SESLHD PROCEDURE COVER SHEET

NAME OF DOCUMENT	Wound – Graduated Compression Therapy (GCT) in Venous Disease
TYPE OF DOCUMENT	Procedure
DOCUMENT NUMBER	SESLHDPR/398
DATE OF PUBLICATION	December 2024
RISK RATING	Medium
LEVEL OF EVIDENCE	National Safety and Quality Health Service Standards: Standard 1- Clinical Governance Standard 5 - Comprehensive Care Standard 6 - Communicating for Safety
REVIEW DATE	December 2027
FORMER REFERENCE(S)	N/A
EXECUTIVE SPONSOR	Director, Nursing and Midwifery Services
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FUNCTIONAL GROUP(S)	Critical Care and Emergency Medicine Nursing and Midwifery
KEY TERMS	Compression, venous, leg ulcers, cellulitis, graduated, wound
SUMMARY	This document outlines the appropriate use of compression therapy for the prevention and treatment of venous insufficiency and related lower leg ulcerations.

1. POLICY STATEMENT

Compression therapy is the primary intervention in the prevention and management of venous hypertension, venous oedema and related lower leg ulceration[1]. A patient should be fully informed prior to initial application of therapy including benefits and potential risks. Where uncertainty about the appropriate use of compression exists, the clinician must seek a review of the patient by a Wound Care Expert, which includes but not limited to the following: a Medical Officer (including Vascular surgeons), Wound CNC/NP or Podiatrist.

Note: this procedure is not applicable for the management of lymphoedema.

2. BACKGROUND

Compression therapy is one of the most important therapeutic procedures in chronic venous disease and it is indicated in all symptomatic stages[2]. It improves venous return, reduces venous hypertension, controls venous oedema and assists with wound healing[1]. It also reduces the likelihood of wound recurrence and improves quality of life[3]. For any lower leg wound that has been present for 2 weeks or more, suitability of compression therapy should be assessed, especially if there are signs of venous disease[4].

When compression is applied to the lower limb, graduated compression therapy (GCT) is achieved in a leg of normal proportions, with the greatest compression at the ankle and decreasing at the calf[4]. Compression can be applied by various forms: elastic and inelastic bandages, stockings, adjustable compression wraps and intermittent pneumatic compression[2]. Effective compression should provide some compression at rest but work effectively during exercise[4].

Where a leg ulcer has mixed aetiology of arterial and venous disease, lighter form of compression may still be suitable. However, this should only be applied following consult with a vascular specialist[2,5,6]. GCT has the potential to cause serious adverse effects if applied incorrectly or to a vascularly impaired limb, peripheral arterial disease should be excluded prior to initiation of GCT[5,6]. A lower leg arterial occlusion must be addressed prior to application of compression. Compression therapy may also be beneficial in the treatment of lower limb cellulitis[2].

3. DEFINITIONS

Ankle Brachial Pressure Index (ABPI)	Ratio of ankle arterial systolic blood pressure divided by the brachial systolic pressure[1], used to exclude peripheral arterial disease.
Toe Brachial Pressure Index (TBPI)	A procedure to determine arterial perfusion in the feet and toes by measuring the systolic pressure in the arm and the great toe.
Compression Therapy	Also known as Graduated Compression Therapy (GCT), can be in the form of compression stockings, adjustable wraps, compression bandages or intermittent pneumatic compression pumps.

Compression Bandages	Bandage systems that apply external pressure to a limb. Can be cotton and/or synthetic, with or without elastic or latex and are described as short or long stretch bandages. It is achieved by applying a bandage at a constant and even pressure from toes to below knee. GCT can alter depending on the Laplace's Law (See Appendix I).
Compression Hosiery	Manufactured graduated compression hosiery that is applied to the lower limb provides GCT. Can be 'off the shelf' or custom-made and vary in compression levels (20-30 mmHg, 30-40 mmHg, 40-50 mmHg or >50 mmHg) depending on patients' requirements.
Compression Wraps	Adjustable compression wraps consist of low-elastic material sections that wrap across the limb and are secured with hook and loop fasteners (Velcro)
Compression classifications	Mild (less than 20mmHg) Moderate (20-40mmHg) Strong (40-60mmHg) Very strong (greater than 60mmHg)
Graduated Compression Therapy (GCT)	See Compression Therapy
Long stretch bandages (Also known as long stretch or elastic)	These bandages have low stiffness. They provide constant pressure, maintaining a therapeutic level of compression at rest, but with less marked changes in pressure during exercise (standing or walking). Elastic bandage is preferred for immobile patient[3,4].
Short stretch bandages (also known as inelastic)	These bandages have high stiffness. They remain rigid due to their lack of extensibility, which allows them to generate intermittent high working pressures and low resting pressure (improving both comfort and effectiveness of calf muscle pump). Inelastic bandage is recommended for active / mobile patients[3,4].
Multi-Layer Bandages	Includes long-stretch and short-stretch elements within bandage system. The total sub-bandage pressure of the multi-layers systems is the sum of pressure achieved from each compression layer. Two- and 4-layer bandage system have similar effectiveness[6].
Tubular Bandaging System	A three-layer tubular bandaging system that exerts about 15mmHg of pressure at ankle. The outer layers can be removed if required to improve tolerance. Sizing should be determined based on limb measurements and manufacture guidelines.
Intermittent pneumatic compression (IPC) systems	Pressure is applied via a boot inflated by a machine either continuously, intermittently or in sequential cycles[6].

