Use and application of graduated elastic compression stockings


Summary

As part of *Nursing Standard’s* clinical skills series, this article discusses how to apply graduated elastic compression stockings, which are used as a prophylactic method to prevent deep vein thrombosis and its more serious complication, pulmonary embolism.

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PE can lead to post-thrombotic venous insufficiency and possibly pulmonary embolism (PE), a potentially fatal event (Nicolaides 1997, Nicolaides et al 2001).

It is well recognised that patients who undergo operations or who are not ambulatory for prolonged periods of time are at risk of developing venous thromboembolic disease (Colditz et al 1986, Clagett and Reisch 1988, Collins et al 1988, Bergqvist and Lindblad 1994). Risks increase because of the patient’s condition, age and weight, and because of peri-operative factors, including length of surgery and type of anaesthesia used.

Graduated elastic compression stockings

Evidence from the literature indicates that graduated elastic compression stockings reduce the risk of DVT (Agu et al 1999, Amaragiri and Lees 2000, Barker and Hollingsworth 2004). Graduated elastic compression stockings work by reducing venous capacity and increasing venous velocity in the deep veins, thus reducing venous stasis (Agu et al 1999). Based on the work of Lawrence and Kakkar (1980) and Sigel et al (1973), graduated elastic compression stockings have been designed to deliver a gradient of external pressure, which is highest in the ankle region and lowest in the upper thigh region. These pressures are defined as 18mmHg at the ankle, 14mmHg at the calf, 8mmHg at the knee, 10mmHg at the lower thigh and 8mmHg at the upper thigh, although these can vary slightly depending on the hosiery manufacturer (Sparrow et al 1995, Agu et al 1999, Hameed et al 2002).

Patient assessment

Tools: It is important for nurses and clinicians to use an assessment tool to help identify patients who are at risk from DVT and who need appropriate but standard prophylaxis. However, only one such tool was evident in the literature and the authors did not feel that this tool would be effective in the trust’s clinical setting. Individual institutions may therefore wish to develop their own tools. The authors have recently developed an assessment tool, which is currently being validated.

Contraindications: It is essential to assess patients thoroughly before stocking application. For example, patients with peripheral arterial disease or diabetic neuropathy are at significant risk of impairment of subcutaneous tissue oxygenation if graduated elastic compression stockings are applied. It is, therefore, essential that these patients are assessed and excluded (Agu et al 1999). Manufacturers also advise against the use of stockings where the ankle brachial pressure index is less than 0.7, so assessment using Doppler ultrasound is recommended (McCollough 2001). McConnell (2002) recommends that stockings should not be applied if the patient has severe peripheral arterial occlusive disease, extreme leg deformity, massive leg oedema or pulmonary oedema due to heart failure. This is in agreement with the work of Collier (1999), who states that anti-embolic stockings should not be used in patients with known gangrenous conditions affecting the limb, vascular disease resulting from...
Congestive heart conditions, nor should they be used if the thigh circumference exceeds the size specified in the fitting instructions.

Although the ideal is that all patients should have Doppler assessment before application of graduated elastic compression stockings, it is recognised that this is impractical and trusts will need to develop their own risk assessments and policies.

Correct fitting. Byrne (2001) indicates that before application, limbs must be measured to ensure that stockings are applied and worn correctly, and warns that stockings that cannot be worn correctly should not be worn at all. Ill-fitting stockings have been associated with heel ulcers and gangrenous areas on the feet, especially if the patient has indications of circulatory and sensory impairment (Kay and Martin 1986, Merrett and Hanel 1993).

Hui et al (1996) found that thigh and below-knee stockings were often poorly applied, with Byrne (2001) reporting that thigh-length stockings, in particular, are frequently rolled or folded back down the leg to make them fit. This can create a tourniquet effect and lead to greater pressure being exerted around the leg, resulting in a reversed gradient of venous blood flow, as well as skin damage. Heath et al (1987) reported case studies of patients who acquired arterial thrombosis from the pressure of multiple layers of stocking caused by the tourniquet effect of a tightened band of graduated elastic compression stockings at the top of the thigh. Lawrence and Kakkar (1980) demonstrated that pressures approaching 30mmHg led to a progressive fall in subcutaneous tissue flow and a reduction in deep venous velocity, showing why correct measuring and fitting of stockings is crucial. The technique for applying graduated elastic compression stockings is shown in Figure 1.

