Compression therapy for venous disease

***Mauro Vicaretti**, Senior Lecturer, Vascular and Endovascular Surgery, Sydney Medical School, University of Sydney*

Summary

Compression therapy, by bandaging or stockings, is routine for thromboprophylaxis and for chronic venous disease and its complications, including deep venous thrombosis. The degree of compression is dependent on the condition being treated and underlying patient factors. It is important that a thorough clinical vascular examination with or without non-invasive vascular investigations be performed to rule out significant arterial disease that may contraindicate the use of compression therapy.

Key words: chronic venous disease, compression, deep vein thrombosis, leg ulcer.

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Introduction

Compression therapy has been used to treat chronic venous disease since antiquity, with the earliest recording found in the Corpus Hippocraticum (450–350 BC).[1] Although it remains the cornerstone component in the management of both venous and lymphatic disease, there is no agreement and clarity for prescribing compression therapy.[2]

Compression therapy aims to increase venous and lymphatic return, reducing oedema and venous pressure in the limb, by the application of an external force. Compression can be achieved using bandages, stockings or, in certain circumstances, intermittent pneumatic compression (pressure is applied through a sealed chamber around the limb).

Indications for compression

The recognised indications for compression therapy are:

- tired legs secondary to venous disease
- lower limb oedema
- varicose veins
- skin changes due to venous insufficiency (venous eczema, pigmentation, lipodermatosclerosis, atrophe blanche)
- prevention of deep vein thrombosis
- treatment of deep vein thrombosis or superficial thrombophlebitis
- active or healed venous leg ulcers
- lymphoedema
- prevention of deep vein thrombosis and oedema on long-haul flights (more than four hours).

Assessing the patient

Before compression therapy is commenced, thorough vascular assessment to exclude significant peripheral arterial disease is essential. If pedal pulses are weakened or absent, an ankle-brachial pressure index should be calculated. Divide the ankle systolic pressure of the dorsalis pedis or posterior tibial artery (the greater value taken as the ankle pressure) by the brachial systolic pressure (Figs. 1A–C).

If the patient has arteriosclerosis or diabetes, it is imperative that a great toe pressure index (photoplethysmography) also be performed. This is measured using a photoelectric cell that consists of a light emitting diode and a photosensor that transduces changes in dermal arterial flow. A toe cuff is inflated then deflated (Fig. 1D). A waveform appears when the toe systolic pressure is reached. This pressure is divided by the brachial pressure to give the toe brachial pressure index. A normal toe brachial pressure index is >0.7.

Compression therapy is deemed safe in patients with an ankle-brachial pressure index greater than 0.8. However, reduced compression is advised when the ankle-brachial pressure index is 0.5–0.8. Referral of these patients to a vascular specialist for assessment of arterial disease is also recommended. Compression should be avoided when the ankle-brachial pressure index is less than 0.5, and intermittent pneumatic compression may be considered only after appropriate vascular specialist review (Fig. 2).[3]

Degree of compression

An international standard has been suggested although not accepted by the vascular community. It divides compression levels into mild (<20 mmHg), moderate (≥20–40 mmHg), strong (≥40–60 mmHg) and very strong (>60 mmHg).[4]

A general guide to the amount of compression recommended for various indications is given in Table 1. The sub-bandage pressure (mmHg) required for therapy is determined by patient factors and the underlying disease process. The pressure is directly related to the tension and number of layers applied and indirectly related to the circumference of the limb and bandage width.[5] The application technique and the sub-bandage pressure

Table 1

Guide to recommended compression for various indications

Degree of compression	Indication
<20 mmHg	Prevention of deep vein thrombosis (graduated compression stocking) Mild oedema Tired, aching legs (occupational leg symptoms)
20–30 mmHg	Mild varicose veins Mild to moderate oedema Long-haul flights (>4 hours, high-risk patients for deep vein thrombosis) Varicose veins during and after pregnancy
30–40 mmHg	Venous ulcers (including healed ulcers) Deep vein thrombosis Superficial thrombophlebitis Following venous surgery and sclerotherapy Varicose veins with severe oedema and/or skin changes Post-thrombotic syndrome Mild lymphoedema
>40 mmHg	Severe lymphoedema Severe chronic venous insufficiency

are not only dependent on the type of bandage but also on the skill of the person applying the bandage. Most importantly the final sub-bandage pressure depends on the tension of application.

Irrespective of the method of compression, if there is an ineffective calf muscle pump or limited ankle mobility then the effect of compression therapy is limited. It is likely that variable ankle mobility and calf muscle function may account for much of the variability in the success of compression therapy.[6]

Compression with bandages or stockings

Compression therapy, either by bandages or stockings, can be applied via two principal methods:

- an elastic system that allows for a high resting pressure and a lower pressure during muscular contraction
- a support system that is relatively rigid and inelastic allowing for a lower pressure at rest and higher pressure during muscular activity.