Wound Care Expert	Includes but not limited to the following: a Medical Officer (including Vascular surgeons), Wound CNC/NP or Podiatrist.

4. RESPONSIBILITIES

4.1 Employees will:

- Adhere to the content of this document
- Ensure they work within their scope of practice
- Attend relevant education related to this procedure
- Obtain and document valid consent before and during the proposed treatment/ procedure as per the NSW Health Consent to Medical and Healthcare Treatment Manual[9]

4.2 Line Managers will:

- Ensure all clinical staff are given the opportunity to attend district wound management education
- Ensure all clinical staff work within this procedure and have appropriate resources
- Have appropriate stock items to implement the recommendations within this procedure.

5. PROCEDURE

5.1 Assessment

5.1.1 General assessment

- Prior to application of compression therapy, to inform appropriate treatment plan, patients should have a full, documented assessment that includes evaluation of the following[4]:
  - Peripheral arterial supply, by measuring Doppler ABPI, arterial duplex or arteriogram to rule out significant arterial disease
  - Neurological status (lower limb/foot neuropathy)
  - Cardiac and renal status (decompensated heart and/or renal failure)
  - Skin condition
  - Extent of oedema
  - Limb shape
  - Level of mobility
  - Patient's level of pain
  - Patient's physical ability to remove compression if required
  - Patient's cognitive ability to understand education regarding monitoring for complications
  - Allergies
- Contraindications to compression therapy are critical limb ischaemia (ABPI<0.5, and/or ankle systolic pressure <60mmHg) and pulmonary oedema[2].

- In patients with oedema and cardiac insufficiency, it is recommended that, with close monitoring, to start compression therapy with reduced/lighter pressure on one lower leg and slowly progress to stronger pressure applied on both legs[2].
- Alternative methods of compression therapy should be explored should the patient not want to wear or is not able to tolerate compression bandages.
- The application of compression bandages must not put the patient at a falls risk. Therefore, when contemplating the type of compression to be used, consider how safe footwear can be achieved.
- Compression should not be discontinued until all the ramifications of this decision have been discussed with the patient and carers, unless clinically indicated.

5.1.2 Arterial disease determination

- Significant arterial disease should be excluded prior to application of GCT. Arterial disease can be determined by a comprehensive physical examination and the following tests:
  - Ankle brachial pressure index (ABPI) every six months
  - Toe brachial pressure index (TBPI) every six months
  - Arterial duplex every 12 months
  - Arteriogram
- For people with diabetes and the aged, or an ABPI >1.3, TBPI is recommended as an alternative to ABPI to counter unreliable elevated measures in the presence of artery calcification[7].
- It is important to note that ABPI should not be used as a sole measure when deciding the type or level of compression. Other indicators, such as visible clinical signs and symptoms, the presentation of their wounds and the perfusion pressure should also be considered[2].

5.1.3 Level of compression therapy

- When describing the level of compression, whether by hosiery or bandages, the following terminology should be used:
  - Mild (less than 20mmHg)
  - Moderate (20-40 mmHg)

    → Lighter compression
  - Strong (40-60mmHg)
  - Very strong (greater than 60mmHg)[2]
- Lighter compression refers to pressure <40mmHg and encompasses the terms of mild and moderate compression (<20mmHg and <40mmHg respectively) [2]
- In case of leg oedema or symptomatic varicose vein, a mild to moderate compression pressures of <40mmHg is sufficient to reduce or solve clinical symptoms and signs[2].
- For treatment of venous leg ulcers, in general, strong compression (of ≥ 40mmHg at the ankle) is recommended. However, factors such as mild arterial disease, neuropathy, patient's tolerance and cardiac failure may render strong compression potentially harmful or painful. In this case, mild or moderate compression may be required[2].

- See Appendix B for the Leg Ulcer Flow Chart
- See Appendix D for the level of compression different bandages provide.

Compression level	Pre-requisite for application	Indications
Mild (Less than 20mmHg)	No 'red flag' conditions, including severe peripheral arterial disease, a suspected and untreated deep vein thrombosis, a skin cancer, or an acute infection[8]	• Prior to full assessment • Comorbidities deem other modes of compression inappropriate
Moderate (20-40 mmHg)	• Full assessment as per outlined in 5.1, with ABPI ≥ 0.5 • Compression authority form required in community setting	• Mild arterial disease • Moderate venous disease • Venous leg ulcers prevention
Strong (40-60mmHg)	• Full assessment as per outlined in 5.1, with ABPI between 0.8 and 1.2, or TBPI ≥ 0.7 • Compression authority form required in community setting	Venous leg ulcers management and prevention
Very strong (Greater than 60mmHg)		Lymphoedema

5.1.3.1 Lighter compression

Lighter compression (less than 40mmHg) may be used in the following situations:

- Mixed aetiology leg ulcer, where venous incompetence occurs simultaneously with moderate arterial disease (ABPI 0.5-0.8)[2]. Consultation with a vascular specialist should occur prior to commencement of compression for these clients.
- Low patient concordance and tolerance. Starting from a lower compression pressure and progressively increasing the pressure could help increase patient concordance, little compression is better than no compression[2].
- During periods of infection where pain may be increased
- Before formal vascular studies can be performed and patients not presenting with 'red flags', including severe peripheral arterial disease, a suspected and untreated deep vein thrombosis, a skin cancer, or an acute infection[8].
- Patients with decompensated cardiac and/or renal failure, diabetic foot ischaemia and/or neuropathy. These patients require specialist referral for further assessment before compression therapy can be considered[4].

