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Use of anti-embolism stockings and intermittent pneumatic compression is widespread but health professionals need assistance on aspects of these treatment options

Best practice in the use of VTE prevention methods

Learning points...

- Ten FAQs about mechanical thromboprophylaxis
- Assessing patients for thromboprophylaxis suitability
- Recommendations for use as outlined in national guidance

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Abstract Gee E, Doyle C (2015) Best practice in mechanical thromboprophylaxis. Nursing Times; 111: 16, 12-14.
Although anti-embolism stockings and intermittent pneumatic compression are commonly used for mechanical thromboprophylaxis, practice varies significantly. This article reviews national guidance and research evidence on common questions relating to the use of these interventions to prevent venous thromboembolism.

Anti-embolism stockings and intermittent pneumatic compression devices are commonplace in the acute hospital setting and have been used as a mode of thromboprophylaxis for many years. Despite this, our experience shows disparity in their practical use. Therefore, we put 10 frequently asked questions relating to mechanical thromboprophylaxis to venous thromboembolism clinical nurse specialists from across the country. Variation in the answers prompted a literature search to see what evidence is available to inform these clinical decisions.

The National Institute for Health and Care Excellence (2010) outlines the contraindications to anti-embolism stockings (Box 1), but it is vital that a clinical decision is made in conjunction with the patient, balancing the risk of potential harm and benefit. With this in mind, we have addressed the FAQs discussed with the VTE specialists using a combination of national guidelines, information from the existing evidence base and the experience and knowledge of specialist nurses. This information should be used alongside local guidance to make clinical decisions about the use of mechanical thromboprophylaxis.

Anti-embolism stockings

Anti-embolism stockings are thigh- or knee-length garments made from elastic with a graduated compression profile that gently compresses the leg to aid venous return in non-ambulatory patients. NICE (2010) recommends using stockings that produce a calf pressure of 14-15mmHg, as this profile has been shown to reduce the incidence of deep vein thrombosis (DVT). The procedure for applying anti-embolism stockings is outlined in Box 2.

For how long should stockings be worn?

Amaragiri and Lees (2000) reviewed clinical trials involving anti-embolism stockings and found wide variation in the length of time for which they should be worn; this ranged from six to 14 days.

NICE (2010) advises that clinicians should "encourage patients to wear their anti-embolism stockings day and night until they no longer have significantly reduced mobility". Patients should be given both verbal and written advice when discharged from hospital and be shown how to use stockings safely. Patients discharged with stockings should know how to access help if they experience any issues after discharge.

For how long can stockings be removed?

Although no studies have looked specifically at how long patients can be without stockings for them to remain effective at

5 practice points

1. The use of anti-embolism stockings and intermittent pneumatic compression devices is common in acute hospital settings
2. As health professionals are often unclear about how best to use stockings and IPC devices, their use varies widely
3. Patients must be assessed to ascertain whether stockings or IPC devices are suitable treatment options
4. Patients treated using stockings must have their legs checked regularly for skin damage
5. Professionals must be trained and competency assessed to ensure they know how to use stockings appropriately

Anti-embolism stockings aid venous return in non-ambulatory patients

preventing DVT, one study found that venous distension starts to occur 30 minutes after stockings have been removed (Coleridge Smith et al, 1991).

Venous distension is thought to cause subendothelial tears and activate clotting factors, which may lead to thrombus formation (NICE, 2010).

Do stockings cause skin damage?

With any compression there is a risk of skin damage. Ulceration and damage to the heel is a recognised complication of anti-embolism stockings if applied incorrectly, especially to patients who are vulnerable (Merrett and Hanel, 1993). NICE (2010) recommends that stockings should be removed to check for skin damage:

- Up to three times daily in those most at risk of skin damage;
- At least once daily for all other patients.

Skin checks should be recorded in the patient's clinical notes along with the leg measurements and size of stocking.

Stockings should be discontinued and the patient's medical team informed so that suitable alternatives can be considered if there is any:

- Marking;
- Evidence of skin damage;
- Pain or discomfort.

