Early intervention is the key to success

How to avoid the progression of venous and lymphovenous disease

An educational supplement in association with
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Strategies to prevent the progression of venous and lymphovenous disease

Ongoing disruption to the normal flow of venous blood will result in oedema. If the lymphatic system is unable to remove this excess fluid, the condition will become chronic. Left untreated, the symptoms of venous and lymphovenous disease will increase in severity. Early identification and treatment is therefore vital to delay or control this progression to a more advanced disease state. This involves the use of simple management strategies such as compression hosiery.

Chronic oedema can have devastating consequences for patients and their families, yet in many cases its onset can be slowed down or even prevented. It is associated with venous and lymphovenous disease, whose symptoms become progressively worse if not promptly identified and treated. These symptoms can range from the minor skin changes and mild swelling associated with the early stages of the disease process, to the grossly swollen limbs and enhanced skin folds of severe chronic oedema. This supplement describes the causes of chronic oedema, how to identify the early signs and symptoms, and which early interventions, such as compression hosiery, can help prevent a subsequent deterioration.

The circulatory system

The circulatory system comprises the arterial, venous and lymphatic systems.

Arterial system

Blood is pumped away from the heart through the arterial system, delivering oxygen and nutrients throughout the body. The arteries branch into smaller and smaller vessels until they become capillaries. The walls of capillaries are just one cell thick, allowing nutrient and oxygen-rich fluid to filter through them into the tissue spaces. The cells in the tissue spaces absorb the oxygen and nutrients, and excrete waste products and carbon dioxide. Some of these waste products are filtered back into the circulatory system at the venous end of the capillary, while the larger molecules are returned by the lymphatic system (Tortora and Grabowski, 2000).

The venous system

Veins return deoxygenated blood to the heart. The venous system in the legs is comprised of superficial and deeper systems of veins, which are connected by the perforators (Figure 1), so-called because they ‘perforate’ the fascia that encapsulates the leg muscles.

Blood in the veins of the lower limbs not only has to travel a long way to reach the heart, but also has to flow upwards against gravity. To achieve this, unidirectional valves in the lumen of the lower leg veins open when blood is flowing upward and close to prevent backflow. Similarly, the valves in the perforator veins open to allow blood to flow towards the deeper veins and close to prevent its backflow into the superficial veins (Figure 2). The valves in the leg operate mainly as a result of calf muscle action. As skeletal muscles contract, they squeeze the veins passing through them, which increases venous blood pressure. This causes the valves to open, and the increased pressure forces the blood upwards. Relaxation of the muscles causes the valves to close, preventing backflow of blood (Tortora and Grabowski, 2000; Foldi et al, 2003). The network of veins and arteries in the leg is illustrated in Figure 3.
The lymphatic system

The lymphatic system is a single direction drainage system that spreads throughout the entire body. The lymphatic journey starts in the tissue spaces at the capillary bed, with the superficial lymphatics lying just below the skin surface. These absorb waste products, which are then transported through the lymphatic system back to the venous system.

The initial lymphatics are blind-ended vessels (i.e. have a sealed end) that are slightly larger than capillaries (Figure 4). They are situated in the tissue spaces all over the body and are supported by anchoring filaments that allow the vessel walls to open and close. The initial lymphatics absorb excess water and waste products, especially protein and fat molecules, that are too large to enter the venous end of the capillaries.

Once this fluid enters the lymphatic system, it is called lymph and is transported first into pre-collectors and then into larger collector vessels. Smooth muscle in the vessel walls of the collectors pumps the lymph along, and valves ensure there is no backflow. External muscular activity in the form of moving and breathing also encourages venous and lymphatic return (Tortora and Grabowski, 2000; Foldi et al, 2003).

There are approximately 500 lymph nodes all over the body and the lymphocytes produced within them kill bacteria/viruses. Once through the nodes, the filtered lymph returns to the circulation via lymph trunks and lymphatic ducts. The lymph then enters the venous system at the right and left subclavian veins. The right duct carries lymph drained from the right side of the head and neck, the right arm, lung and right side of the heart. The left duct carries the lymph drained from the rest of the body.