5.1.4 Factors influencing choice of compression system

The patients' psychological, cultural and social factors must also be considered in the selection of appropriate GCT, as they may have difficulty accepting compression therapy due to its effect on work, showering / bathing, choice of clothing and footwear. Decisions about the compression system should consider the following issues:

- The shape and size of the leg, unusually shaped legs may require custom made compression garments
- Patient tolerance and preference
- Patient's lower leg sensation e.g. if reduced
- Patient's ability to remove compression if required
- Patient's cognitive ability to understand education regarding monitoring for complications
- Clinician knowledge and experience in application
- Environment e.g. temperature/climate
- Ease of application and removal
- Access to compression systems
- Presence of comorbidities

5.1.5 Limb assessment considerations

- Some wound management products are not suitable for use under compression, e.g. thick dressing products and hydrocolloids. Discuss product selection with a wound care expert if unsure.
- Prior to the application of compression bandages assess the wound and skin condition of the limb and treat accordingly in line with SESLHDPR/297 - Wound Assessment and Management.
- Ankle circumference should be measured prior to application of bandages. Ankle sizes less than 18cm may need extra padding to reduce risk of bandage trauma.

5.1.6 Patient/Carer education

The patient / carer should be educated on the importance of concordance and of possible complications and problems arising because of the compression (see Appendix C).

Education should include:

- Signs and symptoms of arterial compromise
- Pain management and the management of loose, slipping and wet bandages
- Advice should be given about appropriate footwear, consider an orthotics consult to ensure appropriate footwear achieved to avoid risk of falls
- Manufacturer's guidelines regarding laundering and replacement of bandages or stockings should also be provided to the patient. Garments should be discarded and replaced according to the manufacturer's recommendations. For further information please refer to Appendix J.

5.1.7 Prescription or documentation

5.1.7.1 In hospital setting:

Consent[9] must be obtained from patient or patient advocate and documented. A wound care expert, medical officer, or vascular specialist should document an order in the clinical notes. This should include the type and level of compression.

5.1.7.2 In community setting:

- Community Nurses should be provided with an authority form to apply compression, including an ABPI/TBPI or arterial duplex scan with the result recorded in clinical records.
- An authority form can be signed by a wound care expert with supportive instruction from medical staff.
- An authority form is required for any compression system with a compression level greater than 20mmHg.
- An authority form should include level and type of compression, date and results of arterial test (please refer to the example in Appendix A).

5.1.7.3 Compression commenced in the community setting:

Consent[9] must be obtained from patient or patient advocate and documented. A wound care expert, medical officer, or vascular specialist, general practitioner should document an order in the clinical notes. This should include supportive diagnostics (e.g. ABPI/TBPI) and the type and level of compression.

5.2 Application

5.2.1 Who can apply compression bandages?

Health professionals are not permitted to apply compression until they have gained specific education and assessment (determined at a local level) in the application and use of GCT. The correct level of compression must be applied and the correct application technique must be used refer to appendices below:

- Appendix C - Complications following the Application of Compression
- Appendix D - Compression types
- Appendix E - Four Layer Bandage Systems
- Appendix F - Two Layer Compression System
- Appendix G - Short Stretch (Inelastic) Compression Bandage
- Appendix H - High Stretch (Elastic) Compression Bandage

5.2.2 Safety considerations before GCT application

Application of compression bandages can cause injury to the clinician or carer. The patient should be positioned to ensure easy access to the leg. The following should be considered:

- Appropriate posture throughout the procedure must be maintained
- A position must be assumed which will minimise twisting, reaching and bending

- Avoid squatting and kneeling for long periods whilst applying garments or bandages
- Take breaks as necessary between bandage layers and between legs
- Avoid rushing the procedure as this may result in inappropriately applied bandages/garments and increase the risk of injury

5.2.3 Assessment required before, during and after application of GCT

- Neurovascular status of the affected limb/limbs and patient's level of comfort must be assessed before and immediately after the application of compression therapy.
- Pain scores should be measured before and after application of compression therapy with reference made to any increase in scores or changed sensation, as appropriately applied compression should reduce pain. If pain persists, remove compression and ensure arterial status has been adequately assessed.
- In the community, GCT must not be applied unless the patient or carer can remove it if problems arise, such as severe pain, changes in colour / perfusion or sensation.

