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Evaluation and Management of Arterial and Venous Ulcers

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June 28, 2017

Objectives

1) Identify the at least three characteristics between arterial and venous ulcers.

2) List at least two treatment options for both arterial and venous ulcers.

3) Describe at least three signs that indicate a patient should be referred to another health care provider when presenting with arterial or venous ulcers.
Introduction

• Many people affected by chronic wounds
  • ~2% of the general population
  • Care to treat these chronic wounds is more than 50 billion dollars a year
    • “10 times more than the annual budget of the World Health Organization” (Fife et al, 2012)
  • Of chronic wounds, venous and arterial ulcers make up a significant percentage
    • In an analysis of outpatient wound center data, venous ulcers represented 7.8% of the dataset, and arterial ulcers and nonhealing amputations 1.5% each (Fife et al, 2012)

• We will first examine arterial ulcers and then contrast them with venous ulcers later

ARTERIAL INSUFFICIENCY ULCERS
Introduction

• Important to know that these ulcers make up only about 5-10% of all lower extremity ulcers

• Often arterial insufficiency is asymptomatic but is cause of 5% of amputations

• Greater than 80% of people with arterial insufficiency have a history of smoking

• Important to know that other disease processes can cause ischemia such as thrombangiitis, vasculitis, Raynaud’s, Pyoderma gangrenosum, and Sickle Cell Disease

Arterial System Overview

• Carries blood from the heart and into the rest of the body

• Arteries have 3 layers
  1. Tunica externa: Protective outer layer
  2. Tunica media: Middle layer, made of smooth muscle and collagen and elastin fibers
  3. Intimal layer: Single layer of endothelial cells that is in direct contact with blood

• Vary in size depending on what they are supplying blood to
  • Smaller arteries are called arterioles

• Capillaries: Simplest vessel, only 1 layer of endothelial cells and a thin basement membrane; Can only allow 1 red blood cell through at a time
Anatomy of Artery

Vascular System

Blood Vessels
- Aorta ➔ Arteries ➔ Arterioles ➔ Capillaries ➔ Venules ➔ Veins ➔ Vena Cavae
Etiology of Arterial Insufficiency and Related Tissue Damage

• Arterial insufficiency is term for a decrease in blood getting to the extremities

• Often associated with trauma, acute embolism, rheumatoid arthritis, and diabetes
  • Ischemia is also common in other diseases such as sickle cell disease, Buerger’s disease (thrombangiitis obliterans), Raynaud’s disease, etc.

• Most common cause is arteriosclerosis
  • Thickening and hardening of arteries
  • Typically caused by atherosclerosis
    • “Systemic, degenerative disease process in which the arterial lumen is gradually and progressively encroached upon”
    • Cholesterol sticks to vessel walls, causing plaques
    • This leads to narrowing of the artery, thus causing increased impedance to blood flow and decreased overall blood flow
Peripheral Arterial Disease

- Sequelae of this disease include:
  - Intermittent Claudication
  - Nocturnal Pain
  - Rest Pain
  - Ulceration and Gangrene

Intermittent Claudication

- Activity-dependent
- Pain from this is characterized by cramping or aching sensation while ambulating
- This is relieved by resting
- Pain occurs most often in calf
  - However, if occlusion occurs higher up, patient can complain of pain in buttocks and upper thigh
- Symptoms depend on degree of ischemia to which leg muscles are subjected to
Intermittent Claudication

- Video
Ischemic Rest Pain

• A progression of the atherosclerosis
• Patients begin to have pain even at rest
• Patients will state it feels better to dangle the leg at night
• 2 types
  1. Nocturnal Pain
  2. Rest Pain

Nocturnal Pain

• Form of ischemia neuritis
• Usually precedes rest pain
• Occurs at night as blood flow circulates around core of body and not the extremities
• Pain usually occurs in the toes, across the base of the metatarsals and in the plantar arches
• Pain is relieved with standing, dangling feet over edge of bed and occasionally with walking
Rest Pain

• Caused by increased nerve ischemia due to arterial insufficiency
• Pain is worse at night and usually requires narcotics to treat pain
• Pain decreased by dependency of lower extremities and is increased by heat, elevation, and exercise
• Usually seen with at least 2 significant arterial occlusions
• Patients with rest pain will usually have an ABI of less than 0.5mm Hg (will discuss ABI in future slides)

Ulceration

• When arterial disease has become its most severe, ischemic ulcers occur
  • Tissue demand for blood exceeds the supply
• These are generally seen on distal portions of foot, toe or heel and are exquisitely painful
  • Commonly result from ill-fitting shoes, positional pressure, or shearing in medically compromised patients
• Ulcers generally do not bleed and often have necrotic rim or crater
• Pain can be relieved by dependence of limb
Dry vs. Wet Gangrene

**Dry Gangrene:** “Dead tissue that is dry, dark, cold and contracted when compared similar areas or the contralateral side.” Typically seen with arterial insufficiency and is a slow progression.

