Lower Extremity Venous Ulcers

1. Introduction
2. Assessment
3. Classic Signs and Symptoms of Venous Disease (Table)
4. Classic Signs and Symptoms of Venous Disease (Table Cont)
5. Pathophysiology of Chronic Venous Insufficiency
6. Pathophysiology of Chronic Venous Insufficiency (Cont)
7. Animation of Normal Venous Flow and Venous Insufficiency
8. Non-Invasive Vascular Assessment
9. Locating Pulses
10. Ankle Brachial Index (ABI) Procedure
11. ABI Video Demonstration
12. ABI Clinical Significance
13. ABI Worksheet
14. Segmental Pressure Recordings
15. Duplex Ultrasonography
16. Clinical Features: Hemosiderin Staining / Hyperpigmentation, Lipodermatosclerosis, Edema
17. Clinical Features: Venous Dermatitis, Ankle Flare
18. Clinical Features: Venous Ulcer Characteristics
19. Treatment
Recommendations:
Compression

20. Treatment
Recommendations: LaPlace's Law

21. Treatment
Recommendations: Methods of Compression

22. Treatment
Recommendations: Methods of Compression (Cont)

23. Treatment
Recommendations: Effect of Compression Bandaging

24. Treatment
Recommendations: Adjunctive Therapies

25. Appropriate Dressing
Selection

26. Education

27. Treatment of Mobile and Immobile Patients

28. Outcomes

29. Summary

30. References
Introduction

Accurate assessment is the key to effective leg ulcer management. Chronic venous insufficiency, diabetic complications and arterial insufficiency are responsible for over 90% of leg ulcers. Of all lower leg ulcers, venous ulcers are the most common, affecting 1-2% of the population.

The cost of managing leg ulcers is very high in terms of dollars spent. With cost containment in health care being a national issue and the number of individuals needing care for leg ulcers so large, several groups have developed guidelines for the care of leg ulcers. Despite these efforts, the impact of leg ulcers is immeasurable. Individuals with leg ulcers experience pain, decreased mobility, negative self-image and feelings of anger, fear, isolation and depression. While fewer people experience arterial ulcers than venous ulcers, arterial ulcers are quite painful and can severely impact quality of life. Given the increasing rates of obesity and diabetes, these individuals may also then have to deal with diabetic/neuropathic ulcers.

Learning Objectives

After completing this module, you will be better able to:

- Describe the basic pathophysiology of venous ulcers.
- Identify the distinguishing characteristics of venous ulcers.
- Discuss the major treatment objectives for venous ulcers.
Assessment

An initial assessment of the patient with an ulcer of the lower extremity must include a detailed patient history which will provide clues as to the differential diagnosis. Careful physical examination is necessary to evaluate the size and characteristics of the wound and should highlight any associated medical conditions. The initial assessment should also include evaluation of the patient’s social circumstances as these may impact both care and healing.

Patient Assessment
The assessment of a patient with a wound begins with a thorough patient history and physical exam. The clinician must begin by identifying:

- Previous history of deep vein thrombosis or venous ulcer
- Previous wound history including method and outcome of treatment
- History of leg edema
- Cause of the wound such as trauma or pressure
- Treatment history of the wound to date
- Wound duration
- Identification of systemic factors that affect wound healing (medications, acute and chronic illnesses, age, etc.)
- Nutritional status
- History of travel or known exposure to fungal or parasitic causes.

Investigating and obtaining a thorough patient history will help in identifying the correct cause and facilitating management.

Wound Assessment
A complete wound assessment consists of a careful evaluation of the wound and surrounding tissue. Components of the wound assessment include:

- Location of the wound
- Physical characteristics of the wound including size and depth of injury
- Presence of undermining, tunneling, sinus tracts, foreign bodies and exposed bone
- Appearance of the wound bed
- Skin color and condition
- Skin temperature
- Amount and characteristics of exudate
- Presence of local or general edema
- Presence and nature of pain.
# Classic Signs and Symptoms of Venous Disease

The following table will guide the clinician in identifying classic signs and symptoms of venous disease and an accurate differential diagnosis of a lower extremity ulceration.