5.2.4 Correct Application of the GCT System

- A natural padding layer is required under all compression bandages to protect the skin. It must extend beyond the compression bandaging layer to ensure no pressure indentations or pressure injuries occur. Adequate padding is essential to protect bony prominences. Additional padding maybe required to achieve a conical limb shape for patients who have altered leg contour, such as 'champagne bottle' legs.
- Ankle circumference should be measured prior to application of bandages. Ankle sizes less than 18cm may need extra padding to reduce risk of bandage trauma.
- A compression bandage must extend from just proximal to the toes to two fingers widths below the knee. The foot should be positioned at 90 degrees to the leg during application to avoid the bandage wrinkling during standing or walking.
- Changes of limb shape due to reduced oedema should be monitored by measuring and documenting circumference at defined sites (ankle and calf).
- For single use bandages, the excess bandage should be 'taped off' or 'cut off' as winding around the limb or turning it over can impair circulation. If one bandage does not adequately cover the leg a second bandage should be used. Finishing the bandaging too low or applying increased stretch to reach the knee may result in adverse patient outcomes.
- For reusable systems, if excess bandage present, once compression has finished 2 fingers below the knee, loosely wrap 1.5 turns back down the leg, ensuring no tension is applied, and cut and tape bandage to secure. This allows for any potential increase in limb size.

5.3 Monitoring

5.3.1 Monitoring Following Application of GCT

Following application of compression, the patient should be observed for pain, colour/perfusion, warmth, sensation, movement, capillary return, if there is a change in perfusion remove compression therapy.

Note: in patients unable to verbalise pain increased pain may present as delirium.

5.3.1.1 In the Hospital setting: If bandaging is satisfactory post initial application assessment, compression bandages and neurovascular status should be reviewed every eight hours thereafter.

5.3.1.2 In the community setting: The client/carer must be provided with information on indications for bandage removal & CHN contact details. The assessment findings and action taken must be documented in the health care record.

5.3.2. Assessment on removal of GCT system

On removal of a GCT system, assess for visible skin trauma including pressure damage, and loss of calf muscle and skin problems[4] See Appendix C.

5.4 Compression post healing of venous leg ulcer

- Compression needs to be continued for life unless surgical intervention is an option and successful.
- Once the venous leg ulcer has been closed for 2-4 weeks consider:
  - If the patient could be reviewed by a vascular specialist for possible vascular surgery to prevent recurrence
  - If the patient can be fitted with appropriate compression stockings, consider if they are able to get the stockings on and off, an applicator maybe required
  - If the patient is unable to get the stockings on and off consider alternatives e.g. compression wraps or referral for home assistance package

6. DOCUMENTATION

- SESLHD Wound Assessment and Management Plan SEI060.118, or the electronic equivalent, e.g. in Ambulatory and Primary Health Care (APHC), use Wound Assessment Treatment Evaluation Plan (WATEP).
- Any additional comments are to be recorded in the patient's health care record, including:
  - valid consent given
  - discussion regarding treatment options
  - discussion regarding patient goals (short and long term)
  - aspects of the education provided
- Transfer or clinical handover documentation, e.g. from community to hospital, or vice versa
- Discharge letters should include wound assessment and management plan
- When appropriate, attach digital wound photo/images to patient's health care record as per SESLHDPR/285 – Wound - Clinical Digital Photography procedure.
- Complete IMS+ if any adverse events occur during the application or management of GCT.

7. AUDIT

Sites are required to follow up with any incidents that occur in relation to this policy.

8. REFERENCES

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9. VERSION AND APPROVAL HISTORY

Date	Version	Version and approval notes
February 2015	0	Area wound committee Endorsed by Executive Sponsor
April 2017	1	Minor amendment to Appendix A
April 2018	2	Minor amendment to Appendix E. Approved by Executive Sponsor
May 2018	2	Processed by Executive Services prior to publishing
August 2021	3	Major review commenced. Draft for comments period
October 2021	3	Reviewed and approved by SESLHD Wound Committee, Review led by Naomi James CNC. Approved by Executive Sponsor. To be tabled at Clinical and Quality Council.
November 2021	3	Approved at Clinical and Quality Council.
5 December 2024	4.0	Major review by SESLHD Wound Committee. Approved at SESLHD Patient Safety and Quality Committee.

Appendix A: Example of Authority to Apply Compression Therapy Form

BARCODE HERE

SMR000000

Health
South Eastern Sydney
Local Health District

Facility:

Authority to Apply Compression Therapy

FAMILY NAME	MRN
GIVEN NAME	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION / WARD	
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE	

I, (please print) ..... Position.....

give permission to apply compression therapy for the above patient (Please select compression below).

Medical officer/Vascular Specialist Name .....

Diagnosis: .....

Medical order* for compression therapy given: ☐ **Verbal** ☐ **Written** ☐ **eMR**

*Please note a medical order for compression therapy is required.

Please specify which limbs/limb compression to be applied: .....

Signed: ..... Position: .....

Facility: ..... Date: .....

Print Name: ..... Phone number: .....

Allergies: .....

In the last six months has this patient had the following (indicate by √):

☐	Ankle Brachial Pressure Index	Date.....
☐	Toe Brachial Pressure Index	Date.....
☐	Lanarkshire Oximetry Index Assessment	Date.....
☐	Vascular studies	Date.....

Results.....

