the following steps:

**Step 1**

Assess the patient’s **baseline risk of VTE**, taking into account inherited and/or acquired risk factors and morbidities.

**Step 2**

Assess the patient’s **additional risk of VTE**, taking account of the reasons for hospitalisation (surgical procedures, trauma or specific medical illness).

**IMPORTANT POINT:** Patients experiencing an acute phase of illness must be initially assessed and **reassessed** if their condition changes, this is especially pertinent to medical patients whose conditions may fluctuate/change from original assessment.

**Step 3**

Assess the patient’s **risk of bleeding or contraindications** to pharmacological or mechanical prophylaxis.

**Step 4**

Formulate an **overall patient’s risk assessment** (with consideration of the risks associated with thromboprophylaxis against the benefits or VTE prophylaxis).

**Step 5**

**Select appropriate methods** of thromboprophylaxis based on the patients’ risk assessment in consultation with the patient.

The National Institute of Clinical Studies (NICS), in collaboration with the Private Hospital VTE Prevention Program Advisory Committee, have produced a sample VTE assessment form and state that ‘all hospitals should have a VTE prophylaxis policy for assessment of VTE risk in admitted patients’.

VTE prevention policies should include information about appropriate prophylactic measures to minimise the risk of DVT and PE in every admitted patient based on best practice recommendations’.
For a more concise look at evidence based risk assessment please download the following risk assessment tool for developed by NICS for the prevention of VTE in surgical and medical patients:

**Venous Thromboembolism (VTE) risk assessment tool**

The Physician - Patient Alliance for Health and Safety has developed Ob/Gyn VTE Safety Recommendations for the Prevention of VTE in Maternal Patients.

Please download the following risk assessment for obstetric patients:

**Ob/Gyn VTE Safety Recommendations for the Prevention of VTE in Maternal Patients**

Placing the responsibility on healthcare professionals to complete risk assessments is futile unless collaboration and compliance exits between the medical and nursing professions.

Self-check your learning and see how you’re going.

1. Using a VTE risk assessment tool will help healthcare professionals to:
   
   A. Assess patient risks  
   B. Approach the topic of treatment with patients  
   C. Develop an overall picture of the patient’s VTE risk  
   D. Select a method for prophylaxis.

2. Multiple risk factors present in a patient are thought to increase the patient’s risk of developing VTE. (true/false)

   (Answer Appendix 5)

Let’s recap what we’ve covered so far.

There are risk assessment tools available that can be used to establish a method for assessing a patient’s risk of VTE. Use the risk assessment tools you have downloaded to practice with the following patient scenarios.

**SCENARIO PRACTICE**

- 65 year old man, admitted with a hemorrhagic stroke and right sided hemiplegia. PHx smoker
• 41 year old female, admitted for r/o bunion. PHx Factor V Leiden and DVT 2 years ago
• 36 year old female, admitted for elective C-section. PHx BMI >30, gross varicose veins.
• 45 year old Male, admitted for Knee arthroplasty. PHx Mother and Brother have both had a DVT, overweight.

You can also use the following steps to guide the decision for appropriate VTE prophylaxis:

**Step 1:** Assess the patient’s baseline risk  
**Step 2:** Assess the patient’s additional risk  
**Step 3:** Assess the patient’s risk of bleeding and any contraindications to mechanical prophylaxis  
**Step 4:** Formulate overall risk assessment  
**Step 5:** Select appropriate methods of prophylaxis.

Now it’s time to look at the role of the healthcare professional.
6. The role of the healthcare professionals

This section details the role of the healthcare professional in VTE Prophylaxis and prevention.

VTE risk assessment and prescribing of VTE prophylaxis, has traditionally been a medical practitioner’s responsibility. Today nurses take more responsibility for patient assessment, and have an active role in identifying patients at risk and then advocating for the appropriate VTE prophylaxis.

To overcome the barriers to VTE prevention and aid reducing VTE events and subsequent complications, all healthcare professionals require an understanding of VTE risk assessment and appropriate prophylaxis.

Common barriers

Before we have a look at the strategies that can be used to improve VTE prevention, let’s first have a look at some of the common barriers to VTE prevention (NICS 2008).

Common barriers include:

Lack of awareness

- Of the incidence of VTE
- VTE is a silent complication which usually manifests after discharge from hospital.

Knowledge and education deficits

- Appropriate risk assessment
- Appropriate prophylaxis by risk category.