<table>
<thead>
<tr>
<th>Venous Insufficiency</th>
<th>Arterial Insufficiency</th>
<th>Neuropathic/Diabetic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varicose veins/previous DVT</td>
<td>Smoking</td>
<td>Previous history of ulceration</td>
</tr>
<tr>
<td>Decreased mobility</td>
<td>Diabetes</td>
<td>Loss of protective sensation</td>
</tr>
<tr>
<td>Obesity</td>
<td>Hypertension</td>
<td>Peripheral vascular disease</td>
</tr>
<tr>
<td>Traumatic injury</td>
<td>Aging</td>
<td>Duration of diabetes</td>
</tr>
<tr>
<td>Family history</td>
<td>Hyperlipidemia</td>
<td>Poor glycaemic control</td>
</tr>
<tr>
<td>Previous venous ulcer</td>
<td>H/O arterial disease</td>
<td>Impaired functional abilities</td>
</tr>
<tr>
<td>Pain when extremity is dependent for prolonged periods</td>
<td>Intermittent claudication</td>
<td>Paresthesia - insensate</td>
</tr>
<tr>
<td>Decreased pain and swelling with elevation</td>
<td>Pain with elevation, improves with dependency</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Location</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaiter area (lower calf area and above the ankle)</td>
</tr>
<tr>
<td>Most frequent is medial aspect of lower leg superior to malleolus</td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
</tr>
<tr>
<td>Color: wound base fibrinous or granular</td>
</tr>
<tr>
<td>Size: shallow in depth, small to large in surface area, irregular margins</td>
</tr>
<tr>
<td>Drainage: moderate to heavy</td>
</tr>
<tr>
<td>Edema: frequently present and often associated with dermatitis</td>
</tr>
<tr>
<td>Skin temperature: normal</td>
</tr>
<tr>
<td>Surrounding skin: brown staining called hemosiderosis</td>
</tr>
<tr>
<td>May see structural changes and bony deformities</td>
</tr>
</tbody>
</table>
### Classic Signs and Symptoms of Venous Disease (Table Continued)

<table>
<thead>
<tr>
<th>Venous Insufficiency</th>
<th>Arterial Insufficiency</th>
<th>Neuropathic/Diabetic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perfusion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palpable pulses</td>
<td>Pulses diminished, may only be audible with Doppler or absent</td>
<td>Palpable pulses</td>
</tr>
<tr>
<td>ABI &gt; 0.8</td>
<td>ABI 0.7 or lower</td>
<td>ABI may not be reliable in diabetic patients</td>
</tr>
<tr>
<td>Capillary refill normal &lt; 3 seconds</td>
<td>Capillary refill &gt; 3 seconds</td>
<td>Capillary refill normal &lt; 3 seconds</td>
</tr>
<tr>
<td><strong>Treatment Considerations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve venous return</td>
<td>Vascular consult to evaluate potential for revascularization</td>
<td>Pressure relief off loading the plantar surface of the foot with appropriate footwear</td>
</tr>
<tr>
<td>Compression therapy</td>
<td>No smoking</td>
<td>Tight glucose control</td>
</tr>
<tr>
<td>Unna Boot</td>
<td>Moisturize dry skin, do not apply between toes</td>
<td>Aggressive sharp debridement of callous</td>
</tr>
<tr>
<td>Multi-layer compression therapy</td>
<td>Avoid trauma</td>
<td>No bathroom surgery</td>
</tr>
<tr>
<td>Tubular compression dressing</td>
<td>Appropriate footwear</td>
<td>Aggressive treatment of infection</td>
</tr>
<tr>
<td>Compression stockings</td>
<td>Moist wound healing (if adequate blood flow to support healing is present)</td>
<td>Routine professional foot care</td>
</tr>
<tr>
<td>Compression pumps</td>
<td>High risk for pressure ulcers on heels</td>
<td></td>
</tr>
<tr>
<td>Leg elevation</td>
<td>Provide adequate pain management as pain may be pronounced</td>
<td></td>
</tr>
<tr>
<td>Must rule out arterial disease before initiating compression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pathophysiology of Chronic Venous Insufficiency

Normal Venous Return
Normal venous return is the result of two mechanisms. First, during ambulation the calf muscle contracts and compresses the venous compartment, propelling blood in the veins up towards the heart. Second, one way valves open when the calf muscle contracts and close when the calf muscle relaxes, preventing the reflux of blood and distention of the veins.