Graduated Compression Therapy: Bandages	**Graduated Compression Therapy: Stockings**
☐ **Strong:** 40-60mmHg 2 layers: padding / short stretch – (e.g. PutterBinde, UrgoK2, Coban2)	☐ **Very Strong:** >60mmHg (Lymphoedema)
☐ **Strong:** 40-60mmHg 2 layers: padding / high stretch (e.g. Surepress, Setopress 'brown' square)	☐ **Strong:** 40-60mmHg (Class three stocking)
☐ **Strong**: 40-60mmHg 4 layers: padding / crepe / high stretch / short stretch (e.g. Profore, Veno4)	☐ **Moderate:** 20-40mmHg (Class two stocking)
☐ **Moderate:** 20-40mmHg 2 layers: padding / short stretch – (e.g. Coban 2 Lite, UrgoK2 Lite)	☐ **Mild:** 18-24mmHg (Class one stocking)
☐ **Moderate:** 20-40mmHg 2 layers: padding / high stretch (e.g. Setopress 'green' square)	☐ **Mild:** 3 layer tubular bandage (e.g. Tubigrip, TubularForm, Flexigrip)
☐ **Other:**	☐ **Other:** .....

Comments: (Recommended dressing for wound review only)

Holes punched as per AS2828-1999

BINDING MARGIN - NO WRITING

XXX0000 – 00/0000

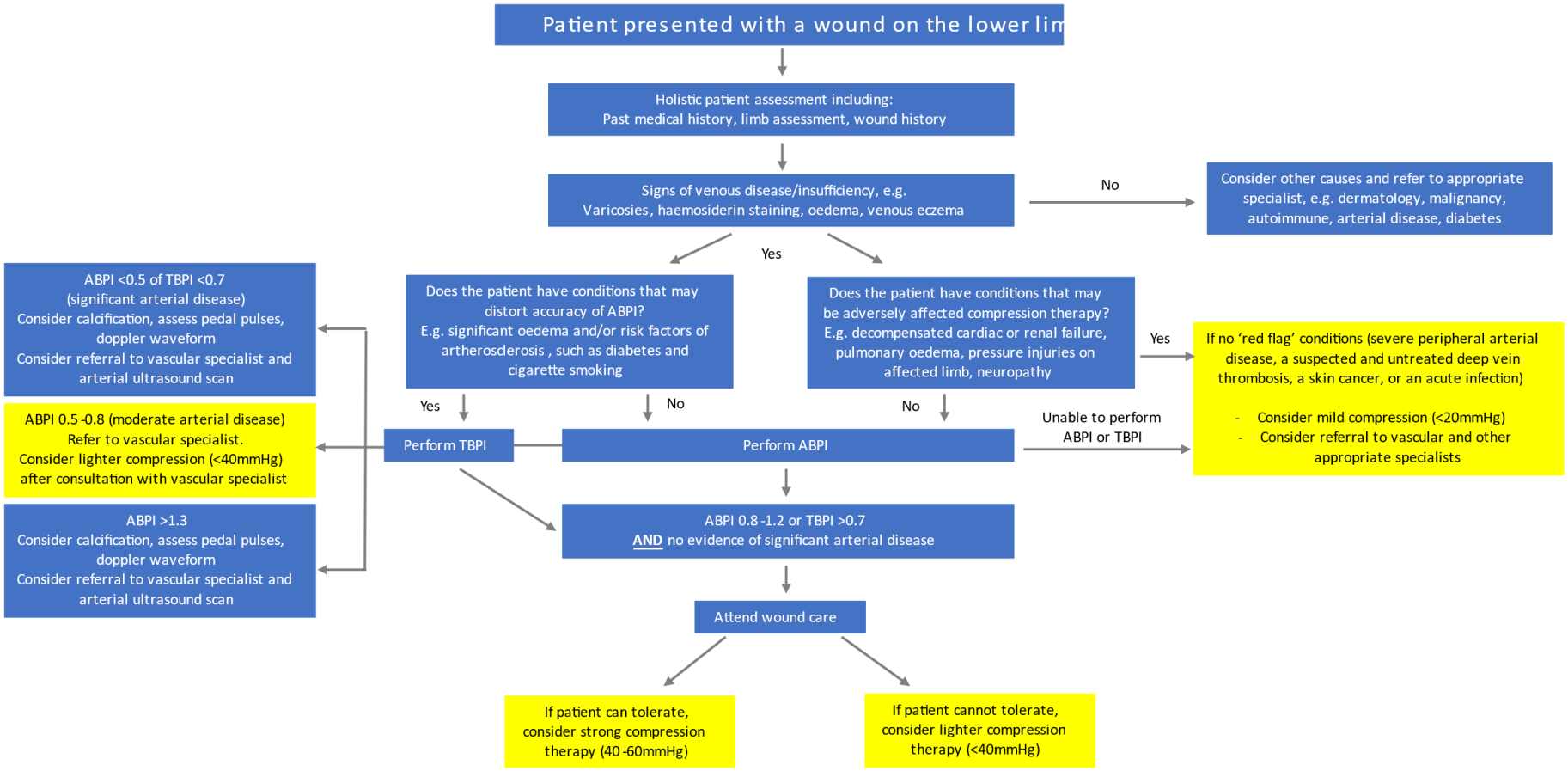
Authority to Apply Compression Therapy

FORM #

This space for form information, notations, trial dates. Etc...

Page 1 of 1

Appendix B: Leg Ulcer Flow Chart



Appendix C: Complications following the application of compression

Pain:

The application of compression bandages should not increase pain in the limb. If pain persists remove compression and recheck arterial status of the limb, also reassess for infection.

Pressure damage:

Patients with impaired peripheral perfusion, thin or altered limb shape, foot deformity or dependent oedema are at increased risk of pressure damage. Other risk factors include reduced sensation, reduced pain sensation, long term systematic steroid use and presence of chronic disease associated with reduced mobility, loss of calf muscle and foot / ankle deformity.