Ongoing care. No consensus could be found from the literature on how often stockings should be removed and the skin inspected. Byrne (2001) states this should be done daily. McConnell (2002) advises that stockings should be removed every eight hours, and Collier (1999) suggests twice a day. In no case was evidence given to support these recommendations. It could be argued that checking stockings more than once in a 24-hour period is impractical. However, if there is any cause for concern in a particular patient, these checks should be increased as appropriate. It is important that the limbs are re-measured and the results compared with the previous measurements.

Local policy protocols are good indicators for determining how often stockings should be removed, checking the patient’s skin condition and for recommending the frequency of re-measuring. The importance of checking the limbs regularly to avoid ischaemic complications, particularly in the high-risk older population, cannot be overstated (Benko et al 2001).

Particular care should be taken with patients who have oedema to ensure the stockings are fitted correctly, as these patients are at risk of impaired blood circulation, localised pressure areas and iatrogenic DVT formation (Byrne 2001). Merrett and Hanel (1993) suggest that when wearing graduated elastic compression stockings, an increase of 5cm in the circumference of a limb can double the amount of pressure being applied by the stocking and, in effect, create a tourniquet.

For patients who lose weight, re-measuring the patient’s legs is important to ensure correct fitting of the stockings, as if they are loose and baggy they will have no therapeutic effect.

There is no guidance from either the manufacturers or the literature on how long a patient should continue to wear stockings (Hayes et al 2002). Thomas et al (2000) state there is strong evidence that graduated elastic compression stockings are only beneficial to patients who are not ambulant, as stockings have insufficient elasticity to prevent the pooling of blood in a patient who is standing or walking. It is important to document in the patient’s records when the use of stockings was discontinued.

When planning to discharge a patient from the care setting, the nurse should give serious consideration to whether the patient should be discharged home with stockings. These decisions should only occur following an assessment to ensure that the patient is able to understand or comply with instructions on the correct way to wear the stockings. If a patient is unable to do so then an alternative prophylactic method may need to be considered (Heath et al 1987, Benko et al 2001). This would include medication or an appropriate exercise regimen. It is crucial that the nurse gives the patient adequate instruction and explains the importance of following these instructions carefully.

Advice to patients. Patients need to be educated in the reasons for the use of graduated elastic compression stockings and their correct application. They also need to be given the manufacturer’s instruction leaflet (Hayes et al 2002), although this is not included in many brands of stockings and may need to be drawn up locally or requested from the manufacturer.

It is important that the patient is advised not to roll the stockings down or use oily substances on the skin, as this can have an adverse effect on the elastic within the stockings (Collier 1999). Stockings can be washed (Thomas et al 2000) and this will not adversely affect the stocking.
pressures so long as the manufacturer’s recommendations are followed. Collier (1999) suggests changing the stockings every two to three days and laundering them to a temperature of 95°C. They should then be air dried, as tumble drying can affect the elasticity of the material. The process of washing, drying and reuse can occur up to 20 times, although Collier (1999) does advise that the manufacturer’s recommendations should be followed closely. Individual organisations should consider the practicality of washing the graduated elastic compression stockings for the patient and devise their own policies.

Box 1 outlines the procedure for fitting graduated elastic compression stockings.

FIGURE 1
Techniques for applying graduated elastic compression stockings

a) Take one stocking and insert your hand into the stocking as far as the heel. Pinch the centre of the heel between your thumb and fingers and pull the top of the stocking down to turn the stocking inside out, down to the heel area.

b) With both hands, one at each side of the stocking, carefully slide the stocking over the patient’s foot and heel making sure that the heel is located in the heel pocket.

c) Grasp the top of the stocking and pull the body of the stocking up around the ankle and calf (over the knee and up the thigh if full-length stockings are being used) until the stocking is fully applied.

d) Smooth out any wrinkles. Pull toe section forward to smooth ankle and instep areas. Check the fitting of the elastic stocking top that it is not too tight or too loose, as this indicates that the wrong size stockings have been applied. Repeat for the other leg.
Fitting graduated elastic compression stockings

Preparation of patient and equipment

**Materials required for fitting graduated elastic compression stockings**
- Local assessment tool (if available).
- Single-use tape measure.
- Selection of graduated elastic stockings.
- The manufacturer’s measurement and size guide for the type of stocking in use.

Have available the following application aids (if your hospital provides them):
- Single-use ‘slip socks’ for the patient.
- Metal stocking applicator.