Causes of oedema

Any disruption to the normal flow of venous return will result in oedema (Williams, 2009). This disruption can be due to pathological changes within the venous system or to more extrinsic factors.

The main intrinsic cause is chronic venous insufficiency (CVI), which refers to the impaired flow of venous blood from the legs to the heart. During prolonged periods of standing or immobility, the calf muscle pump is largely inactive. This, combined with the effects of gravity, results in blood pooling in the distal veins, which can lead to
inefficient valvular action and venous hypertension. The latter largely occurs when ineffective valves in the perforator veins allow blood to flow back into the superficial veins (venous reflux), increasing the pressure there. Sustained venous hypertension increases capillary filtration, resulting in greater volumes of fluid in the interstitial spaces (Mortimer and Levick, 2004). The result is oedema.

In some patients, there is normal muscular activity but, due to hereditary venous disease or age-related factors, valvular incompetence occurs. Other causes of this are postoperative or post-traumatic fibrosis (thickening and scarring of connective tissue), post-thrombotic syndrome and chronic intravenous drug abuse (Anderson, 2008a).

Chronic venous hypertension (CVH) is the underlying cause of approximately 70% of venous leg ulcers (Morrison and Moffatt, 2004). Risk factors for CVH are listed in Table 1.

Chronic oedema is persistent swelling that has been present for more than 3 months, indicating that the lymphatic and venous systems cannot cope with the high level of fluid in the interstitial spaces. In addition to CVI, other causes of chronic oedema are:

- Prolonged immobility/leg dependency
- Obesity, where the weight of the intra-abdominal bulk exerts pressure on the inguinal vessels, making venous and lymphatic return from the legs less effective (Todd, 2009)
- Medication that increases the level of capillary filtrate, with fluid-retaining side effects (e.g. non-steroidal anti-inflammatory drugs [NSAIDs], drugs used for neuropathic pain and calcium channel blockers) (Keeley, 2008)
- Chronic organ failure, primarily cardiac, renal and liver failure, all of which result in oedema.

The term ‘chronic oedema’ encompasses venous oedema, lymphovenous oedema, dependency oedema and lymphoedema. Chronic oedema should not be confused with true lymphoedema, which is caused by a mechanical failure of the lymphatic system and is not directly related to excessive fluid in the interstitial spaces (high output). Causes of lymphoedema are given in Table 2. Patients with chronic oedema are often misdiagnosed with lymphoedema, resulting in inappropriate referrals to specialist lymphoedema services (Todd et al, 2008; Hopkins, 2010).

### Table 1. Risk factors for chronic venous hypertension (Anderson, 2008a)

- Occupations that involve standing for long periods of time
- Prolonged heavy lifting
- Obesity
- Low-fibre diet resulting in constipation
- Pregnancy
- Smoking

### Venous and lymphovenous disease progression

It is essential that early venous and lymphovenous disease is recognised and appropriate treatment is initiated to slow and control its progression to a more advanced state. Early in the disease progression, skin changes and mild swelling may be present, along with mild signs of venous hypertension. Leg elevation may result in complete or partial reduction in the swelling. If left untreated, chronic venous and lymphovenous disease will progress along a continuum of increased swelling and chronic inflammatory skin changes. The physical and psychosocial effects of this can be marked. Therefore, early identification, diagnosis and intervention are the cornerstones of proactive management of chronic venous and lymphovenous disease.

A venous and lymphovenous disease progression tool was developed by Timmons and Bianchi (2008) to highlight the signs that clinicians should look for during their day-to-day contact with patients — for example, when washing legs and feet, changing bandages, applying dressings and fitting hosiery — and to help clinicians undertake a comprehensive assessment that will identify the treatment decisions required to manage or delay the disease progression.