Both methods may be either single or multilayer.[4]

Compression may be achieved with a combination of elastic and inelastic materials which is used in some multilayer systems. It is generally not recommended to apply strong

Fig. 1

Measuring peripheral pulse pressures

A Measuring dorsalis pedis artery systolic pressure

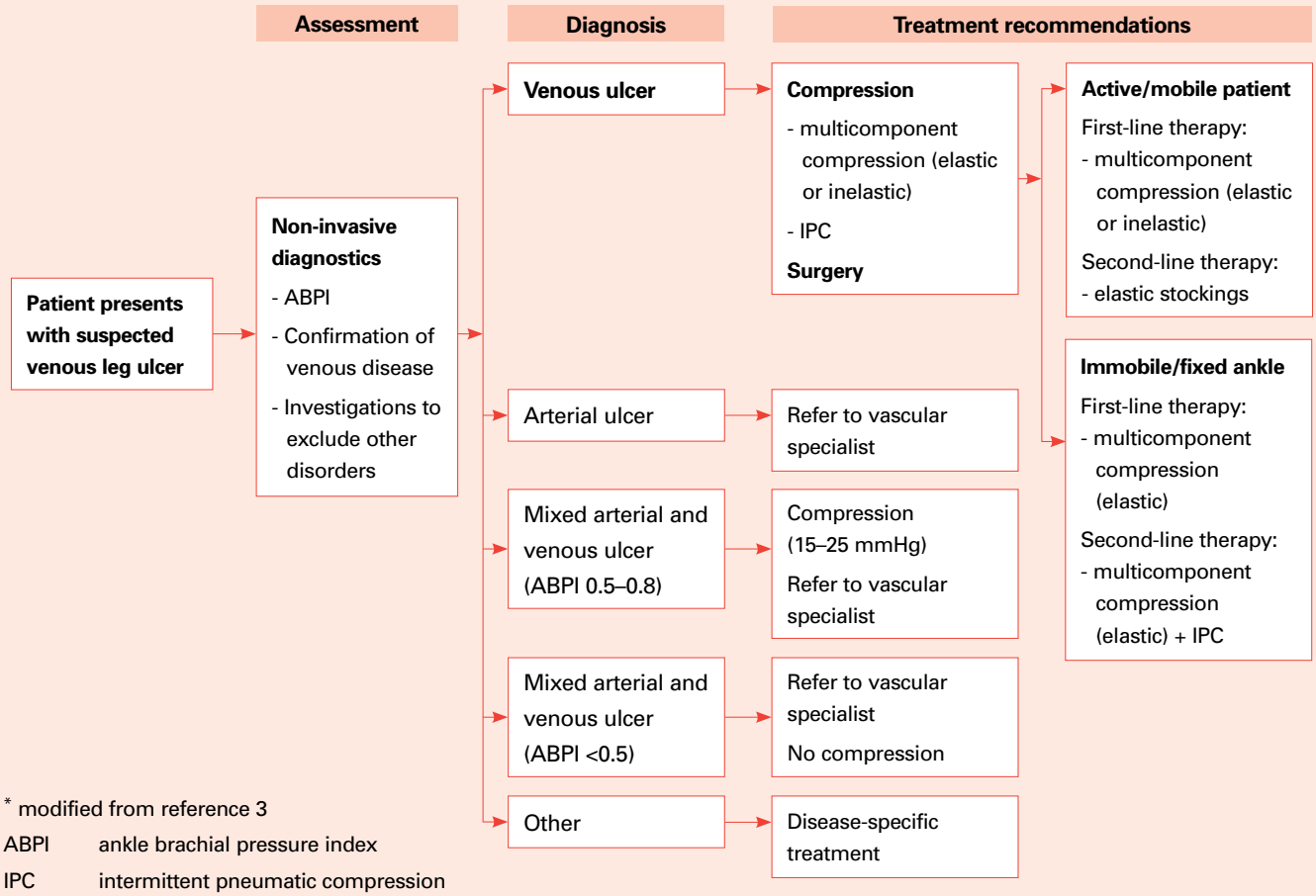
B Measuring posterior tibial artery systolic pressure

C Measuring brachial artery systolic pressure

D Measuring toe pressure

Fig. 2

Algorithm for the use of compression therapy in venous leg ulcers *



* modified from reference 3

ABPI ankle brachial pressure index

IPC intermittent pneumatic compression

compression with a single elastic bandage because of the risk of skin damage from the pressure. It is preferable to refer to multilayer systems as multicomponent as they generally achieve strong compression independent of the number of layers used.

Bandages

Bandaging can be applied by spiral, continuous or figure of eight methods. There are no data to support one bandaging technique over another.[7] Bandages may be long stretch (extend by more than 100% of original length), short stretch (extend 70–100% beyond original length), or inelastic such as zinc plaster bandages or Velcro devices.[8] Generally, bandaging systems are recommended during the therapy phase of treatment (control of oedema, treatment of venous ulceration, control of lymphoedema). They may also be more practical for those incapable of applying compression stockings or in patients with fragile skin. The disadvantages of compression bandages are the variability of pressure achieved even when applied by experienced professionals, the potential limitations in daily activities such as showering and patient compliance because of discomfort.