Pathogenesis of Venous Ulcers
The basic physiologic abnormality underlying the manifestations of chronic venous insufficiency is an elevation of ambulatory venous pressure.

- Valvular incompetence within the perforating veins connecting superficial and deep veins
- Ambulatory venous hypertension
- Failure of the venous pressure to decrease during ambulation
- Capillary distention and increased permeability of large molecules into the skin
- Venous ulceration assessment
Pathophysiology of Chronic Venous Insufficiency (Continued)

Pathogenesis of Venous Ulcers (Continued)

The pathogenesis of venous ulcers is the focus of much research. It is generally agreed that venous hypertension is the fundamental problem. Several hypotheses have emerged to explain the formation of venous ulcers.

Venous hypertension is often the result of valvular incompetence secondary to varicose veins that cause reflux or deep vein thrombosis (DVT). As a DVT forms, the thrombus adheres to the endothelium and contracts. Scarring destroys the valves. Recanalization of the vessel leaves high resistance incompetent channels.

It has been suggested that venous hypertension leads to the distention of vessels causing an increased permeability of the vessel wall which results in the leakage of large molecules or blood components into the skin. The presence of these components interferes with the diffusion of oxygen and the delivery of nutrients to the skin.

One hypothesis suggests that the presence of fibrin, which forms pericapillary fibrin cuffs, impedes the diffusion of oxygen and nutrients between the blood vessel and the dermis. This results in anoxia leading to ulceration. While this hypothesis has some merit, a number of flaws have been identified.

Another hypothesis suggests that white blood cells can become entrapped in areas of reduced venous flow where they adhere to endothelium, thereby causing occlusion of the capillaries and damage to dermal vasculature and releasing fluid and inflammatory mediators into the tissue which leads to chronic inflammation.
Animation of Normal Venous Flow and Venous Insufficiency

Regardless of the exact pathogenesis, clinically one observes that ulcers fail to reepithelialize often in the presence of a granulated wound bed. The following animation illustrates venous blood flow and the pathogenesis of ulceration.

Introduction

This animation demonstrates venous return from the lower limb. The buttons below are examples of those in the animation, which will allow you to interact in a number of ways:

- you can see the mechanism of venous flow
- you can visualise what happens during venous insufficiency
- you can control the contraction and relaxation of the calf muscle.

To return to this introduction at any time click on the question mark in the top right hand corner of the screen. Simply close this box to access the animation.

- Normal venous flow
- Cause venous insufficiency
- Muscle Control
- Exterior
- Labels

Starts the demonstration
Displays the effects of venous insufficiency on the leg
Activates the calf muscle, allowing you to view the effects on venous blood flow
view the leg exterior (on/off)
Switches the diagram labels on/off
Moves a message window (like this one)
Closes a message window (like this one)
Non-Invasive Vascular Assessment

An accurate vascular assessment of the extremity is necessary to ensure that the correct etiology of an ulceration has been identified and to exclude those patients with arterial disease for whom compression is dangerous. A number of non-invasive methods are used to confirm venous disease when a patient presents with suspected venous ulceration. Methods of assessment include examination of:

- Skin color and temperature
- Areas of dryness and cracking skin
- Capillary refill time - This is a simple test that provides information about the extent of ischemic disease. Normally, color should return in 3-4 seconds.
- Palpation of peripheral pulses - There can be significant discrepancies in documentation of pulses when the 1+, 2+, 3+,...(etc.) technique is used. It is more reproducible to document pulses as palpable or absent. Be sure to review the protocol for pulse assessment in your facility.