- Avoid using sustained compression on these patients, consider inelastic systems or IPC
- Apply extra padding over bony prominences
- Ensure bandaging is not too tight and overlap is even. At risk areas include the ankle, the dorsum of the foot and the calf
- Observe for signs of pressure damage such as erythema, blistering or altered limb shape
- Encourage limb elevation for dependent oedema

Loss of calf muscle:

Wastage of calf muscle can occur for patients receiving long term compression. This is usually directly not due to the compression but is often caused by reduced patient activity, underlying co-morbidities and medication.

- Ensure bandage allows good knee and ankle mobility.
- Ensure flat comfortable shoes are worn.
- Encourage exercise and rehabilitation

Skin problems:

Maceration, excoriation, dryness, itching, allergic or irritant eczema and erosive pustular dermatosis are often associated with compression, topical preparations or chronic inflammation.

- Ensure adequate exudate control with appropriate primary dressings
- Use cotton liner or paste bandage against the skin
- Moisturise the skin with a simple emollient. Use downward movement in direction of the hair growth to avoid folliculitis
- Treat eczema
- Review all products use in treatment of the limb4

Allergy alert:

Some bandages / compression garments may contain latex remember to check this and do not use if patient has latex allergy or sensitivity.

Bandage slippage:

Reassess method of bandage application to ensure it has not been applied too loosely. Slippage can also occur if bandages have been applied correctly as the reduction of oedema and subsequent limb size may cause the bandages to slip. If slippage continues consult wound care expert for review.

Swelling of the toes or the area around the knee:

This may result from the bandage being too tight, too low from the knee, too far back from the toes, lack of exercise or sitting for long periods with legs down. This reduces the effectiveness of the pump action required for venous return and increases oedema in these areas.

Footwear:

Some clients will not tolerate compression bandaging as they can't wear their usual footwear. Therefore, adjustable footwear to accommodate compression bandaging may need to be sourced such as a temporary post-op shoe e.g. a 'DARCO' shoe. Allied health departments, e.g. Orthotics, Podiatry, Physio or Occupational Therapy, can advise or assist.

Ineffective compression:

Reassess the client's limb shape. Make certain there is enough padding and the bandage materials are appropriate. Ensure the primary dressing is not reducing the sub-bandage pressure. Check that the bandage is it being applied at the correct tension.

Tourniquet effect:

This can occur at the top of the limb when compression bandaging is finished off incorrectly. At the completion of applying the compression layer any leftover bandage needs to be cut off or taped off so that the bandage is held in place without causing a tourniquet effect. This can also occur in limbs where a skin lobule over hangs the joint e.g. at base of leg over ankle joint. This skin fold needs to be padded out to be level with surrounding skin.

Tourniquet effect from stockings:

Circular / round knit stockings may not be appropriate in patient with a skin lobule that over hangs the joint e.g. at base of leg over ankle joint, customise flat knit stockings may be required to level skin out. Education should be provided to patients to ensure they pull up stockings or tubular bandages if these slip to avoid the tourniquet effect.

Appendix D: Compression Types

Pressure Level	Short / Long Stretch	Reusable	Examples
Mild (Less than 20mmHg)	NA	Minimally	Three-layer tubular system Urgo K2® Lite[13]
Moderate (20-40 mmHg)	Long stretch	Yes	• Profore™ (3 layers only) • Veno 4 (3 layers only) • Setopress (green square)[10] • Eloflex[11]
	Short stretch	No	• 3M™Coban™ Lite[12] • JOBST® Compri2 Lite[11] • Farrow Wraps Lite
Strong (40-60mmHg)	Long stretch	Yes	• Setopress (brown square)[10]
	Short stretch	No	• 3M™Coban™ 2[12] • JOBST® Compri2[11] • Farrow Wraps Strong
		Yes	• Putterbinde • Comprilan[11]
	Both long and short stretch	No	• Profore™ (all 4 layers) • Veno 4 (all 4 layers)

Appendix E: Four Layer Bandage Systems

Examples are Profore™ (Smith and Nephew) or Veno 4™ (Hartmann)

A four-layer bandage system achieves 40mmHg at the ankle through application of a number of layers of low compression that together exert a cumulative effect. To achieve 40mmHg at the ankle all four layers must be applied correctly and to the correct ankle size.

The four layers include:
1. The padding bandage
2. Crepe or similar retention bandage
3. Light weight long stretch (elastic) bandage (This layer delivers approximately 17-20mmHg)
4. Elasticised rubber bandage. (This layer delivers approximately 23 mmHg)

Apply in the following sequence for ankle size 18-25cms:

- Wound contact layer. Apply directly to the wound. If wound has a moderate to high exudate an alternative dressing might be required
- Padding bandage (layer 1). Apply from toes to knee with slight tension (to avoid puckering) using a spiral technique with 50% overlap. Ensure shin and ankle is adequately padded
- Light retention bandage (crepe or similar) (layer2). Apply from toes to knee using spiral technique with 50% overlap
- Light compression bandage (layer 3). Apply from toes to knee using figure of eight technique with 50% extension of bandage. Use central yellow line as a guide to overlap. Secure with tape
- Flexible cohesive bandage (layer 4). Apply from toes to knee using a spiral technique with 50% extension and 50% overlap. This bandage will adhere to itself. The use of tubifast over the flexible cohesive bandage is acceptable if the client finds the cohesiveness uncomfortable.