Remeasuring patients' legs, particularly in the event of swelling or oedema, to ensure their stockings are the correct size, also contributes to risk reduction.

Should qualified nurses decide which patients use stockings?

Nurses should use a VTE risk assessment and local thromboprophylaxis guidelines to establish whether stockings are indicated for individual patients. They should then assess those patients for contraindications before proceeding. Merrett and Hanel (1993) demonstrated the importance of applying stockings correctly to ensure they are in an optimum position to be effective in reducing DVT and to minimise the risk of skin damage. Nurses therefore require training and assessment to guarantee the stockings are used appropriately.

When should thigh- or knee-length stockings be used?

A recent series of clinical trials known collectively as the CLOTS – Clots in Legs or sTockings after Stroke – trial (CLOTS Trial Collaboration, 2010) aimed to evaluate the effectiveness of mechanical compression in reducing VTE in patients who had experienced a stroke. The second of these trials, CLOTS 2, demonstrated a significant reduction in DVT formation in patients using thigh-length stockings compared with knee-length ones. Individual patient factors such as leg size and shape, comfort and hygiene are considerations when choosing stocking length (NICE, 2010). However, the evidence supporting thigh-length stockings should be a factor in the decision-making process.

Can stockings be used with patients who have wounds?

NICE (2010) guidance states that: "Caution and clinical judgement should be used when applying stockings over venous ulcers and wounds."

It is important to rule out arterial insufficiency as a cause for the wound, as compression in this instance would inhibit peripheral arterial blood flow, potentially resulting in ischaemia. Although there is evidence that compression can aid the healing of venous ulcers, the effective pressure profiles of compression bandages and stockings are different to that offered by anti-embolism stockings (Johnson, 2002).

Patients with a wound need stockings to be removed and the skin to be checked for any sign of damage or deterioration at least three times a day. Careful documentation of the wound size and characteristics is required to ensure deterioration can be identified on routine checks. If deterioration occurs, stockings should be removed immediately and other options considered.

From what age can stockings be worn?

The annual incidence of VTE in children is estimated to be 0.7-1.0 per 100,000 people, with a prevalence of 5.3 of 10,000 hospital admissions (Andrew et al, 1994). Mechanical methods of thromboprophylaxis may be applicable in older or larger children – usually weighing more than 40kg – who have significant VTE risk factors, (Chalmers et al, 2011).

Outcome data for the paediatric population exists for prevention of DVT (Monagle et al, 2008) but anti-embolism stockings have never been shown to reduce the incidence of pulmonary embolism or death in children. Nurses should ensure the decision process for whether to apply stockings in children at high risk of VTE is clearly documented.

IPC devices

Intermittent pneumatic compression devices consist of inflatable sleeves that wrap around the legs or feet, attached with tubing to a machine that inflates the sleeves intermittently. This compression promotes blood to return to the heart from the limb. It is thought that IPC reduces the risk of VTE by preventing venous stasis and stimulating the release of fibrinolytic factors in the blood (Kohro et al 2005). It is used in patients who cannot move.

What is the right length of IPC sleeve?

Although there is evidence that thigh-length sleeves offer superior haemodynamic effects compared with knee-length versions (Patterson and Cardullo, 2013), convincing outcome data to prove superiority does not yet exist. NICE (2010) states that thigh- or knee-length sleeves can be used so nurses should use their clinical judgement to assess factors, such as comfort, to select the length of sleeve most suitable and tolerable for the patient. Documentation of this decision should be recorded in the patient's clinical notes.

Can qualified nurses decide which patients use IPC?

Nurses can use the outcome of VTE risk assessments and local thromboprophy-

BOX 1. CONTRAINDICATIONS FOR ANTI-EMBOLISM STOCKINGS

Do not offer anti-embolism stockings to patients who have:

- Suspected or proven peripheral arterial disease
- Peripheral arterial bypass grafting
- Peripheral neuropathy or other causes of sensory impairment
- Any local conditions in which stockings may cause damage, for example fragile "tissue-paper" skin, dermatitis, gangrene or recent skin graft
- Known allergy to the material of manufacture
- Cardiac failure
- Severe leg oedema or pulmonary oedema from congestive heart failure
- Unusual leg size or shape
- Major limb deformity preventing correct fit

Use caution and clinical judgement when applying anti-embolism stockings over venous ulcers or wounds.