The following system for grading palpable pulses is often used:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1+</td>
<td>Barely palpable</td>
</tr>
<tr>
<td>2+</td>
<td>Palpable but diminished</td>
</tr>
<tr>
<td>3+</td>
<td>Normal</td>
</tr>
<tr>
<td>4+</td>
<td>Bounding</td>
</tr>
</tbody>
</table>

The Doppler is a vital tool of assessment when trying to determine the underlying etiology of leg ulcers and a course of treatment that will maximize wound healing potential. Leg ulceration is predominantly of venous origin and requires sustained compression to facilitate venous return from the lower extremities. However, before any type of compression management can be considered, a Doppler test should be performed to determine whether there is arterial involvement or whether the ulcer is the direct cause of arterial compromise. The significance of assessing for adequate arterial flow in the affected extremity is of utmost importance as the application of compression to an ulcer of arterial or mixed etiology could further compromise blood flow and result in ischemia.
Locating Pulses

The following exercise will help you in locating pulses and differentiating arterial and venous sounds of the arms and lower extremities. An explanation of the procedure follows the exercise.

**Welcome...**

This quiz will test your knowledge of the arterial sounds & locations.

You will be able to move the doppler probe over the parts of the body shown to find the arterial sounds.

You will have four chances to locate each pulse before you are asked to move onto the next one.

Before you start you can familiarise yourself with the arterial and venous sounds by clicking and holding the buttons below.

[Start Button]
Ankle Brachial Index (ABI) Procedure

The procedure for recording Ankle Brachial Index (ABI), also known as Ankle Brachial Pressure Index (ABPI) or Resting Pressure Index (RPI), is as follows.

- Check that the patient has rested for the appropriate amount of time (15-20 minutes).
- Prepare the patient’s arms and legs for access.
- Measure the brachial pressure in both arms using the Doppler. The Doppler probe should be held at a 45 to 60-degree angle to the limb. The electrode gel assists the transmission of the pulse to the probe.
- Identify the sound of the arterial flow. The artery has a high-pitched sound. If you hear a gale-like whoosh with ill-defined beats, you are listening to venous return and need to change the probe position.
- For the purpose of this test, systolic pressure only is required.
- Position the cuff approximately 5 cm above the malleolus. Any wounds which have had their dressings removed need to be covered by a plastic wrap or plastic bag to cover the wound and prevent contamination of the wound bed and cross contamination of the cuff.

Prior to inflating the cuff, locate the pedal pulses using the Doppler. The two main pulses from which an arterial sound may be heard are the dorsalis pedis pulse and the posterior tibial pulse. It is quite common in arterial compromise to find foot pulses absent or diminished. The posterior tibial pulse is more reliable than the dorsalis pedis pulse which is congenitally absent in 10% of people and impalpable in another 10%.

- Take systolic measurements on each ankle using different pulse points for greater accuracy. When all the measurements have been taken and recorded, the Ankle Brachial Index (ABI) can be calculated using the highest brachial systolic Doppler recordings and the readings from each ankle.

- **Note:** ABI is not always reliable in patients with diabetes due to arterial calcification that can lead to falsely high ABIs. **Do not pump the blood pressure cuff higher than 200 mm HG** as this may cause damage to calcified vessels.
ABI Video Demonstration

Click on the arrow in the picture above to view a demonstration of the ABI procedure.

Source: John Cooke, MD, PhD, Stanford Medicine 25 website (http://stanfordmedicine25.stanford.edu/).
ABI Clinical Significance

**ABI Calculation**

\[
\text{ABI} = \frac{\text{Ankle Systolic Pressure}}{\text{Brachial Systolic Pressure}}
\]

**Example**

Ankle systolic pressure = 80 mm Hg  
Brachial Systolic Pressure = 100 mmHg  
\[
\frac{80}{100} = 0.8
\]

Various groups, e.g., the Wound, Ostomy and Continence Nurses Society (WOCN) and the P.A.D. Peripheral Artery Disease Coalition, post ranges that can differ slightly from one another as noted below. The ABI number should become a part of the initial assessment and good clinical judgment becomes essential in making treatment decisions.