It is essential that staff applying graduated elastic compression stockings are properly trained in their application in general terms and in specific requirements for individual brands.

**The procedure**

1. Before commencing any procedure it is important to explain to the patient what you are about to do and why.
   **Rationale:** This is so that he or she is fully informed about the procedure and can give informed consent.

2. Assess the patient to decide whether or not to fit anti-embolism stockings, using an assessment tool (if recommended in local policies) to assist with the decision. This should then be documented in the patient’s records.
   **Rationale:** This is so that any contraindications for using anti-embolic stockings, using an assessment tool (if recommended in local policies) to assist with the decision. This should then be documented in the patient’s records.

3. If there are any contraindications or questions that arise from the assessment which makes the decision to fit stockings difficult, then this should be discussed with medical staff.
   **Rationale:** The fitting of stockings is risky if applied to a patient with medical conditions that contraindicate the use of graduated elastic compression stockings (Agu et al 1999). It is best to check with medical staff immediately rather than apply stockings incorrectly to a patient who should not have them.

4. Ask the patient to lie on the bed with legs straight (legs cannot be measured with a patient sitting in a chair).
   **Rationale:** Gravity and muscular action deform the legs’ natural resting shape when the patient is in the sitting position and so could potentially provide incorrect measurement information. The lying position also makes stocking application much easier.

5. Expose the patient’s legs by removing all socks, stockings and pyjamas (the latter is only necessary if applying thigh-length stockings). Maintain the patient’s dignity throughout.
   **Rationale:** This is because the legs need to be measured to assess the correct size of stocking. Measurements obtained over the top of clothing could lead to the patient receiving the wrong size stockings.

This also provides the nurse with an opportunity to assess the patient’s skin condition and to see if there is any damage, such as pressure ulceration.

6. Using a single-use tape measure, measure the patient’s legs according to the manufacturer’s instructions.
   **Rationale:** Single-use tape measures prevent cross-infection.

Each manufacturer may require that measurements are taken from different parts of the limb. It is essential that this guidance is followed accurately to ensure that the patient receives the right size stockings.

McConnell (2002) maintains that each leg must be measured and states that where the leg measurements are different, then two different sizes of stocking need to be fitted to ensure the correct fit on each leg.

7. The patient’s leg measurements, type and size of stocking, and date the stockings were applied must be documented in the patient’s records.
   **Rationale:** It is important that there is a record of the care decisions made in selecting the stockings. It is also important that staff reassessing the patient have a benchmark from which to work. The record can indicate that there may be some underlying physical or medical problem if the patient’s limbs increase or decrease in size.

8. Using the manufacturer’s size measurement chart for the brand of stocking being fitted, choose the correct size of stockings.
   **Rationale:** Each manufacturer has a different methodology for what measurements need to be taken and the size that needs to be selected. It is important that the correct chart is used and the guidelines followed accurately, to ensure a correct fit.

9. After selecting the correct size stockings, follow the procedure outlined in Figure 1.
10. Help the patient to put on pyjama bottoms and slippers, if necessary.
    **Rationale:** To preserve the patient’s dignity. stockings are slippery if worn without footwear. To prevent patient falls, slippers or footwear should be worn at all times if the patient is ambulant.

11. If there is an available patient leaflet, read through this with the patient. Check his or her understanding and offer explanations as appropriate.
    **Rationale:** This gives you the opportunity to talk the patient through the importance of wearing graduated elastic compression stockings and also to explain how to look after them.
Conclusion

Graduated elastic compression stockings are not the low-risk intervention that it is commonly believed they are and to ensure therapeutic benefit and prevent complications, certain conditions must be satisfied. The patient must be assessed for potential complications, and if the decision is taken to apply stockings, it is essential they are fitted appropriately by nursing staff following standardised protocols for measurement and application.

Although complications with graduated elastic compression stockings are rare, they are generally avoidable through proper patient assessment and correct fitting (Agu et al 1999).

A final area that needs to be addressed is how often the stockings should be checked when being worn by the patient. As stated, there is no obvious guidance in the literature. Therefore, the authors propose that initially, patients should be checked on a daily basis. If there is any cause for concern in a particular patient, these checks should be increased as appropriate for that patient.

To ensure concordance, it is essential that patients are educated in the reasons for wearing stockings and their correct application and use. Concordance can be increased by giving the patient the manufacturer’s instruction leaflet NS

References


