Evidence Summary: Managing lymphoedema: compression therapy

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CLINICAL QUESTION

What is the best available evidence on the effectiveness of compression therapy in managing lymphoedema?

SUMMARY

Compression therapy is considered the gold standard treatment for lymphoedema[1] (Level 1.b evidence). There is good evidence that compression therapy significantly reduces limb volume in individuals with lymphoedema, with effect commencing within hours of application of compression. There is also some evidence that compression therapy reduces pain and other symptoms (e.g. limb heaviness).

Compression therapy in the form of short stretch (inelastic) multi-layer bandaging (MLB) is generally used in conjunction with other interventions as a component of complex lymphoedema therapy (CLT) to achieve initial reduction in limb volume[1] (Level 1.b evidence). Once significant limb volume reduction is achieved, compression hosiery is recommended for maintenance therapy[1]. Selection of compression therapy should be based on the severity of disease and the individual's preferences and tolerance for therapy[1, 2] (Level 1.b and 3 evidence).

BACKGROUND

Lymphoedema is a form of chronic, progressive oedema in which there is significant, persistent swelling of a limb or other body region due to excess and abnormal accumulation of protein-rich fluid in body tissues. This fluid contains a range of inflammatory mediators and adipogenic factors[1,3-6]. The lymphatic system is unable to manage the volume of accumulated fluid[4].

Lymphoedema occurs due to primary, secondary or mixed causes. Primary causes are described as congenital (e.g. an inherited disorder such as Milroy's disease), praecox (onset at puberty, e.g. Meigs' disease) or tarda (sudden onset no apparent cause)[7-9]. Secondary causes arise from direct damage or trauma to the lymphatic system such as injury, surgery or radiotherapy (usually related to treatment of breast cancer), or parasitic invasion[8-10]. Lymphatic filariasis (also called elephantitis) is a cause of secondary lymphoedema in endemic areas primarily in Africa and Asia[1,11]. Mixed lymphoedema describes lymphoedema arising from decompensation or failure of the lymphatic system associated with other disease or conditions, including but not limited to obesity, immobility, venous disease or lipoedema[8,9,12].

Without management, lymphoedema may lead to:[4,13]

- progressive swelling;
- superficial tissue changes — increasing adiposity and fibrosis;
- physical and functional limitations;
- increased risk of chronic infection;
- lymphorrhoea (leaking of lymph fluid);
- pain and discomfort; and
- reduced ability to undertake activities of daily living (ADLs).

Compression therapy creates pressure differential (increase in interstitial fluid pressure) that reduces capillary filtration, increase microcirculation blood flow and facilitates interstitial fluid movement and lymph drainage, thereby reducing limb volume[14,15].

TYPES OF COMPRESSION THERAPY

Compression therapy includes compression bandages, hosiery/garments and wrap-based systems. Intermittent pneumatic compression therapy, which provides similar therapeutic outcomes, is reported in a separate evidence summary (see JBI ES 12096).

Compression bandaging

Inelastic or short stretch bandages in two or more layers (MLB) with or without a padding layer are applied to limbs to create continuous low resting pressure. During walking or exercise, the bandages provide semi-rigid support against which muscles contract, creating high working pressure that enhances venous and lymph flow[16, 17] (Level 5.c evidence). Multi-layer bandaging is generally used during the acute phase of lymphoedema[16] and appears to be most effective when used as part of a comprehensive management plan that includes manual lymphatic drainage, exercises and skin care (a regimen known as complex lymphoedema therapy [CLT]). Evidence for multi-faceted CLT is reported in a separate evidence summary (see JBI ES 12998). No studies with patients with lymphoedema were identified that investigated effectiveness of elastic bandaging.

Graduated or medical compression hosiery

Medical compression hosiery (or sleeves) are generally used for maintenance compression therapy to prevent re-accumulation of lymphatic fluid after reduction of limb swelling has been achieved with CLT and compression bandaging. They may also be used for individuals with mild lymphoedema. They come in a range of different compression strengths (measured in mmHg at the wrist or ankle) and lengths (e.g. below or above knee). Compression hosiery or sleeves should be selected according to the individual's needs and need to be fitted to the individual[18, 19]. Compression hosiery should not be confused with non-medical 'support stockings' or 'anti-embolism' stockings, neither of which exert sufficient pressures to treat lymphoedema[19] (Level 5.c evidence).

Wrap systems

Wrap systems may have advantages in the ease with which patients can self-apply the compression, attain equivalent interface pressures as healthcare professionals and make adjustments to the compression. Patients can be educated to tighten the compression system if it starts to feel loose, thereby promoting optimal interface pressures over longer wear times[15] (Level 1.c evidence).