**WOCN (Wound, Ostomy and Continence Nurses Society)**

- **Normal range for ABI**
  - 1.0-1.1
  - < 0.9 = Borderline - The patient may begin to experience intermittent claudication or pain with ambulation.
  - 0.8-0.9 = Mild to moderate occlusion - At this point there is likely to be impaired healing.
  - < 0.5 = Severe occlusive disease

**P.A.D. Coalition**

- **Non-compressible vessels** - May represent a falsely elevated ABI which can occur in patients with sclerotic vessels, e.g., patients with diabetes or renal failure. The blood vessels become stiff and ridged and are not readily compressible which leads to falsely elevated readings. These patients may require further vascular testing to determine adequacy of perfusion.
  - 1.0-1.29 = Normal range
  - 0.91-0.99 = Borderline
  - 0.41-0.90 = Mild to moderate occlusion
  - 0.00-0.40 = Severe occlusive disease

It is important to periodically repeat the ABI to monitor progression of disease. A decrease of more than 0.2 is consistent with a decrease in perfusion and progression of disease. WOCN recommends repeating the ABI every three months.
**ABI WORKSHEET**

### Right Arm:
- **Systolic Pressure**
  - mmHg

### Right Ankle:
- **Systolic Pressure**
  - Posterior
  - Tibial (PT)
  - Dorsalis Pedis (DP)
  - mmHg

### Left Arm:
- **Systolic Pressure**
  - mmHg

### Left Ankle:
- **Systolic Pressure**
  - Posterior
  - Tibial (PT)
  - Dorsalis Pedis (DP)
  - mmHg

**Right ABI equals Ratio of:**
- Higher of the Right Ankle Pressures (PT or DP)
- Higher Arm Pressure (right or left arm)
  - mmHg

**Left ABI equals Ratio of:**
- Higher of the Left Ankle Pressures (PT or DP)
- Higher Arm Pressure (right or left arm)
  - mmHg

**Interpretation:**
- greater than 1.3 – non-compressible vessels
- 1.0 to 1.29 – normal
- 0.91 to 0.99 – borderline arterial disease
- 0.41 to 0.90 – mild to moderate PAD
- Less than 0.40 severe PAD

**Practice Points:**
1. Have patient lie flat as flat as possible on back with feet at heart level for 15 minutes prior to testing. May place small pillow under head. Cover with blanket for warmth as needed. Room temperature should be normal range.
2. Pump cuff up to obliterate pulse. Do not inflate cuff higher than 200 mg Hg as vessels may be calcified and this can cause additional damage. Deflate cuff slowly and listen for first systolic beat.
3. Evaluate ABI as one part of the needed assessment prior to placing compression.
4. Patients with arterial disease should be re-evaluated every three months when undergoing therapy as the ABI may decrease
Segmental Pressure Recordings

Examining patients with segmental pressure recordings is a procedure that measures systolic pressures sequentially up the leg from ankle to thigh. A pressure difference of greater than 25 mmHg between levels indicates occlusive disease.
Duplex Ultrasonography

Duplex ultrasonography measures blood flow velocity through a vessel and is the primary method of identifying venous obstruction or abnormal venous reflux.

A number of plethysmographic methods, including air and photo plethysmography, may be used to assess venous function. Other investigations may also be used to exclude disorders such as rheumatoid arthritis, diabetes, renal failure, anemia, tumors and auto-immune disorders.

A comprehensive physical exam can provide important information for the differential diagnosis of venous disease. It is essential to determine the adequacy of arterial perfusion because compression therapy is the gold standard of treatment for venous ulcers and high level compression is contraindicated in the presence of arterial disease with an ABI of less than 0.8. Reduced levels of compression are recommended in the case of mixed etiology ulceration with an ABI of 0.6-0.8 mmHg.
Clinical Features

A number of clinical signs are associated with chronic venous insufficiency (CVI) and useful in making a differential diagnosis. It is helpful to remember that the clinical presentation of CVI is, in part, the result of blood components leaking into the interstitial space.