### Table 2. Causes of lymphoedema

- Surgical removal of lymph nodes (e.g. in the treatment of cancer)
- Radiotherapy to nodal areas
- Tumour blockage (e.g. in advanced cancer)
- Congenital developmental fault in the lymphatic system (primary lymphoedema)
- Infection (e.g. cellulitis, filariasis, insect bites)
- Inflammatory conditions (e.g. dermatitis, eczema, rheumatoid arthritis)
- Injury and trauma (e.g. skin burns, skin grafts)
Characteristics of the early stages of venous and lymphovenous disease

Chronic pooling in the superficial veins causes over-stretching and loss of elasticity, with the valves being unable to close properly. Signs and symptoms associated with these malfunctions are:

- Spider or thread veins — these result from mild venous hypertension (Figure 5)
- Bulging veins — may only be visible while the patient is standing, when venous hypertension is increased. This is relieved by leg elevation
- Ankle flare — distension of the small veins on the medial aspect of the foot as a result of venous hypertension (Figure 6)
- Mild/moderate varicose veins — caused by chronic pooling and stretching of the superficial veins
- Venous dermatitis — itching caused by stagnant blood components that have leaked from the veins into the interstitial spaces (Figure 7)
- Mild oedema with aching legs — this may be more apparent after prolonged periods of standing. Leg elevation (usually overnight) and exercise can relieve these symptoms
• Haemosiderin staining — blood components, especially iron, that have leaked from incompetent veins into the tissue spaces, resulting in a brown staining of the skin (Figure 8).

Approximately 94% of people with venous and lymphovenous disease experience skin changes (Herrick et al, 2002).

**Characteristics of mid-term disease**

If the early stages are not managed effectively, a failure in the venous system will occur (Anderson, 2012) with the following symptoms:

• Atrophie blanche — tiny, white scarred areas, which are thought to be caused by poorly vascularised tissues, and are very painful and susceptible to trauma (Figure 9)

• Ulceration — caused by underlying venous and/or arterial disease

• Severe varicose veins (Figure 10)

• Chronic oedema — initially characterised by soft pitting. If left untreated, it will become hard and fibrosed as the inflammatory skin changes develop (Figure 11)

• Hyperkeratosis — thickening of the stratum corneum, which causes thick, waxy, scaly skin. Varies in colour from yellow to brown (Figure 12).

**Characteristics of chronic disease**

Prolonged, untreated venous and lymphovenous disease has the following symptoms:

• Enhanced skin folds — caused by over-stretching of skin due to oedema. Ankles and toes are mainly affected, but the mid-calf and knee can also be involved (Figure 13)

• Papillomatosis — blind-ended superficial lymphatic vessels swell due to back pressure and protrude through the skin (Figure 14)

• Lymphorrhoea/exudate — if there is oedema and a break in the skin (sometimes too small to be visible to the naked eye), fluid can leak onto the skin surface. This is often called ‘wet legs’ (Figure 15)

• Cellulitis — infection of the skin and soft tissue caused by bacterial infiltration of the stagnant protein-rich fluid. It is usually caused by group A streptococci, but may also involve *Staphylococcus aureus*, especially if folliculitis is present (British Lymphology Society, 2010) (Figure 16)

• Lipodermatosclerosis — fibrosis and induration of the skin around the ankle area, caused by prolonged inflammation, giving a ‘woody’ feel, especially around the ankle. If allowed to progress, this results in the ‘upturned champagne bottle’ shape of the leg (Figure 17).

**Impact of chronic oedema**

Living with chronic oedema can be devastating for the patient and his or her family. Having to adapt clothing/footwear, disguise large and unsightly limbs, and deal with exuding wounds is embarrassing and affects body image, self-esteem and personal relationships (Moffatt et al, 2003; Persoon et al, 2004; Briggs and Fleming, 2007). Many patients experience loss of control, fear and depression. Despite this, only 3% receive psychological support (Moffatt et al, 2003). Physical effects include long-term pain in the limb (Moffatt et al, 2003) and impaired mobility due to the extra weight of the legs and wearing ill-fitting or unsuitable footwear to accommodate the swelling. Patients with mobility problems or restricted movement due to arthritis or obesity may have difficulty reaching their feet when washing or applying hosiery. Exaggerated skin folds not only encourage fungal infection, but can also cause hosiery to gather and tourniquet. Repeated attempts to pull up hosiery can damage the skin. The physical and psychological aspects of chronic oedema culminate in social isolation and reduced employment opportunities (Moffatt et al, 2003).

**Assessment**

Intervention can slow or control the disease progression, avoiding or alleviating these symptoms. It is vital, therefore, that a holistic assessment is undertaken (Table 3). The key components of this are outlined below.