**Wet Gangrene:** Shows there is some type of infection going on. More frequently seen in diabetics. Typically advances very quickly.

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Risk Factors Contributing to Arterial Insufficiency

- Some of these risk factors cannot be modified but many of them are easily modified
  - **Hyperlipidemia:** High cholesterol in blood leads to more plaque being deposited in blood vessels
  - **Smoking:** #1 modifiable risk factor
    - Causes vasoconstriction → decreased tissue perfusion
    - Decreases amount of oxygen available
    - Increased rate of clot formation and thickens blood
    - Enhances the effect of hyperlipidemia
  - **Diabetes:** Increased risk of calcium deposits; may not always consider arterial insufficiency in these patients because they don’t have the sensation to sense ischemic pain
  - **Hypertension:** Increased pressure of the blood flow damages the delicate endothelial cells
  - **Trauma:** Common causes of arterial ulcers
  - **Advanced Age:** Less able to adapt to changes in oxygen demands
Vascular Testing-Introduction

• If, after you have done your thorough history taking and have palpated and observed your patient’s lower extremities thoroughly and you suspect a vascular issue, more objective testing must be done

• Vascular testing can be invasive or non-invasive
  • Magnetic resonance angiography, CT angiography or angiogram done by vascular surgeon to identify where a blockage may be and/or where the level of adequate blood flow is
  • Some of non-invasive techniques we can do as physical therapists
    • Pulses: Ankle Brachial Index
    • Transcutaneous Oxygen Pressures
    • Trendelenburg’s Test
    • Rubor of Dependency
    • Venous Filling Time

Arterial System
Grading Pulses

- Important to check both involved and uninvolved side
- Should assess these:
  - Femoral
  - Popliteal
  - Posterior tibial
  - Dorsalis pedis
    - Lack of posterior tibial is more accurate than lack of dorsalis pedis but a lack of both demonstrates peripheral arterial disease
- How to describe pulses
  - 0 = Absent pulse
  - 1+ = Diminished pulse
  - 2+ = Normal pulse (easily felt)
  - 3+ = Bounding or accentuated pulse
- If pulse is absent, need to do more in-depth testing

Doppler Ultrasound

- Use of a Doppler to detect pulses that are not easily palpable
- Use ultrasound gel for coupling
- Place probe at 45-degree angle to skin and listen for "swooshing" sound
- If you cannot hear sound, there is no blood being moved and thus no perfusion
Ankle Brachial Index (ABI)

- If you determine a patient to have diminished or absent pulses, you will then need to perform an ankle brachial index
  - Reliable, sensitive non-invasive test of blood flow
- New recommendations are to perform an ABI on anyone with a lower extremity ulcer to rule out arterial involvement
- ABI should also be performed prior to any compression is given for venous insufficiency
  - If patient already has compromised arteries and you compress them further, you will cause increased problems with blood flow.

Ankle Brachial Index

- Measures the systolic blood pressure in the ankles and helps determine presence of arterial occlusive disease
  - Lower the number, more likely there is arterial insufficiency
- Equipment needed: Doppler ultrasound, blood pressure cuff and ultrasound gel
- We will practice this in lab
ABI Procedure

1. Lay patient flat and have patient rest for 10-15 minutes
2. Apply BP cuff around patient’s arm
3. Apply ultrasound gel
4. Hold Doppler probe at 45 degree angle and place over brachial pulse
5. Identify arterial signal and inflate cuff until signal disappears
6. Slowly deflate cuff until signal reappears. This is your brachial systolic pressure
7. Obtain brachial pressure in BOTH arms. Take the higher of the two pressures for your brachial pressure.
8. To obtain ankle pressures, place cuff above the ankle and place Doppler probe over the dorsalis pedis or the posterior tibial artery.
9. Repeat steps 3 to 6 for other leg.