Hemosiderin Staining/Hyperpigmentation
Chronic venous insufficiency (CVI) leads to distension of the blood capillaries and damage to the endothelium, leading to leakage of red blood cells. The breakdown products of hemoglobin cause dark staining of the skin or hemosiderosis.

Lipodermatosclerosis
Lipodermatosclerosis may be described as "woody" induration of the tissues with fat replaced by fibrosis. The leg often assumes an inverted champagne bottle shape.

Edema
Venous pressures and increased capillary permeability can lead to increased interstitial fluid. Venous disease can also be complicated by poor lymphatic drainage. Characteristically, edema associated with CVI may involve the lower leg and foot. It is considered pitting edema and may occur in one or both legs depending on the extent of the venous disease.
Clinical Features (Continued)

Venous Dermatitis and Eczematous Changes
Venous dermatitis and eczematous changes are often associated with CVI and can be aggravated by wound care products through irritation and allergy. Persistent scratching may cause secondary infections.

Ankle Flare
Ankle flare refers to the collection of small venular channels inferior to the medial malleolus and extending onto the medial surface of the foot. This sign is indicative of CVI.
Clinical Features (Continued)

Venous Ulcer Characteristics

Location  Gaiter area, most frequently above the medial malleolus but can occur anywhere on the leg
Size  Can be small to circumferential, shallow, with irregular wound margins
Wound bed  Ruddy color, granulation or fibrinous tissue
Drainage  Frequently moderate to large
Skin  Scaling, pruritis, weeping, staining
Pain  Varies greatly from painless to painful
Treatment Recommendations: Compression

There are fundamental principles for developing a comprehensive management plan for the patient with CVI and/or venous ulcers.

**Compression therapy** is the gold standard for treatment of venous ulcers. It is extremely difficult for venous ulcers to heal in the absence of compression. There are a variety of interventions for providing compression. However, not all interventions have the same level of effectiveness.

Sustained compression provides the mainstay of treatment in venous leg ulcers. Compression should be supported with adjunctive medical and surgical therapy, appropriate dressings and patient education. Sustained compression is provided by multi-layer elastic or inelastic bandage systems. There is now considerable evidence that this form of sustained high compression improves ulcer healing and provides quality of life and cost benefits. Multi-layer high compression bandaging improves healing of venous leg ulcers better than single layer low compression bandaging. Reduced compression systems (15-25 mmHg) are available for patients who cannot tolerate high compression.

The **degree of compression** produced by any bandage system over time is determined by complex interactions between four principle factors:

- the physical structure of the elastomeric properties of the bandage
- the size and shape of the limb to which it is applied
- the skill and technique of the bandager
- the nature of any physical activity undertaken by the patient.
Laplace's Law (Determining Sub-Bandage Pressure)

Instructions
This diagram illustrates the different ankle and calf sub-bandage pressures associated with a normal sized and an edematous leg, as indicated by La Place's Law.

Click on the four arrows to measure the relative sub-bandage pressures at the indicated points.

La Place's Law
The degree of compression produced by any bandage system over time is determined by complex interactions between four principle factors - the physical structure of the elastomeric properties of the bandage, the size and shape of the limb to which it is applied, the skill and technique of the bandager and the nature of any physical activity undertaken by the patient.

Laplace's Law (Determining Sub-Bandage Pressure) The pressure generated by a bandage immediately following application is determined principally by the tension of the fabric, the number of layers applied, and the degree of curvature of the limb.

\[ P = \frac{T}{R} \] (P pressure; T tension; R radius)

Applied pressure is directly proportional to the tension in a bandage (P increases with T) but inversely proportional (P decreases as R increases) to the radius of the curvature of the limb to which it is applied.
Treatment Recommendations: Compression (Continued)

Methods of Compression

- **Elastic compression (long-stretch) bandages** exert high compression during rest and exercise.
- **Inelastic (short-stretch) bandages** produce passive compression mainly when the calf muscle contracts, increases in volume and creates pressure against the bandage. At rest, inelastic compression bandages exert pressure dependent on the tension used during application.