**History taking**

The medical history should include previous or current problems, such as arthritis, cancer, cardiac or renal problems, venous disease, and surgery for varicose veins, all which may result in damage to the venous/lymphatic systems. Current or recent medication should be recorded as some drugs may cause or exacerbate oedema (Keeley, 2008). There may be scope to alter the patient’s medication regimen,
and this should be discussed with his or her GP or, if significant disease is present, with a specialist or other member of the multidisciplinary team.

Patients should also be asked if they have gained weight or reduced their level of physical activity. Any changes in activity or lifestyle should be noted.

A family history must be taken when considering hereditary conditions such as primary lymphoedema or venous disease. It is also essential to establish whether the onset of the swelling was sudden or gradual. Sudden onset swelling may have an acute aetiology, such as cancer or deep vein thrombosis (DVT), in which case an urgent referral should be made. The patient should be asked if they were any known precipitating factors such as an insect bite, injury or recent cancer treatment.

Any previous treatment of the swelling must be documented, along with details of who performed it and the outcome, as previous negative experiences with compression and negative staff attitudes can affect concordance with treatment (Bale and Harding, 2003; Edwards, 2003; Miller et al, 2011).

Any allergies should be recorded. A small number of patients are allergic or sensitive to some components of compression hosiery, including latex, in which case an alternative garment should be used or a cotton liner applied (Doherty et al, 2009).

**Pain assessment**

Some patients with venous leg ulcers and oedema will experience pain. A thorough pain assessment should be performed and cover the type of pain and its location, any current analgesia used and its effectiveness, and any exacerbating or alleviating factors. A pain assessment tool such as the McGill pain tool (Billingham, 2007) should also be used.

**Physical examination**

Observation of the legs in the standing position will reveal early symptoms of venous disease (slightly bulging veins) that may not be visible when the patient is supine (Timmons and Bianchi, 2008). The limbs should be palpated to assess whether or not the oedema is soft and pitting or if there is fibrosis. If the swelling extends to the thigh, palpation and visual assessment should continue to the truncal area to exclude swelling there. The absence or presence/extent of any skin changes in the leg should be documented. This is particularly important when staging the disease progression.

**Ruling out compression**

Arterial disease is also likely to be present in many older patients with venous disease and chronic oedema (Burns et al, 2003). Signs and symptoms of peripheral arterial disease are listed in Table 4. Compression therapy is contraindicated in patients with moderate and severe arterial disease.

To rule out arterial insufficiency, a comprehensive vascular assessment must be carried out, which should include palpation of the pulses of the foot, measurement of the limb temperature and capillary refill time of the toes. A Doppler assessment should also be performed to determine if it is safe to use compression (Royal College of Nursing, 2006; Scottish Intercollegiate Guidelines Network [SIGN], 2010a). However, it can be difficult to obtain an accurate Doppler reading in patients with morbid obesity or significant oedema (Doherty et al, 2009) unless an appropriately sized blood pressure cuff is available. If Doppler assessment is not possible, alternative options are calculating the brachial pressure index (Vowden and Vowden, 2001; Doherty et al, 2009) and pulse oximetry (Bianchi, 2009), but these must be performed by

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**Table 3. Components of assessment**

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<th>Psychosocial assessment</th>
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trained specialists only. If there are concerns about arterial status, confirmation should be sought from a vascular surgeon (Billingham, 2007).

Compression therapy should not be applied to patients with unstable cardiac or renal disease as it may increase the fluid load on already compromised organs. Application should therefore be delayed until the condition has been stabilised (Foldi et al, 2003).

Management of early and mid-stage disease

Compression hosiery can help stop the early and mid-term stages of venous and lymphovenous disease deteriorating further (Timmons and Bianchi, 2008; see also the Guide to Compression Hosiery Selection on page 11). Severe symptoms may require more specialist intervention, such as compression bandaging. Effective graduated compression is delivered by hosiery that provides 100% pressure at the ankle, with the pressure gradient reducing gradually along the length of the garment. This graduated pressure supports the weakened valves, improving their function and reducing venous hypertension. However, as the hosiery cannot repair the damaged valves, it must be worn long term.