A reduced compression can be achieved by omitting the light compression bandage (layer 3) or the cohesive bandage (layer 4). Application of only three (3) layers will approximately halve the level of compression. For ankle size greater than 25cms the four layer bandage system will need to be modified as per table:

18-25cm Ankle Circumference	**25-30cm Ankle Circumference**	**>30cm Ankle Circumference**
Padding bandage	Padding bandage	Padding bandage
Crepe or similar retention bandage	Crepe or similar retention bandage	Light weight long stretch bandage
Light weight long stretch bandage	Long stretch bandage	Long stretch bandage
Elasticised cohesive bandage	Elasticised cohesive bandage	Elasticised cohesive bandage

Appendix F: Two Layer Compression System

Examples are Coban™ (3M) or UrgoK2 (Link Medical)

Two Layer Compression System - UrgoK2®

This system comprises two layers that cohere to form one thin conforming compression bandage that can be left in place for up to seven days. The system chosen is available in latex or latex free and dependent on the ankle size (either ankle size 18-25cm or 25-32cm) and the amount of compression required e.g. regular or lite option.

- First Layer KTECH: white, short-stretch bandage, providing compression, protection and absorbency. Composition: wadding: viscose, polyester; knitted layer: polyamide, elastane
- Second layer: KPRESS: pink / beige, cohesive long-stretch bandage, providing additional compression necessary to achieve the therapeutic pressure and securing the bandages in place. Composition: cotton, polyester, polyamide, elastane; synthetic latex free cohesive material

Application Method

Before applying the bandages:

- Examine the shape of the leg and identify any areas at risk of excessive pressure (i.e. bony prominences)
- Protect and reshape leg with wadding if necessary. If a wound in present, apply an appropriate dressing before applying any bandages
- Apply the compression system first thing in the morning or after the patient's legs have been elevated for an hour to minimise any orthostatic oedema

Ankle circumference 18-25cm kit – 50% overlap

1. Place foot at a 90% angle – 'toes to nose'. Start applying KTECH Lite at the base of the toes using two turns to anchor the bandage, ensuring wadding side is in contact with the skin and the pressure indicator is at the top edge, towards the patient. Secure the heel by using a figure of eight, ensuring full coverage of the heel. Do not apply with pressure indicator at full stretch on the foot.
2. Spiral KTECH Lite up the leg from malleolus, stretching the bandage so that the pressure indicator (printed on the bandage) forms a circle, achieving the therapeutic pressure. A correct overlap is applied when the pressure indicator is just covered (50% overlap). Finish 2cm below popliteal space and cut off any excess bandage. Secure with tape.
3. Apply KPRESS (or KPRESS Latex Free) over KTECH Lite using the same application technique as KTECH Lite. For patient comfort, allow a small border of KTEC Lite at the toes and knee. Once applied, press down gently on bandage to ensure full cohesion.

Ankle circumference 25-32cm kit – 2/3 overlap

1. Apply in the same way as the 18-25cm kit, stretching the bandage so that the pressure indicator forms a circle
2. Cover the pressure indicator (printed in the middle of the bandage) to achieve the correct overlap (2/3 overlap).

Two Layer Compression System – 3M™ Coban 2™

This system comprises two layers that cohere to form one thin conforming compression bandage which can be left in place for up to seven days.

Apply from just proximal to the toes to two fingers widths below the knee. The foot should be positioned at 90 degrees to the leg during application to avoid the bandage wrinkling during standing or walking. A figure of eight technique can be used to anchor the bandage to the foot.

Apply in the following sequence:

1. First Layer (comfort layer): Is composed of foam laminated to a latex-free cohesive bandage and is wrapped upwards around the foot and leg with a minimal overlap
2. Second Layer (Compression Layer): Is wrapped over the first layer with a 50% overlap using full stretch to provide effective sustained compression.

Two Layer Compression System – 3M™ Coban 2™ Lite

This is 25% less resting pressure compared to standard - Coban 2.

Apply from just proximal to the toes to two fingers widths below the knee. The foot should be positioned at 90 degrees to the leg during application to avoid the bandage wrinkling during standing or walking. A figure of eight technique can be used to anchor the bandage to the foot.

Apply in the following sequence:

1. First Layer (comfort layer): Is composed of foam laminated to a latex-free cohesive bandage and is wrapped upwards around the foot and leg with a minimal overlap
2. Second Layer (Compression Layer): Is wrapped over the first layer with a 50% overlap using full stretch to provide effective sustained compression.

Appendix G: Short Stretch (inelastic) Compression Bandage

Examples are Comprilan™ (Essity) or Putterbinde (Hartmans)
These systems are washable and washing instructions should be attended as per manufactures guidelines.

Short stretch bandages are able to remain rigid due to their lack of extensibility. This allows them to generate intermittent high working pressures (when patients walk) and low resting pressures. These changes in pressure are important for improvements in venous blood flow[3]. It also improves both comfort and effectiveness of calf muscle pump[4].