Disputed, inconsistent or inconclusive evidence

- Disagreement with evidence-based guidelines, particularly for medical patients
- Concerns about bleeding in surgical and medical patients.
Lack of system support

- Explicit policies for VTE prophylaxis
- Physician compliance with VTE risk assessment
- Lack of compliance with VTE prevention guidelines
- Bleeding concerns
- Engaging with medical practitioners.

We have predominantly referred to medical and nursing professionals when we have mentioned healthcare professionals during this course. These professionals have a direct link to the care of patients, and are the patient advocate. The following strategies are provided to assist them to improve VTE prevention.

Strategies to improve VTE prevention

1) Develop

Both medical and nursing healthcare professionals need to develop an understanding for the need for VTE prevention/prophylaxis and take ownership of VTE risk assessment.

2) Encourage

Healthcare professionals can work together as patient advocates, to reduce the unacceptable incidence of VTE in our community.

Members of healthcare professions involved in patient care must adopt a ‘can do’ attitude ensuring that they are actively promoting measures to protect the patients who are currently in their care. In doing this, there is no doubt that lives will be saved and permanent disability from VTE avoided.

3) Identify

Careful selection of a suitable VTE risk assessment approach is required to improve the chance of successful implementation in hospital. At-risk patients need to be identified, counselled and the most appropriate thromboprophylaxis selected, prescribed and delivered.

The medical faculty and the nursing profession are ideally placed to play a central role in the implementation of this change in clinical practice through leadership and education.
4) Advocate

The Australian Commission on Safety and Quality in Health Care (the Commission) developed the VTE prophylaxis section in the National Inpatient Medication Chart (NIMC) to prompt:

• VTE risk assessment
• VTE pharmacological prophylaxis prescribing
• VTE mechanical ordering.

The section has been placed above the warfarin section to assist with the recognition of patients who are already receiving therapeutic anticoagulation and do not require additional VTE prophylaxis.

Who should document the patient’s VTE risk?

Whoever has responsibility in your hospital for assessing the patient’s VTE risk should sign and date the NIMC which notes that the assessment has been done. In some hospitals this will be done by the admitting medical officer, in others it will be done by the nursing staff. The risk assessment should be completed consistent with local hospital policy.

For more details of the NIMC and VTE prophylaxis section, visit the Commission’s website at:

National Inpatient Medication Chart (NIMC) VTE Prophylaxis Section

5) Information

For patients attending pre-admission clinics, prior to a planned hospital admission, nurses may be able to provide the patient with information on VTE risk and encourage the patient to discuss VTE prophylaxis with their medical practitioner.
For more patient information please go to the following links:

Blood Clots: Reducing Your Risk Patient Information Brochure

World Thrombosis Day - Hospital Associated VTE

Patient educational video

6) Collaboration

Effective VTE prevention can be achieved through collaboration between healthcare professionals. To support this it is necessary for healthcare facilities to implement VTE prophylaxis policy and VTE risk assessment guidelines.

Hospitals must also collaborate with the government and integrate the new Australian Quality and Safety Goals for Health Care (Australian Commission in Quality and Safety in Health Care n.d.). These goals include VTE prevention;

➢ Goal 1 Safety of care: That people receive their healthcare without experiencing preventable harm
➢ Outcome 1.1.3: Adults experience fewer venous thromboembolisms associated with hospitalisation.
➢ There is strong evidence that appropriate risk assessment and prophylaxis can reduce the risk and incidence of venous thromboembolism

To access the Medication Safety Action Goals for Health Care please download the following document:

Australian Quality and Safety Goals for Health Care: Medication Safety

Utilisation

There are many sites that healthcare professionals can access to obtain relevant information and evidence based guidelines. These can be utilised to put together an effective VTE prevention policy. For a more concise look at evidence based VTE prevention guidelines, download the following links:

National Health and Medical Research Council (NHMRC) 2009

International Consensus statement: Guidelines according to scientific evidence. Ed 2013

Nice Guidance (UK guidelines) 2010

American College of Chest Physicians (ACCP) 2012
Ensure

Nurses must ensure that mechanical prophylaxis is applied correctly and that pharmacological agents are given as prescribed. It is also important that the patient is educated about their risk of VTE and the requirement for VTE prophylaxis.