Calculating the ABI

Highest ankle Doppler Pressure

• ABI= Highest brachial Doppler Pressure
• 1.0 is normal value (0.9-1.1 normal range)
• Significance of ABI Values
  ABI < 0.5: Refer to vascular surgeon, compression contraindicated
  ABI 0.5 to 0.7: May be accompanied by intermittent claudication, Refer to vascular surgeon, compression contraindicated
  ABI 0.7-0.9: Mild peripheral arterial occlusive disease, compression therapy with caution
  ABI >1.0: Referral to vascular surgeon; Indicates calcified vessels if diabetic
Ankle Brachial Index

- Video

### ABI Interpretation

<table>
<thead>
<tr>
<th>ABI</th>
<th>Interpretation</th>
<th>Possible Vascular Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1-1.3</td>
<td>Vessel Calcification</td>
<td>ABI is not a valid measure of tissue perfusion</td>
</tr>
<tr>
<td>0.9-1.1</td>
<td>Normal</td>
<td>None needed</td>
</tr>
<tr>
<td>0.7-0.9</td>
<td>Mild to moderate arterial insufficiency</td>
<td>Conservative interventions normally provide satisfactory wound healing</td>
</tr>
<tr>
<td>0.5-0.7</td>
<td>Moderate arterial insufficiency, intermittent claudication</td>
<td>May perform trial of conservative care, physician may consider revascularization</td>
</tr>
<tr>
<td>&lt;0.5</td>
<td>Severe arterial insufficiency, rest pain</td>
<td>Wound is unlikely to heal without revascularization, limb-threatening arterial insufficiency</td>
</tr>
<tr>
<td>&lt;0.3</td>
<td>Rest pain and gangrene</td>
<td>Revascularization or amputation</td>
</tr>
</tbody>
</table>

Wound is unlikely to heal without revascularization, limb-threatening arterial insufficiency.
Calculating the ABI (example)

- Your patient’s Right brachial pressure is 180
- His Left Brachial pressure is 170
- His involved ankle pressure is 120

\[
120/180 = 0.67
\]

- What will you do? Will you do compression therapy for this patient?
Diabetics and ABI’s

- ABI values can be falsely elevated in diabetics due to an inability to compress their arteries.

- Diabetics develop calcifications in their arteries which makes it difficult to obtain accurate ABI.

- So, if you are sure there is an arterial involvement in a patient with DM and their ABI comes back 1.0 or greater, you still will need to refer to vascular surgeon.

- Don’t be fooled!

ABI’s

- We can do ABI easily in the clinic.

- Vascular labs do more in-depth studies, looking at Doppler pressures at different levels of the legs. This can give an indication where a blockage may be occurring.

- Toe pressures are also done in the vascular lab, especially important for diabetics.
  - More reliable assessment of the LE circulation. Digital arteries are less likely to calcify.
Segmental Pressure Measurements

• Similar to ABI but you do at different segments of the leg
  • Dorsalis pedis/posterior tibial
  • Above the malleoli
  • Below the knee
  • Around the thigh

• Can help determine where the occlusion or narrowing is occurring
Capillary Refill

• Indicator of surface arterial blood flow

• Observe color of toes, then apply enough pressure to tip of blanch skin and then release pressure to see how quickly it takes for color to return

• Normal is less than 3 seconds

Rubor of Dependency

• Testing for peripheral arterial circulation

• Note the color of the plantar surface of the feet

• Elevate the leg to 60° for 60 seconds

• Note the plantar surface color

• Return the leg to a dependent position and record the amount of time it takes for color to return to the foot

• Normal color usually returns in 15 to 20 seconds

• If there is arterial insufficiency, it may take >30 seconds and may even get bright red
  - "Reactive hyperemia"
Rubor of Dependency

- Pallor after 45-60 seconds of elevation: Mild arterial insufficiency
- Pallor after 30-45 seconds of elevation: Moderate arterial insufficiency
- Pallor within 25 seconds of elevation, dependent rubor: Severe arterial insufficiency

Venous Filling Time

- Testing for peripheral arterial circulation
- Note the veins of the feet and LE
- Position the patient and elevate the extremity as you did for the Rubor of Dependency
- Then place the leg in a dependent position, and note the time necessary for the veins to refill
- Normal is 5-15 seconds
- A filling time greater than 15 to 20 seconds indicates arterial insufficiency
Venous Filling Time

- Venous filling time <5 seconds: Venous insufficiency
- Venous filling time 5-15 seconds: Normal
- Venous filling time >20 seconds: Arterial insufficiency

When to refer to a Vascular Surgeon?