CLINICAL BOTTOM LINE

Effectiveness in reducing oedema

- A systematic review reported four trials that investigated compression therapy used in isolation of other interventions. Two of the studies reported significant moderate reductions in limb volume of 4 to 7% with *compression bandaging*. The reduction in oedema was also associated with reduction in symptoms including heaviness. However, there was no follow-up period. Two studies reported effectiveness of *compression garment with a pressure of 30 to 40 mmHg* also found modest significant reduction in arm volume over two weeks over therapy[20] (Level 1.b evidence).
- A randomised controlled trial (RCT) conducted in patients with lower limb lymphoedema (n= 30) found that an adjustable *inelastic compression wrap system* was associated with a significantly greater reduction in limb volume compared with two-layer inelastic multicomponent compression bandaging after continuous 24 hour wear (10.3% reduction versus 5.9% reduction, p<0.05)[15] (Level 1.c evidence).
- An observational study reported a mean percentage reduction in limb size of 15.3% (range: 12.9% to 27.8%) for 24 individuals with upper or lower limb lymphoedema who wore a *commercial two layer bandaging system* for 19 days. The bandages were applied at full stretch and required replacing a mean 3.75 times/week. The reduction in limb volumes was significant for all limbs, both upper and lower. In this study 42% of individuals received concurrent manual lymphatic drainage (MLD) and 83% undertook exercise; however, concurrent MLD was not associated with improved limb reduction (p=0.89)[21] (Level 3e evidence).
- Two RCTs have compared the same *commercial two layer bandaging system* to different compression systems. In one, the comparator was MLB that consisted of two layers of bandaging applied over synthetic cast wadding. Participants (n=30) had moderate to severe lower limb lymphoedema. After 24 hours of wear, both groups achieved significant reductions in median limb volumes (–8.4% for commercial system versus –4.4% for MLB, between group p=not significant)[22] (Level 1.c evidence). In another, the *commercial two layer bandaging system* was compared to short stretch (inelastic) bandaging (number of layers unstated) for individuals with upper or lower limb lymphoedema. After 19 days treatment there was no significant difference in the mean reduction in limb volume, which ranged from 7.43% to 18.65% in lower limbs and 6.78% to 10.48% in upper limbs[23] (Level 1.c evidence). The study was insufficiently powered to determine significant findings.
- An RCT compared MLB alone to MLB plus compression hosiery in individuals with unilateral upper or lower lymphoedema of at least 12 months (n=83). After 24 weeks, participants using MLB plus hosiery achieved a mean reduction in limb volume of 32.6% (SD 33.2%), which was significantly greater (p=not reported) than the mean reduction of 19.6% (SD (28.5%) observed in the group wearing only hosiery. Significant reductions were also observed after 19 days and at weeks 7 and 12. The MLB intervention consisted of *tubular stocking, retention bandage, foam padding and a minimum of two layers of short stretch (inelastic) bandage* applied in a spiral, with the last layer applied in a figure eight. Customised compression hosiery was applied on top of the MLB[24] (Level 1.c evidence).
- Numerous case reports and case series provide support for higher level studies regarding the efficacy of *compression bandaging*[25-28] (Level 4.c and 4.d evidence) in attaining significant reduction in limb volume in individuals with upper and lower limb lymphoedema.

Effectiveness of different sub-bandage interface pressures

- An international clinical guideline recommends that compression bandages are applied to achieve sub-bandage pressure of at least 45 mmHg for individuals with lymphoedema stage II or higher, or 15 to 25 mmHg in individuals who cannot tolerate higher pressure[1] (Level 5.b evidence).
- One RCT compared *multicomponent short stretch(inelastic)bandages* applied at low (20 to 30 mmHg) and high (44 to 58 mmHg) pressures in individuals with upper limb lymphoedema (n=36). After two hours both groups had reduction in limb volume (lower pressure –1.5% versus higher pressure –2.5%, p= not significant), and no significant difference between groups was evident after 24 hours. The authors proposed that 30mmHg pressure is sufficient for upper extremities[29] (Level 1.c evidence).
- Reduction in interface pressure of compression bandages occurs over time and reduces efficacy of treatment[15,22,23,25]. This may occur due to bandage failure, high reduction in limb volumes or poor application technique[23] (Level 1.c and 4.c evidence). In one study, compression pressures of both a *wrap system* and *two layer bandaging* were significantly (p<0.001) lower within two hours of initial application. Median interface pressures continued to decrease significantly over a 24 hour period for both compression systems[15] (Level 1.c evidence). In another trial, reductions in interface pressure after 24 hours of wear were noted for a *commercial two layer bandaging* system and *standard MLB*, with no significant difference in pressure reductions between the two compression therapy types[22] (Level 1.c evidence).

Effectiveness in reducing pain

An observational study (n=24 individuals with upper and lower lymphoedema) reported a mean reduction in pain of 2.17 on a 10-point visual analogue scale (92% CI 0.66 to 3.67, p=0.007) associated with a *commercial two-layer bandaging*

system. When an analysis was conducted based on clinical site, patients with lower limb lymphoedema experienced reductions in pain but there was no significant effect on pain for patients with arm lymphoedema[21] (Level 3e evidence).