Click here to access a resource tool that healthcare professionals can utilise to aid integrating VTE prevention strategies:

**NHMRC Stop the Clot Integrating VTE prevention guidelines recommendations into routine hospital care**

**Successful implementation of best practice VTE prophylaxis guidelines should include the following:**

- Use VTE prophylaxis routinely unless contraindicated
- Ensure hospitals have the necessary policies in place for VTE prophylaxis
- VTE prophylaxis policies need to be incorporated into the relevant clinical pathways, unit guides and manuals
- Health services should engage in regular audits of compliance with VTE prophylaxis
- Patient’s individual risk factors should be noted in their medical documentation
- Application and use of VTE prophylaxis should be recorded on the NIMIC
- Familiarisation of VTE prophylaxis guidelines should be included in the senior and junior medical staff orientation, doctor’s rounds and staff newsletters
- Liaison with external medical staff, especially when patients with extended prophylaxis are out of hospital (NICS 2008)

Nursing is the largest professional group involved in direct clinical care within the healthcare system. Nurses with expert knowledge and strong leadership skills can have a prominent role in influencing and implementing changes to healthcare practices.

Nurses who underwent evidence based VTE prevention education session and then took responsibility for risk assessment of admitted patients increased appropriate prophylaxis rates in high risk patients admitted to hospital from 27 percent to 85 percent ($p < 0.0001$) (Collins 2009). Suggesting that by providing a means for patients to be appropriately risk assessed significantly reduces the incidence of VTE events.

While the emphasis here may favour the nursing sector, it is the responsibility of all healthcare professionals involved in care of the patient to ensure that holistic and
efficient care is provided. Our goal is to ensure individual patients are protected from avoidable, adverse events, during their stay in healthcare facilities and when discharged home.

Self-check your learning and see how you’re going.

1. Identify the common barriers to VTE prevention:

   A. Disputed inconsistent or inconclusive evidence
   B. Lack of awareness
   C. Lack of systems support
   D. Lack of patient interest
   E. Knowledge and education deficit.

2. Nurses have in important role to play in shifting attitudes towards VTE prophylaxis. (true/false)

   (Answers Appendix 6)

Let’s recap what we’ve covered so far.

We’ve just learnt how it’s the responsibility of both nursing and medical practitioners to implement practices that prevent VTE.

There are a variety of barriers to overcoming this issue, including:

- Lack of awareness
- Knowledge and education deficits
- Disputed evidence
- Lack of support.

There are lots of ways to approach overcoming these barriers, namely:

- Develop an understanding of the issues
- Encourage collaborative work
- Utilise VTE prophylaxis prescribing box on NIMIC
- Advocate for the cause
Well done. You’ve completed all the sections in this course, please proceed to the final assessment (Answers Appendix 7)
7. Assessment

1. You can best describe DVT as:

   A. A blood clot that develops in the pulmonary artery
   B. A blood clot that develops in an artery
   C. A blood clot that develops in the leg
   D. A blood clot that develops in a vein
   E. Any blood clot that forms in the body.

2. Which two of the following comprise venous thromboembolism?

   A. Venous stroke
   B. Deep vein thrombosis
   C. Venous Aneurysm
   D. Myocardial infarction
   E. Pulmonary embolism.

3. Orthopaedic, surgical and medical patients are all groups that are at risk of developing venous thromboembolism? (true/false)

4. At which points should elective surgical patients and medical patients be risk assessed for venous thromboembolism?

   A. During the hospital stay
   B. Whenever the clinical situation changes
   C. On admission to hospital
   D. During the discharge process.
   E. All of the above

5. The NHRMC provides guidelines for venous thromboembolism prevention and each hospital is responsible for their own risk assessment. (true/false)

6. Which of the following will NOT lead to the development of deep vein thrombosis?

   A. Surgery
   B. Walking
   C. Prolonged immobility
   D. Previous history of DVT or PE

7. Which of the following are predominantly considered to be patient-related risk factors for venous thromboembolism?
A. Age (especially over 40+)
B. Active or occult malignancy
C. Cataract surgery
D. Renal dialysis
E. Haemophilia
F. Obesity (BMI greater than 30 kg/m²)

8. Which of the following is NOT an appropriate thromboprophylaxis for the prevention of venous thromboembolism?

A. Anti-embolism stockings
B. Low dose unfractionated heparin
C. Low molecular weight heparin
D. Warfarin.

9. When measuring a patient for thigh length anti-embolism stockings, which three measurements should typically be taken?

A. Calf circumference
B. Gluteal fold to heel
C. Patella to big toe
D. Thigh circumference
E. Popliteal fold to heel.

10. Risks related to the individual may be either inherited or acquired. (true/false)

11. There are two factors considered essential when determining the appropriate modality for thromboprophylaxis, these are:

A. The patient’s body weight
B. Whether there is a risk of bleeding or contraindications to chemical prophylaxis
C. Whether the patient has any contraindications to mechanical prophylaxis
D. Renal dialysis
E. Serum albumin level.