Stockings

Medical compression stockings are manufactured from various materials such as silk, cotton, polyester, nylon, natural rubber, polypropylene, or in combination wrapped in elastic. The compression is graduated with maximal compression at the ankle and gradual reduction in compression as the limb circumference increases. They may be panty style, above or below knee, made to measure or available in standard sizes. It is imperative that the appropriate size and compression rating be prescribed for the condition and the patient being treated. There are no direct comparisons on the effectiveness of knee- versus thigh-length stockings, but above-knee stockings are more difficult to apply and have the added risk of creating a tourniquet effect further compromising venous return, especially if the limb being treated is not measured properly. These factors will adversely affect patient compliance. If used daily, compression stockings should be replaced after 3–6 months. Unlike compression bandaging, the pressure generated with stockings is less dependent on the person applying it. Different compression classes are available but pressure profiles are not uniform throughout the world and are measured by non-standardised methods, making comparisons sometimes

difficult. Compression stockings are principally used in the maintenance of limb size and prevention of venous ulceration, oedema and lymphoedema.

Patient compliance with bandages or compression stockings is poorly studied, with non-concordance rates of up to 80% in the 'real world'. This has a negative impact on venous leg ulcer healing and recurrence rates. Patients may not comply with therapy for a number of reasons including lack of patient education, physical factors (pain, difficulty in application), aesthetic and cosmetic factors, cost of therapy, and inappropriate prescribing of therapies by the clinician.[9]

Intermittent pneumatic compression

These devices are airtight chambers (single- or multi-chambered) applied to a limb. They sequentially inflate and deflate, simulating normal circulatory action and venous foot and calf muscle action.[10] This aids venous return, reduces oedema and can even increase arterial flow in the arterially compromised limb.[11] The settings, namely compression pressure up to 80 mmHg, compression time and cycle time, can all be varied. Intermittent pneumatic compression is useful for those not able to tolerate compression bandaging, who have difficulties with controlling limb oedema, have reduced calf muscle function or limited ankle mobility, or who have peripheral arterial disease where other forms of compression are contraindicated.[12] The disadvantages of intermittent pneumatic compression are that it is costly, can be bulky and cumbersome to mobilise with, can be noisy and requires an electrical supply. However, the newer units are more portable with extended rechargeable battery lives.

Reviewing the evidence

Venous ulcers

A recent review of compression for venous leg ulcers concluded that the rate of ulcer healing increased with compression compared with no compression. It also found that multicomponent systems are more effective than single component systems, and those with an elastic bandage are more effective than those with inelastic components.[13] A pressure of 30–40 mmHg at the ankle is recommended for ulcer healing.[14]

Recurrent venous ulcers

Although a review of compression for the prevention of recurrent venous ulcers found there were no trials, circumstantial evidence suggested that people receiving high rather than moderate compression were less likely to develop a new ulcer. It was thus recommended that the strongest compression that the patient would comply with should be prescribed.[15]

Post-thrombotic syndrome

A third to a half of patients with lower limb deep vein thrombosis will develop post-thrombotic sequelae within two years.[16] They may present with minor signs and symptoms such as stasis pigmentation, varicosities, slight pain and swelling, ranging to more major symptoms such as intractable oedema, chronic pain and leg ulcers.[17]

A meta-analysis recommended that all patients with deep vein thrombosis should be prescribed a below-knee graduated elastic compression stocking to reduce post-thrombotic sequelae.[18] Elastic compression stockings should have an ankle pressure of 30–40 mmHg and the compression should be continued for at least two years, and longer in those with post-thrombotic symptoms. In patients with severe oedema, a course of intermittent pneumatic compression is recommended.[19]

Deep vein thrombosis prophylaxis

The role of mechanical devices – graduated compression stockings and intermittent pneumatic compression – is dependent on the risk of venous thromboembolism in the medical or surgical patient. They may be used in combination with drug therapy or alone, especially if drugs are contraindicated because of an unacceptable bleeding risk. These mechanical devices are contraindicated in patients with severe peripheral vascular disease, severe leg deformity and severe peripheral neuropathy.

Evidence supports the use of graduated compression stockings as thromboprophylaxis for abdominal, cardiac, thoracic, vascular, major general or gynaecological surgery, neurosurgery and total hip replacement. Similarly, there is evidence for the use of intermittent pneumatic compression for total hip replacement, hip fracture surgery, total knee replacement, vascular, cardiothoracic surgery, neurosurgery, and for major gynaecological surgery. Graduated compression stockings (ankle pressures of 16–20 mmHg) should be measured for the individual and worn for as long as possible until the patient is fully mobile.[20]

Conclusion

Compression therapy is the mainstay for prevention and treatment of venous and lymphatic system dysfunction. The therapy recommended is dependent on patient factors and the degree of dysfunction. There is a need for a standardised classification of degree of compression to assist in appropriate prescribing.

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Conflict of interest: none declared

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Self-test questions

The following statements are either true or false (answers on page 198)

5. Compression therapy is not advised for patients with an ankle-brachial pressure index greater than 0.8.
6. Below-the-knee compression stockings are recommended for at least two years for people with symptoms following deep vein thrombosis.