Compression hosiery has the following benefits (Bates et al, 1992; Tortora and Grabowski, 2000; Foldi et al, 2003; Partsch and Jünger, 2006):

- Supports the calf muscle pump
- Prevents venous dilation during walking/standing, avoiding backflow and venous hypertension
- Increases the velocity of venous blood flow, which prevents leucocytes becoming trapped, with subsequent inflammatory skin changes
- Reduces valvular insufficiency, thereby preventing backflow of blood
- Reduces capillary filtration and, therefore, the lymphatic load
- Increases interstitial pressure, which results in oedematous fluid being re-absorbed into the venous and lymphatic system
- Stimulates lymphatic contractions
- Speeds up healing of any ulcer present by improving blood flow and delivery of nutrients to the skin
- Breaks down fibrosclerotic tissue.

Compression hosiery

Fitting hosiery is part of the management of venous disease and its sequela, oedema. Wrongly prescribed or ill-fitting garments can damage the limb — for example, by gathering in skin folds, which would damage the skin and cause discomfort — and thus affect concordance. Many manufacturers and lymphoedema specialists provide training and support on measuring and fitting hosiery. Clinicians also have a duty to source training, if required.

While there is no empirical evidence on selection, there is much literature to guide clinicians (Hopkins, 2008a; Timmons and Bianchi, 2008). Local lymphoedema specialists also provide advice.

Construction

The fabric of compression hosiery is constructed using two interwoven yarn methods. The body yarn is knitted in the normal way and provides the thickness and stiffness of the fabric. An inlay yarn, which is woven horizontally through the knitted body yarn (weave), provides the compression factor. Both yarns have a stretchable core of latex or elastane that is bound to a polyamide or cotton layer (Clark and Krimmel, 2006) (Figure 18).

Compression garments can be knitted in two ways: circular knit and flat knit. Circular knit hosiery is knitted in a continuous circle using a fixed number of needles. This reduces the range of shape distortion that the garment can accommodate. The variation in shape of these garments is achieved by varying the tension of the inlay yarn or changing the stitch height (Clark and Krimmel, 2006). Hosiery made in this way is seamless. Finer yarns are used, making it more cosmetically agreeable to patients. Circular knit garments are useful
for the prevention and management of mild swelling and early venous disease where there is no shape distortion and the skin is intact.

Flat knit hosiery is knitted on a row of needles, and the edges are then sown together, creating a seam. The shape range is achieved by altering the number of needles used. These garments are constructed with thicker and more robust yarns, making them useful for shape distortion and more severe oedema. They are also useful for bridging skin folds and fatty limbs where circular knit garments would gather and cause a tourniquet effect.

Strength and stiffness
Both flat knit and circular knit hosiery can be constructed in made-to-measure or ready-to-wear styles. Individual manufacturers may not supply all their garments in both styles.

Different strengths of hosiery are available. Hosiery strength relates to the level of pressure provided by the garment and is measured in millimetres of mercury (mmHg). Different classes of compression are available, depending on the pressure (mmHg) delivered, and different countries have developed different standards for each class (Table 5). It is important, therefore, to be aware of these different compression classes and ensure the correct pressure is being applied. For example, if class 1 stockings are prescribed, check if this is the British or European class. To avoid confusion, it may be prudent to ask for clarity on the standard/pressures required in the prescription.

If compression hosiery is to adequately support the tissues to counteract capillary filtration, a level of stiffness and rigidity (Mortimer and Levick, 2004) is required to prevent rebound swelling. Hosiery made of stiffer fabric is more effective than finer elastic in improving venous and lymphatic return and thus controlling chronic oedema; the finer elastic hosiery will allow the limb to swell (Linnitt, 2011).

The static stiffness index (SSI) is the increase in interface pressure that occurs when the patient’s position changes from lying down to standing up (Partsch, 2007). Elastic (long-stretch) fabrics, which are commonly used in compression hosiery, have a lower SSI than short-stretch materials, which are used in many compression bandages. However, if several layers of hosiery are applied on top of each other, the SSI increases (Partsch et al, 2006). Only skilled practitioners should prescribe layering of compression garments, and then only on patients whose arterial status has been appropriately assessed.