12. What is the method of administration for Low Molecular Weight Heparin in the context of VTE prevention?

A. Intravenous
B. Intramuscular injection
C. Subcutaneous injection
D. Oral.
13. How does the use of Anti-Embolism Stockings work to prevent DVT?

A. Anti-embolism stockings aim to reduce the hypercoagulability of the blood
B. Anti-embolism stockings enhance blood flow and prevent venous dilatation.
C. Anti-embolism stockings aim to eliminate the presence of tissue factor in the blood.

14. How do pharmacological methods of thromboprophylaxis work to prevent deep vein thrombosis and pulmonary embolism?

A. Pharmacological methods of thromboprophylaxis prevent stasis of blood and improve venous return in the lower limb
B. Pharmacological methods of thromboprophylaxis interrupt part of the process involved in the formation of blood clots
C. Pharmacological methods of thromboprophylaxis eliminate the presence of tissue factor in the blood.

15. Which of the following statements accurately reflects the need for VTE risk assessment and prophylaxis?

A. VTE poses a significant risk to many hospitalised patients, with an estimated 5,285 deaths in 2008 in Australia alone
B. VTE risk assessment is an optional process directed primarily at preventing VTE in orthopaedic surgical patients
C. VTE risk assessment is a mandatory process directed primarily at preventing VTE in pregnant medical patients.

16. Identify two examples of mechanical thromboprophylaxis:

A. Anti-Embolism Stockings
B. Low Molecular Weight Heparin
C. Intermittent Pneumatic Compression
D. Vitamin K antagonists.

17. Which two measurements are typically taken when fitting a patient with knee length anti-embolism stockings?

A. Popliteal crease to heel
B. Gluteal fold to heel
C. Calf circumference
D. Thigh circumference
E. Ankle circumference.
18. Where should mechanical and pharmaceutical VTE prophylaxis be prescribed?

A. Anywhere on the medication chart  
B. In the VTE prevention box on the medication chart  
C. On post-op orders  
D. In the patients notes  
E. Verbal order

19. Which of the following are procedure-related VTE risk factors?

A. Light sedation  
B. Duration of surgery and anaesthetics >45 minutes  
C. Endoscopy  
D. Immobilisation of lower limb post surgery.  
E. Cataract surgery

20. Which of the following healthcare professionals could potentially be involved in VTE risk assessment in primary care?

A. Pharmacists  
B. Dieticians  
C. Doctors  
D. Podiatrists  
E. Nurses

21. Risk assessment should start with a patient’s admission to a health facility and should be repeated whenever there has been a change in the patient’s condition. (true/false)

22. Consider the following scenario:

A 78 year old female patient with a BMI 31 kg/ m², who has existing mobility problems due to a recent fall, is admitted to hospital with acute pneumonia. Which of the following three statements are true for this patient?

A. The patient is at high risk of VTE because she is older than 60  
B. The patient’s BMI increases her risk of VTE  
C. The patient is at low risk of VTE because she is not an orthopaedic surgical patient  
D. The patient’s BMI is not relevant when considering the risk factors for VTE  
E. Acute infections such as pneumonia may increase the risk of VTE.
**Conclusion**

Well done! You’ve reached the end of the course, ‘Venous Thromboembolism (VTE) Prophylaxis’.

Now that you’ve completed your learning you should be able to:

- Understand definitions and development of VTE
- Explain clot formation and pulmonary emboli
- Describe the incidence of VTE in Australia and patient costs
- Identify procedural and patient risk factors and assessment processes
- Describe the pharmacological and mechanical methods of VTE prophylaxis
- Identify methods for advocacy for VTE prevention
- Understand best practice guidelines for VTE prevention and access online resources to guide you in the practice of VTE prophylaxis.

*Congratulations, you’ve come to the end of the program.*
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Self-check your learning and see how you’re going.

Appendix 1

1. false
2. false
3. true
4. true
5. false

Appendix 2

1. b
2. d, e
3. d

Appendix 3

1. b
2. true
3. c
4. true

Appendix 4

GCS Sizing scenario
1. Thigh length large regular
2. Knee length large long

1. a, c, e
2. true
3. a
4. true

Appendix 5

1. a, c, d
2. true

Appendix 6

1. a, b, c, e
2. true
Appendix 7

1. d
2. b, e
3. true
4. e
5. true
6. b
7. a, b, f
8. d
9. a, b, d
10. true
11. b, c
12. c
13. b
14. b
15. a
16. a, c
17. a, c
18. b
19. b, d
20. a, c, e
21. true
22. a, b, e