WHAM Evidence summary: Managing lymphoedema: Compression therapy

Emily Haesler, PhD, P Grad Dip Adv Nurs (Gerontics), BN, Fellow Wounds Australia¹²³

1. Adjunct Professor, Curtin Health Innovation Research Institute, Wound Healing and Management (WHAM) Collaborative, Curtin University, Perth, Australia
2. Adjunct Associate Professor, Australian Centre for Evidence Based Aged Care, La Trobe University, Melbourne, Australia
3. Honorary Senior Lecturer, Australian National University Medical School, Australian National University, Canberra, Australia

CLINICAL QUESTION
What is the best available evidence on the effectiveness of compression therapy for managing lymphoedema?

KEYWORDS
Lymphoedema, oedema, lymphatic system, compression therapy, compression bandaging, compression wrap, multi-layer bandaging, graduate hosiery, compression hosiery

SUMMARY
Compression therapy is considered the gold standard treatment for lymphoedema.¹ 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 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.

CLINICAL PRACTICE RECOMMENDATIONS
All recommendations should be applied with consideration to the wound, the person, the health professional and the clinical context:

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 45mmHg for individuals with ISL stage II or greater lymphoedema. (Grade A)

---

Table 1: Sources of evidence and the level

<table>
<thead>
<tr>
<th>Level 1 Evidence</th>
<th>Level 2 Evidence</th>
<th>Level 3 Evidence</th>
<th>Level 4 Evidence</th>
<th>Level 5 Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.b Systematic review of RCTs and other designs² ³</td>
<td>None</td>
<td>3.e Observational study without a control group⁵ ¹¹</td>
<td>4.c Case series¹² ¹⁴</td>
<td>5.b Expert consensus¹ ¹⁷</td>
</tr>
<tr>
<td>1.c RCT⁴ ⁸</td>
<td></td>
<td>3. Qualitative study⁵⁰</td>
<td>4.d Case report¹⁵ ¹⁶</td>
<td>5.c Expert opinion¹⁹ ²⁹</td>
</tr>
</tbody>
</table>
**SOURCES OF EVIDENCE**

This summary was conducted using methods published by the Joanna Briggs Institute. This evidence summary is based on a structured database search using variations of the search terms describing lymphoedema and compression therapy. Searches were conducted in EMBASE, Medline, AMED and the Cochrane Library for evidence from 1990 to 2015 in English. Levels of evidence for intervention studies are reported in the table above.

**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. The lymphatic system is unable to manage the volume of accumulated fluid.

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. Meige’s disease) or tarda (sudden onset no apparent cause). 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. Lymphatic filariasis (also called elephantitis) is a cause of secondary lymphoedema endemic in areas primarily in Africa and Asia. Lymphatic filariasis is a parasitic (roundworm) infection that is spread by mosquitoes and causes damage to the lymphatic system that may result in lymphoedema. Infection generally occurs in childhood, although. Management focuses on large-scale treatment programs to reduce disease spread.

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.

Without management, lymphoedema may lead to:
- progressive swelling,
- physical and functional limitations,
- chronic infection,
- fibrosis,
- 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.

**Type 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.

**Compression bandaging**

Inelastic or short stretch bandages in two or more layers (multi-layer bandaging, 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. Multi-layer bandaging is generally used during the acute phase of lymphoedema 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]). 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. Compression hosiery should not be confused with non-medical ‘support stockings’ or ‘anti-embolism’ stockings, neither of which exert sufficient pressures to treat lymphoedema.
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.5

CLINICAL EVIDENCE

Effectiveness in reducing oedema

A systematic review4 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.3 (Level 1).

A RCT5 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)5 (Level 1).

An observational study6 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)6 (Level 3).

Two RCTs6,7 have compared the same commercial two-layer bandaging system to different compression systems. In one of the RCTs6 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)6 (Level 1). In the second RCT,7 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 limbs7 (Level 1). The study was insufficiently powered to determine significant findings.

An RCT4 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 MLB4 (Level 1).

Numerous case reports15,16 and case series13,14 provide support for higher level studies regarding the efficacy of compression bandaging in attaining significant reduction in limb volume in individuals with upper and lower limb lymphoedema (Level 4).

Effectiveness of different sub-bandage interface pressures

An international clinical guideline1 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 pressure1 (Level 5).

One RCT8 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 extremities3 (Level 1).

Reduction in interface pressure of compression bandages occurs over time and reduces efficacy of treatment.5-7, 14 This may occur due to bandage failure, high reduction in limb volumes or poor application technique7

In one study,5 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 systems5 (Level 1). In another trial,5 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 types5 (Level 1).

Effectiveness in reducing pain

An observational study2 (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 lymphoedema9 (Level 3).

CONSIDERATIONS FOR USE

Cautions

Compression therapy should be used cautiously in individuals with arterial insufficiency (ABPI < 0.5) because it impedes blood flow to the limb.1, 20 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.20 Review by a vascular specialist and lower compression bandage pressure (15 to 25 mmHg) are recommended1 (Level 5).

Compression therapy is contraindicated in individuals with decompensated heart failure because increase in blood return can exacerbate cardiac failure1, 20 (Level 5).

Compression therapy should be used with caution in individuals with severe peripheral neuropathy, acute deep vein thrombosis, diabetes, rheumatoid arthritis and acute cellulitis20 (Level 5).

Adverse events

Participants in a qualitative study30 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 MLB30 (Level 3).

An observational study11 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 compression11 (Level 3).

Discomfort, skin irritation, heat rash, anxiety, folliculitis, fibrosis, cellulitis, dyspnoea and neuralgia have been reported by small numbers of individuals receiving compression therapy.7 (Level 1).

CONFLICTS OF INTEREST

The author declares no conflicts of interest in accordance with International Committee of Medical Journal Editors (ICMJE) standards.

FUNDING

The author would like to acknowledge the support of the Australian Government’s Cooperative Research Centres Program.

ABOUT WHAM EVIDENCE SUMMARIES

WHAM evidence summaries are consistent with methodology published in


Methods are provided in detail in resources published by the Joanna Briggs Institute as cited in this evidence summary. WHAM evidence summaries undergo peer-review by an international review panel. More information is available on the WHAM website: https://www.whamwounds.com/.
WHAM evidence summaries provide a summary of the best available evidence on specific topics and make suggestions that can be used to inform clinical practice. Evidence contained within this summary should be evaluated by appropriately trained professionals with expertise in wound prevention and management, and the evidence should be considered in the context of the individual, the professional, the clinical setting and other relevant clinical information.

REFERENCES

21. General Practice Divisions of Victoria. Lymphoedema: Guide for diagnosis and...