Source: National Institute for Health and Care Excellence (2010)

Nursing Times Learning

For a Nursing Times Learning unit on venous thromboembolism, go to **www.nursingtimes.net/VTE**

BOX 2. USING ANTI-EMBOLISM STOCKINGS

- Identify whether anti-embolism stockings are indicated by assessing the patient's risk of venous thromboembolism and bleeding.
- Assess for contraindications to anti-embolism stockings (see Box 1)
- Decide what length of stockings to apply, taking into consideration:
  - Clinical judgement
  - Patient preference
  - Concordance
  - Compliance
  - Surgical/wound site
  - Gain informed patient consent for treatment with anti-embolism stockings
  - Measure the patient's legs to find the correct size, noting that different sizes for each leg may be needed; this can be done with the patient in bed or standing

Thigh-length stockings

- Measure the circumference of both thighs at their widest point
- Measure the circumference of both calves at their widest point
- Measure the distance from the gluteal furrow (buttock fold) to the heel

Knee-length stockings

- Measure the circumference of both calves at their widest point
- Measure the distance from the popliteal fold (back of the knee) to the heel

All stockings

- Select the correct stockings using the manufacturer's measurement table
- Apply the stockings to the patient's legs
- Teach the patient how to apply and remove the stockings and ensure they understand that the stockings will reduce the risk of VTE
- Monitor the side-effects of anti-embolism stockings
- Ask the patient to report any feelings of numbness, tingling, pain or discomfort
- Remove stockings daily for washing and inspect skin condition, particularly over the heels and bony prominences. Patients with significantly reduced mobility, poor skin integrity or sensory loss should have their skin checked two or three times per day
- If there is evidence of marking, blistering or skin discolouration, or if a patient experiences pain, discontinue the use of anti-embolism stockings and consider alternative mechanical thromboprophylaxis
- Remeasure legs if the patient develops swelling or oedema
- Advise the patient to wear anti-embolism stockings day and night until their mobility is no longer significantly reduced
- Complete documentation
- If the patient needs stockings on discharge, provide verbal and written information as per the manufacturer's instructions on caring for the stockings and checking the patient's skin

Source: Gee (2011)

laxis policies to inform whether IPC is indicated in individual patients. Nurses who have received training on the use of IPC devices are well placed to assess patient suitability. Training should include assessment of contraindications to IPC. An important contraindication is clinical suspicion of VTE due to the perceived increased risk of embolisation from the compression device. Nurses must ensure they have assessed patients for signs and symptoms of VTE before applying IPC.

Can IPC be used instead of stockings in the presence of heel ulcers?

There is evidence suggesting that IPC has a positive impact on venous ulcers so an IPC device could be used as thromboprophylaxis as long as the aetiology of the ulcer has been confirmed as venous and not arterial (Nelson et al 2014; Dolibog at el, 2013), unless otherwise specified by the manufacturer. This is important as any sort of compression in the presence of arterial disease could cause further restriction to peripheral blood flow. It may be necessary to consider using a pressure-relieving heel product in combination with the IPC.

Conclusion

Our work has highlighted the need for standardisation in the use of anti-embolism stockings and IPC as well as empowering nurses to make clinical decisions on an individual basis by giving them the necessary skills and knowledge. In many cases, diligent monitoring is key to ensuring that mechanical thromboprophylaxis does not harm patients.

The work has also highlighted that the evidence base is still lacking in certain areas such as the optimum length of a stocking or sleeve, the paediatric population and the time a device can be safely removed for. More work needs to be done to address this. Nurses and midwives should have access to expert resources for help with these more complex decisions. **NT**

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