Indications for use
A guide to the indications for each compression class is given opposite. The guide is based on the venous and lymphovenous disease progression tool developed by Timmons and Bianchi (2008). Before using the guide, it is therefore necessary to identify if the patient is presenting with any of the symptoms outlined in the progression tool. The guide lists these progressive symptoms in a timeline, and indicates that symptoms occurring in the early stages of the venous/lymphovenous disease progression require preventive action, those in the mid-stage require early/medium intervention and those in the chronic stage require intensive management. The guide then suggests which compression hosiery class is appropriate for each

| Table 5. Differences in compression standards (Hopkins, 2008a) |
|-----------------|-----------------|-----------------|
| Class | British standard | French standard | European class |
| 1    | 14–17mmHg        | 10–15mmHg       | 18–21mmHg       |
| 2    | 18–24mmHg        | 15–20mmHg       | 23–32mmHg       |
| 3    | 25–35mmHg        | 20–36mmHg       | 34–46mmHg       |
| 4    | N/A              | >36mmHg         | >49mmHg         |

Andrew Bezear and Cameron Law
Without oedema

BS hosiery

Class 1
14-17mmHg

Class 2
18-24mmHg

Class 3
25-35mmHg

Venous and lymphatic disease progression

Time

Spider and visible superficial veins
Tired aching, heavy legs
Mild varicose veins
Ankle flare
Mild hyperkeratosis
Moderate varicose veins
Hyperpigmentation (staining)
Venous dermatitis

With oedema

European class hosiery

Class 1
18-21mmHg

Class 2
23-32mmHg

Class 3
34-46mmHg

Varicose eczema/contact dermatitis
Atrophie blanche
Induration
Severe varicose veins
Moderate hyperkeratosis
Healed ulcer
Recurring ulcer*
Cellulitis**
Chronic oedema (toes/feet/leg)

Acute-chronic lipodermatosclerosis
Severe hyperkeratosis
Skin folds
Papillomatosis
Lymphangiomata
Lymphorrhoea (wet legs)

*Leg ulcer hosiery kit
40mmHg

Please note:
In the ‘early and medium intervention’ and ‘intensive management’ phases, before managing with hosiery, a period of treatment with compression bandaging (e.g. Actico® cohesive inelastic bandages) may be required.

Contraindications to prescribing compression hosiery
Patients with diabetes, unless under specialist supervision. Significant arterial disease (ischaemia) according to vascular assessment. Congestive cardiac failure, as compression can lead to cardiac overload. Known sensitivity to the fabric of the stocking.

**Acute cellulitis should be treated before using compression.

This guide is designed to reflect current best practice. Before using it, please ensure the following are undertaken:
- A visual and tissue assessment of the patient’s leg, including for the presence of oedema
- A vascular assessment
- A full holistic assessment

This guide is based on Timmons J, Bianchi J (2008) Disease progression in venous and lymphovenous disease: the need for early identification and management. Wounds UK 4(3) 59–71
of these three stages. It suggests using the European class on patients with oedema and British standard hosiery on those without oedema.

However, the patient’s needs and ability must be fully assessed before a compression class is selected. For example, while European class 3 is indicated for a patient with severe venous disease or chronic oedema, if the individual has arthritis in both hands, he or she might only be able to apply a class 1 garment. In this case, experienced practitioners can prescribe two class 1 stockings to give more pressure. For example, wearing two European class 1 stockings will provide approximately 36mmHg. Careful monitoring must be arranged when layering garments because exact levels of compression may not be guaranteed.

**Styles**

A wide range of flat knit and round knit hosiery is available, and most can be prescribed. The complete list of garments and compression classes available on FP10 is located in part IXA of the Drug Tariff (http://www.ppa.org.uk).

Many different styles of hosiery are available to meet individual needs:

- **Toe caps** can be used when closed toe stockings are unable to prevent the risk of (or actual) swelling of the toes.
- **Below-knee stockings** are recommended for swelling and venous disease limited to the lower leg or if application of thigh-length stockings is not possible; an example is patients with dexterity or strength issues who are elderly, receiving palliative care or have an upper limb disability.
- **Thigh-length stockings** should be prescribed when swelling or venous disease extends to the knee and thigh area.
- **Tights** are indicated for swelling that extends to the lower trunk or genitalia. Many young female patients with bilateral leg swelling prefer tights as the slight indentation at the top of thigh-length stockings may be seen through clothing. Tights are also useful if stocking are slipping.
- **Cycling short-style garments** can be used to support genital and/or lower truncal swelling where there is no swelling in the legs or as an adjunct to full leg hosiery.