CAUTIONS AND ADVERSE EFFECTS

Cautions

- Compression therapy should be used cautiously in individuals with arterial insufficiency (ABPI < 0.5) because it impedes blood flow to the limb[1,14]. Before commencing compression therapy comprehensive clinical assessment and an ankle brachial pressure index (ABPI) or toe brachial pressure index (TBPI) should be conducted to identify any arterial insufficiency[14] (Level 5.c evidence). Review by a vascular specialist and lower compression bandage pressure (15 to 25 mmHg) are recommended[1] (Level 5.b and 5.c evidence).
- Compression therapy is contraindicated in individuals with decompensated heart failure because increase in blood return can exacerbate cardiac failure[1,14] (Level 5.b and 5.c evidence).
- Compression therapy should be used with caution in individuals with severe peripheral neuropathy, acute deep vein thrombosis, diabetes, rheumatoid arthritis and acute cellulitis[14] (Level 5.b evidence).

Adverse effects

- Participants in a qualitative study found MLB restrictive, uncomfortable and stigmatising. Individuals reported a *commercial two layer bandaging system* as easier to apply, more flexible and maintained superior aesthetics over a number of days compared with standard MLB[2] (Level 3 evidence).
- An observational study involving women with post-surgery upper arm lymphoedema found significant reductions ($p<0.01$) in grip strength and manual dexterity with MLB compared with a *compression garment*. Both compression types led to significant reduction in dexterity compared to no compression[30] (Level 3.c evidence).
- Discomfort, skin irritation, heat rash, anxiety, folliculitis, fibrosis, cellulitis, dyspnoea and neuralgia have been reported by small numbers of individuals receiving compression therapy[23] (Level 1.c evidence).

CHARACTERISTICS OF THE EVIDENCE

This evidence summary is based on a structured database search combining search terms describing lymphoedema and compression therapy. The evidence comes from:

- Systematic reviews of studies of various design[5,20] (Level 1.b evidence)
- Randomised controlled trials[15,22-24,29] (Level 1.c evidence)
- A qualitative study[2] (Level 3 evidence)
- Observational studies with no control group[10,21,30] (Level 3.e evidence)
- Case series report[12,25,28] (Level 4.c evidence)
- Case reports[26,27] (Level 4.d evidence)
- Expert consensus[1,8] (Level 5.b evidence)
- Expert opinion[3,4,6,7,9,11,13,14,16-19] (Level 5.c evidence)

BEST PRACTICE RECOMMENDATIONS

- Selection of compression therapy should be based on the severity of disease and the individual's preferences and tolerance for therapy. (Grade B)
- Before applying compression therapy the individual's arterial status should be assessed by performing a comprehensive clinical assessment and an ABPI or TBPI. A vascular specialist should be consulted before applying compression therapy to an individual with an ABPI < 0.5. (Grade A)
- Assessment should include checking for contraindications and conditions in which compression therapy should be used with caution. (Grade A)
- Compression therapy should be applied at a sub-bandage pressure of at least 45 mmHg for individuals with ISL stage II or greater lymphoedema. (Grade A)

RELATED EVIDENCE SUMMARIES

JBI 11559 Lymphedema: classification

JBI 11562, 11564, 11870, 11871 Lymphedema: methods of objective assessment

JBI 11560 Lymphedema: subjective assessment

JBI 12998 Managing lymphoedema: complex lymphedema therapy

JBI 12921 Single modality treatment of lymphedema: manual lymphatic drainage

JBI 12096 Single modality treatment of lymphedema: pneumatic compression therapy

JBI 13918 Managing lymphoedema: laser therapy

JBI 13567 Prevention of filariasis

JBI 13568 Treatment of filariasis

ACKNOWLEDGEMENT

The author wishes to acknowledge the support of the Australian Government's Cooperative Research Centres Program.

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Evidence Summary: Lymphoedema: skin care

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CLINICAL QUESTION

What is the best available evidence on skin care in managing lymphoedema?

SUMMARY

Skin and tissue inflammation and infection are a common sequelae in individuals with lymphoedema. Ongoing, daily skin care that includes inspecting the skin for breaks and signs of infection, and performing hygiene is a well-recognised strategy to preventing infection. Skin care should be performed in conjunction with interventions that manage lymphoedema such as compression therapy, manual lymphatic drainage and complete lymphoedema therapy (see Evidence Summaries listed below). Individuals with lymphoedema should also be encouraged to engage in preventive practices to avoid skin injury[1] (Level 1.b evidence) and [2-4] (Level 5.c evidence).

BACKGROUND

Lymphoedema is a form of chronic, progressive oedema in which there is significant, persistent swelling of a limb or other body region due to excess and abnormal accumulation of protein-rich fluid in body tissues. This fluid contains a range of inflammatory mediators and adipogenic factors[5-9]. The lymphatic system is unable to manage the volume of accumulated fluid[8].