The higher standing and working pressures of short stretch bandages may mean that oedema resolves more quickly and the bandages will become loose more quickly as the leg circumference reduces[4]. However, it has been shown that short stretch bandages continue to provide haemodynamic benefits over a week despite a significant reduction in the pressure produced[4].

Short stretch bandages may be applied singularly, as directed and then if needed a second short stretch bandage may be applied if additional pressure is required*.

Apply in the following sequence:
1. Padding bandage
2. Short stretch bandage: Apply from toes to knee using a spiral technique with 75 to 100% extension and 50% overlap
3. In-elastic retention tubular bandage e.g. Tubifast™ (Molnlycke), if required

* Apply second short stretch bandage if required: Apply from toes to knee using a spiral technique with 75 to 100% extension and 50% overlap in the opposite direction to the first Short stretch bandage.

Appendix H: High Stretch (elastic) Compression Bandage

Example is Setopress® (Molnlycke®)

High stretch bandages contain elastomers and their length can increase significantly when stretched. They provide constant pressure, maintaining a therapeutic level of compression at rest, but with less marked changes in pressure during exercise[4].

Note **Setopress®** is a guided compression bandage,

- Using the green rectangle as a guide and stretching until it is a square achieves 30mmHg of pressure
- Using the brown rectangle as a guide and stretching until it is a square achieves 40mmHg of pressure

Apply in the following sequence:

1. Padding bandage
2. Long stretch bandage: Apply from toes to knee using spiral technique with 50-75% extension and 50% overlap
3. In-elastic retention tubular bandage e.g. Tubifast™ (Molnlycke®), if required.

Appendix I: Sub-bandage pressure

Factors which Determine Sub-Bandage Pressure

The pressure developed beneath any bandage is governed by the[3]:
1. Tension in the fabric
2. Radius of curvature of the limb
3. Number of layers applied
4. The width of the bandage

Applying a bandage at a 50% overlap produces two layers of fabric, which generates pressure twice that produced by a single layer. Sub-bandage pressure may be calculated using a simple formula derived from the Laplace's equation as follows.

Principles of Sub-bandage Pressures based on Laplace's Law

$$\text{Pressure (mmHg)} = \frac{T \times N \times 4620 \text{ (constant)}}{C \times W}$$

T = Bandage tension* (kgf)	- the greater the force applied, the greater the pressure
N = number of layers applied	- the more layers, the greater the pressure
C = Limb circumference/shape (cm)	- the smaller the circumference at any given point, the greater the pressure
W = Bandage width (cm)	- the narrower the bandage, the greater the pressure

Appendix J: Compression stockings to prevent venous leg ulcers returning

What are venous leg ulcers?

Venous leg ulcers are caused by your veins not working properly to bring the blood from your legs back to your heart. This condition leads to increased swelling in your lower legs, which causes ulcers to form. To help your veins return your blood back to your heart and reduce this swelling, you must wear a compression stocking to prevent the ulcer returning.

Compression stockings need to be very firm at all times. Please observe the following advice:

COMPRESSION STOCKINGS: Once the ulcer has healed using bandages, you will be required to wear a compression stocking every day to prevent an ulcer from reoccurring (coming back). Your doctor or nurse will advise if you need to wear compression stocking on one leg or both legs.

TO HELP YOU WEAR YOUR COMPRESSION STOCKING EACH DAY PLEASE:

- Shower of an evening immediately prior to going to bed (do not shower in the morning)
- Massage moisturiser (e.g. Sorbolene cream) into skin of legs (after shower)
- Sleep with legs elevated (raise foot end of bed slightly)
- Put compression stockings on before putting feet to floor in the morning (to prevent swelling). Note: keeping stocking by bedside may help with this
- Cover any open wounds (sores or ulcers) before putting compression stocking on
- If due to hot weather the compression stockings become unbearable to wear, you may remove them. ***BUT DO NOT*** walk around whilst compression stockings are off, as your legs will immediately swell, making re-application difficult. **Rest with your ankles higher than your hips and move feet back and forwards to improve circulation!**

STOCKINGS MUST BE REPLACED EVERY SIX MONTHS and as per the Manufacturer's instructions!!!

COMPRESSION STOCKING TO PREVENT VENOUS LEG ULCERS RETURNING

FITTING: Compression stockings can be very hard to put on. When you buy your stocking ask if there is something to help you 'put on' and 'take off' your compression stocking.

When applying compression stocking:

- Protect the stocking from jewellery and fingernails – by wearing cotton or rubber gloves
- When pulling up stocking do not over stretch the stocking. The stocking should start at the toes and stop just below the knee cap. (do not fold or roll the top of the stocking over as this can stop the blood flow in the leg)
- Always wear stocking as the instructions say

CARE OF YOUR COMPRESSION STOCKING:

- Do not use Vitamin E or petroleum-based moisturisers
- Wash stocking by hand or gentle machine wash daily
- Use a mild laundry detergent
- Do not dry in direct sun – DO NOT use a clothes dryer
- Do not soak garments or use bleach
- Always lie stocking flat to dry (hanging may stretch stocking)

Please remove the compression stocking and contact your GP, Community Health Nurse or hospital emergency department if you are concerned or notice any of the following:

- Increasing pain in toes, foot or leg
- Blue discolouration of the toes
- Numbness, coldness or swelling of the toes, foot or leg
- Staining from a wound coming through the compression stocking