Most stockings and tights are available in open and closed toe styles. Open toe garments may be slightly easier to apply and, to some extent, cooler in the hot weather, but are more likely to ride up the foot and cause toe swelling (Figure 19). In the author’s clinical experience, open toe stockings can exacerbate bunions and corns.

Stockings are also available with or without silicone bands. Again, in the author’s clinical experience, they help prevent slippage, and only a very small number of patients report a skin reaction to them. Skin glue is an alternative but a patch test should be carried out to exclude allergy.

**Application and removal**

Some agility and strength is required to successfully apply and remove compression hosiery. Conditions that may impede the donning of garments include: arthritis of the hands; multiple sclerosis and other muscle wasting conditions; arthritis or obesity; other complex medical conditions that may limit physical exertion, such as advanced cancer, chronic obstructive pulmonary disease or heart failure. Flat knit garments, which do not cut in at the ankle, are easier to apply and so may be indicated for such patients (Doherty et al, 2009). Application aids are available but some manual dexterity and bending are required to use them. Some custom-made garments can have zips inserted to ease application, but again manual dexterity is required to hold both sides of the garment together and pull the zip up without catching the skin. Wearing rubber gloves can improve grip when applying and pulling up the stocking.

Patients and carers should be advised how and when to apply and remove the garments, how to care for them and when to replace them.
**Skin care**

In the author’s clinical experience, skin integrity may be compromised by application of hosiery, especially if the skin is vulnerable or the person applying them is inexperienced or in a rush. Mild skin problems, such as varicose eczema, can be managed with skin care products, over which hosiery can then be carefully applied.

Regular basic skin care will help maintain skin integrity. This entails regular washing with soap or a soap substitute, drying thoroughly and then moisturising with lanolin-free emollient creams. Long-term use of lanolin-based moisturisers may induce eventual skin irritation (Mortimer, 1995).

**Exercise**

One of the primary aids to venous and lymphatic return from the legs is muscular activity, especially the calf muscle. The importance of movement cannot, therefore, be underestimated. It is possible for patients with reduced mobility to undertake moderate exercise or movement — for example, by activating the calf muscle by circling, flexing and dorsiflexing the feet (Anderson, 2008a). The health benefits of exercise, such as weight loss, improvement in mood and self-esteem, should be explained and encouraged. A helpful approach is to encourage patients to focus on their current activity levels and look at ways of increasing this (SIGN, 2010b).

**Increasing concordance**

Involving patients in decision-making about their treatment plan will increase concordance. This means giving them some choice in garment selection. For example, young women can be averse to wearing class 2 or 3 flat-knit hosiery due to image problems, preferring instead to wear the finer circular knit hosiery, even if this is not the most appropriate treatment for them. However, involving patients in treatment planning can encourage them to wear more appropriate compression hosiery at times when it is less likely to cause image problems.

**Compression bandaging**

Compression bandaging is used to treat the chronic stage of disease progression. Indications and contraindications for compression bandaging are given in Table 6. A wide range of compression bandages is available, and can be divided into two main categories: long-stretch and short-stretch bandages. It is beyond the scope of this supplement to cover this in detail, but more information can be obtained from the European Wound Management Association (2003) position document, Thomas (1996), Finnie (2001), Anderson (2008b), Hopkins (2008b) and Todd (2011).

**Concordance**

In literature reviews on concordance with compression therapy, it has been reported that non-concordance ranges from 2% to 52% in clinical trials, with higher rates of 10–80% in more practice-based studies (Van Hecke et al, 2008; Moffatt et al, 2009; Miller et al, 2011). Factors associated with non-concordance are pain (Edwards, 2003; Miller et al, 2011), previous negative experiences with compression, and psychosocial factors such as age, fear, isolation, health-related changes in employment status, negative attitudes/behaviour from health-care professionals, and poor psychological health (Charles, 1995; Edwards, 2003; Miller et al, 2011). Concordance is more likely to be achieved when expert practitioners tailor treatment to suit the individual needs of patients.