---

**Instructions**

This animation demonstrates the different levels of pressure achieved by different types of compression bandaging in the immobile and ambulatory limb.

Once you have started the animation, simply select the type of bandaging from the panel at the top of the screen, for example select 'short-stretch bandaging'.

A simulation of this bandaging will appear in the panel at the bottom of the screen on an immobile and an ambulatory limb. The pressure dials will indicate the relative pressure exerted by the compression bandaging in each situation.

To move onto another simulation, simply select an alternative form of bandaging from the panel at the top of the screen.

Please click on the start button to begin the animation.
Treatment Recommendations: Compression (Continued)

Methods of Compression (Continued)
Compression products are selected from a wide variety of options today. Wraps and stockings are available, as well as garments that fasten with Velcro. Tubular products and intermittent pneumatic pumps are also on the market. Selection of appropriate compression must be based on careful assessment of the individual person, but research bears out the value of some compression over no compression.

Compression wraps range from single layer, re-usable wraps applied over a felt layer to two-, three- and four-layer wraps. Wraps can vary from inelastic (no stretch involved) to elastic which adjusts to changes in the size of the leg. Some two-layer wraps today will provide the same compressive force as the four-layer wrap.

Compressive stockings come in a wide range of compressive force as well as types (knee-high, thigh-high, panty hose, men's socks, etc.). They also come in fashionable colors and special designs.

Intermittent pneumatic compression may be available for those patients needing a high level of compression such as in lymphedema but payment authorization is limited based on documented diagnosis and failure of six months of standard compression therapy.
Treatment Recommendations: Compression (Continued)

The Effect of Compression Bandaging on Venous Insufficiency in the Lower Extremity

The following exercise is designed to help you understand the effect of bandaging on venous insufficiency in the lower extremity.

Introduction

This animation demonstrates the effect of compression bandaging on venous insufficiency in the lower limb.

Once you have closed this window, you will be presented with an external view of the call. To view the effects of venous insufficiency, click on the ‘View cut-away animation’ button. You can then apply compression using the button provided to see how compression bandaging reverses the effects of venous insufficiency leading to closure of the wound.

Selecting each of the numbers shown will give you more information regarding the vascular and microvascular events you are seeing.

You can replay the animation at any point by using the ‘rewind’ button provided.

Buttons at a glance

- View cut-away animation
  - Starts the animation
- Apply compression
  - Displays the effects of compression bandaging on the lower limb
- You can view this page by simply clicking the question mark button.
- Rewind the sequence

To view the effects of venous insufficiency, click on the ‘View cut-away animation’ button.
Recommendations for Treatment: Adjunctive Therapies

A number of adjunctive medical therapies, i.e., pentoxifylline, may be used as an adjunct to compression therapy to treat venous ulcers. There is also increasing realization that chronic wounds, such as venous ulcers, benefit from an overall approach aimed at optimizing the wound bed. There is emerging evidence that cellular and/or tissue-based products may be beneficial in the treatment of hard to heal venous leg ulcers (especially ulcers with duration of >1 year) when used in conjunction with multi-layer compression bandaging. Other biological agents, such as growth factors and protease inhibitors, are currently being evaluated for their efficacy in the management of venous leg ulcers. Some patients with leg ulcers suffer pain that can adversely affect quality of life and may influence speed of healing. Reduced compression should be used until pain and edema resolve and then high compression bandaging can be introduced. In most cases, appropriate dressings or oral analgesics can effectively manage pain, although skin grafting may be required in cases of intractable pain.
Appropriate Dressing Selection

Patients with leg ulcers, especially venous leg ulcers, are prone to contact sensitivity particularly from wood alcohols, topical neomycin, framycetin, cetylstearyl alcohols and rubber mixes which are present in many dressings, ointments and creams. Emphasis should be placed on allergen avoidance to allow optimal wound healing. However, this remains a difficult management issue in individual patients given that the leg is typically wrapped for up to a week at a time. Since products are available that contain no latex, clinicians should check on the brand of compression used and select latex-free products.