Many of these studies focused on concordance with compression hosiery in patients with healed ulcers, and studies on compression bandaging were sparse. Sadly, there is no literature on concordance in patients with chronic oedema or lymphoedema. However, there is anecdotal evidence that those with lymphoedema are very concordant with compression bandaging, whereas patients with chronic oedema are poorly concordant with management strategies to reduce contributing factors, such as obesity and a sedentary lifestyle (Todd, 2009).

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**Table 6. Indications and contraindications for compression bandaging**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous leg ulceration</td>
<td>Acute DVT</td>
</tr>
<tr>
<td>Severe chronic/lymphoedema</td>
<td>Acute cellulitis</td>
</tr>
<tr>
<td>Moderate to severe lymphorrhoea/exudate</td>
<td>Acute cardiac failure</td>
</tr>
<tr>
<td>Severe skin changes</td>
<td>Arterial insufficiency</td>
</tr>
<tr>
<td>Distortion in shape</td>
<td></td>
</tr>
</tbody>
</table>

Compression therapy can be safely used on patients with an ankle pressure brachial index of ≥ 0.8 (SIGN, 2012a)
Conclusion

Untreated venous and lymphovenous disease progresses until there are severe skin and tissue changes resulting in oedema and ulceration. The impact can be enormous affecting the patient physically, psychologically and socially.

Nurses are in a prime position to identify and assess this condition and then initiate treatment to slow and control the progression of this disease. However, an in-depth knowledge of the disease progression and its risk factors is a prerequisite for achieving a thorough assessment and diagnosis. This may require sourcing appropriate training.

A disease progression tool has been developed to assist nurses to identify the stages of the disease and provide strategies for management and prevention (Timmons and Bianchi, 2008). Further advice is given in the Guide to Compression Hosiery Selection (see page 11), which can be used in conjunction with the disease progression tool. The penalty for failing to act promptly when the early signs and symptoms present is more time-consuming and costly interventions for both the NHS and the patient.

References

Keeley Y (2008) Drugs that may exacerbate and those to use to treat lymphoedema. J Lymphoedema 3(3): 57–60
Veins return deoxygenated blood to the heart. Valves in the veins ensure the blood flows upwards. Damage to the valves results in blood flowing back down the vein. When this occurs in the superficial veins in the leg, the backflow of blood increases the pressure there (venous hypertension). This causes the capillaries to release fluid into the interstitial spaces, resulting in oedema.

Chronic oedema is persistent swelling that has been present for more than 3 months, indicating that the lymphatic and venous systems — both of which absorb and transport fluid and waste products from the limb back to the heart — cannot cope with this high level of fluid.

If left untreated, the signs of venous and lymphovenous disease will increase in severity, eventually resulting in grossly swollen limbs. The disease progression has the following stages:

- The early stages of venous and lymphovenous disease occur when impaired valves cause blood to pool in the superficial veins, which become stretched and less elastic. This results in symptoms such as spider/thread veins, mild/moderate varicose veins, mild oedema with aching legs and venous dermatitis.
- If these early stages are not managed, this will result in a further failure of the venous system, with signs such as ulceration, severe varicose veins and chronic oedema.
- Prolonged and untreated venous and lymphovenous disease results in symptoms such as enhanced skin folds, lipodermatosclerosis and cellulitis.

However, any intervention can slow or control this disease progression. Compression hosiery can stop the early and mid-stages of venous and lymphovenous disease progressing further. More severe symptoms may require compression bandaging. Benefits of compression hosiery include that it supports the calf muscle pump, prevents venous dilation (and therefore backflow and venous hypertension), reduces capillary filtration and increases interstitial pressure, which results in the excess fluid being re-absorbed into the venous and lymphatic system.

In addition, good skin care will help maintain skin integrity. Patients should also be encouraged to exercise in order to promote calf muscle action, which improves valve function. Finally, maintaining a healthy weight will prevent obesity-related pressure on the venous and lymphatic systems.

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