Guidelines for the Society for Vascular Surgery and the American Venous Forum suggest application of skin lubricants to lessen dermatitis (Guideline 4.16). This guideline also suggests not using antimicrobial agents for infected venous ulcers, advocating instead for the use of systemic antibiotic therapy based on culture sensitivities and that this therapy should last for only about two weeks (Guideline 4.12 and 4.13).10
Education

Factors that encourage ulcer healing, such as improved nutritional status, diabetes control, appropriate bandage use and mobility, are dependent on patient involvement. Education to improve patient understanding of the condition will aid compliance with therapy. Our understanding of the pathophysiology of lower leg ulcers continues to advance and it is essential that providers of wound care stay abreast of new information in order to share it with patients and increase their participation in therapy.

Patients can be resistant to use of compression, e.g., saying that wraps/stockings are too hot or too tight. Because an individual with chronic venous insufficiency needs to use compression to avoid reulceration, it is important to involve the patient in finding a pathway that achieves its use. Remember that when maximum compression cannot be achieved, some compression is better than no compression for venous leg ulcer treatment and prevention.
Treatment of Mobile and Immobile Patients

Reduced mobility and reduced ankle function, as well as other factors such as ulcer size and duration, have been shown to independently affect healing rates. As inelastic bandages lose pressure when leg edema is reduced, multi-layer elastic compression is recommended as first-line therapy for immobile patients with venous leg ulcers. The incidence of venous leg ulcers increases with age, rising to 6% in the population over 80 years old because a high proportion of this age group suffers from some degree of immobility.

For the individual who has an initial ulcer with a fair amount of edema, it is necessary to reduce the edema by using compression wraps or tubular compression before ordering compression stockings. If stockings are measured for and ordered before the edema is controlled, the stockings (which are very expensive) will not fit properly.
Outcomes

Careful initial assessment must include pulse examination and ABI evaluation when venous ulceration is suspected. This assessment is essential to rule out arterial involvement which would impact treatment decisions.

Topical therapy for venous ulcers should manage exudate and provide an appropriately moist wound bed for healing. When venous leg ulcers do not heal after 4-6 weeks of standard wound therapy, other treatment modalities may need to be considered. New skin replacements and cellular modalities are available but appropriate compression and good standard wound care should be the initial approach.

Referral for vascular management may be appropriate for patients with reflux issues that do not respond to standard care.
Summary

A comprehensive review of the literature and expert consensus confirm the role of sustained compression (elastic and inelastic) as first-line therapy for venous leg ulcers. Reduced compression and compression hosiery are useful alternatives in those patients with additional arterial disease or who cannot tolerate multi-layer bandaging.

There is a need for further randomized controlled trials (RTCs) on other medical and surgical therapies to be used in conjunction with compression therapy.

Guidelines noted in this module provide useful working tools for all providers of wound care to facilitate appropriate care based on findings in the literature.

- Sustained multi-layer compression is confirmed as first-line therapy for venous leg ulcers.
- Reduced compression and compression hosiery are useful alternatives.
Recommended Resources

Wound management is a rapidly evolving field. The editors of the UW Wound Academy strongly recommend consulting multiple sources, including the following publications, to continually update your knowledge and verify current approaches to treatment and prevention when making wound management decisions.

Texts


Journals

- Advances in Skin and Wound Care: The International Journal for Prevention and Healing
- Journal of WOCN (Wound Ostomy and Continence Nursing)
- OWM -- Ostomy Wound Management
- Today's Wound Clinic
- Wounds: A Compendium of Clinical Research and Practice

References

The following list includes references from the original version of this module which was developed for the Global Wound Academy by Smith and Nephew, Inc. In 2014, permission to independently review, edit, update and publish this module as part of the UW Wound Academy was given to Continuing Nursing Education at the University of Washington School of Nursing (UWCNE) by Smith and Nephew, Inc as part of an unrestricted educational grant to expand access to wound management continuing education. This module was last edited in 2016.