- **No need for vascular consult:**
  - ABI greater than 1.0 and tcPO2 measurement greater than 30mmHg
  - ABI greater than 0.8 and wound healing well
- **Semiurgent vascular consult:**
  - ABI between 0.5-0.8
  - ABI less than 1.0 with diminished or absent pulses
  - Non-healing wound despite 3+ pulses and good wound care
- **Urgent Vascular Consult:**
  - Gangrene present
  - ABI below 0.6
  - Exposed bone or tendon at base of ulcer
  - Gross infection or cellulitis

- When in doubt, refer out!
Classification and Characteristics of Arterial Ulcers

- **Pain**: Usually severe; worse with elevation
- **Position**: Typically distal toes, dorsal foot or if trauma has occurred
- **Presentation**: Pale granulation bed; Eschar or gangrene. Minimal drainage
- **Periwound and structural changes**: Shiny, dry skin; lack of hair growth; thickened nails; Cyanotic skin
- **Pulses**: Decreased or absent
- **Temperature**: Cool

Prognosis

- Depends on severity of arterial disease
- Also depends on severity of sequelae of disease
  - How bad is the wound
  - How bad is the atherosclerotic pain
Physical Therapy Interventions

- Similar to other PT interventions
- Education of patient and family
  - Foot Care Guidelines Coordination with other ancillary services
  - Vascular surgery
  - Endocrinology
  - Dietician
  - Counselor or behavioral psychologist

Management of Arterial Wounds

- Concept is simple!
  - Must increase perfusion to extremity/ulcer site

- Wound Care Precautions
  - Debridement of gangrene contraindicated in the presence of ischemia until blood flow restored
  - Avoid compression

- Moist wound healing applies to ulcers with adequate blood supply
  - Manage infection
Physical Therapy Interventions

- Therapeutic Exercise
  - Gait and Mobility training
  - Patient positioning
  - Aerobic exercises
  - Resistive exercises
  - Flexibility exercises
- Proper footwear
- Physical Agents/Modalities
  - Therapeutic Heat

Medical Intervention

- Interdisciplinary
- Tests to be performed:
  - Plethysmography and duplex scanning
  - Toe pressures: Similar to ABI but looks at pressure in toes
  - Arteriography: Dye is injected into artery to look at blood flow
- Need for vascular consultation:
  - Absence of both dorsalis pedis & posterior tibial pulses
  - ABI < 0.9, plus any of the following:
    - No ulcer improvement w/ 2-4 weeks of treatment.
    - Intermittent claudication
    - TcPO2 < 30 mm Hg: See next slide for more detail
    - Measure of transcutaneous oxygen; measure at skin level mirrors amount of oxygen at cellular level
    - Clinical Signs & Symptoms of infection
- NEED FOR URGENT CONSULTATION:
  - ABI < 0.4 and gangrene

WOCN guidelines, 2003
Transcutaneous Oxygen Measurements (tcPO2)

- Measures oxygen delivery to skin tissue
- Useful in predicting ulcer healing
- Documents the hypoxemia characteristic of ischemic tissue
- Sensor is placed over skin for 20 minutes and then reading is taken
- Less than 20mmHg, wound will not heal.
- 30mmHg or greater, healing will occur
- If low, refer to vascular surgeon
- Test not reliable in patients with swelling or infection
Medical Intervention (Interdisciplinary)

Education on Management of Risk Factors:

- Smoking cessation
- Exercise program – walking to near maximal pain 3x's per week
- Lipid control – If patient has high cholesterol, Niacin often prescribed
- Glycemic control if diabetic
- Nutrition: L-arginine – increases pain-free ambulation and vasodilatation of femoral artery

Pharmacological Interventions for pain

- Pain management plays huge role in treating these patients
- Some medication may be aimed at improving circulation
- Sympathetic blocks may also help with pain
Surgical Intervention

- Debridement
- Revascularization: Bypass surgery
  - “First identifying the most distal segment with normal blood flow and the occluded artery segment, then choosing a new conduit, or bypass to replace the diseased segment”
- Percutaneous balloon angioplasty
  - May involve use of balloons to open arteries or place stents
- Amputation
  - Last resort; after many attempts to revascularize
  - “Level of amputation determined by most distal satisfactorily perfused arteries and the patient's future mobility”

Examples of Arterial Ulcers
Summary

- Arterial Insufficiency caused by atherosclerosis
- Many risk factors contribute to arterial insufficiency
  - Those that can be modified should be big focus of treatment of disease
- Many tests available to test for adequate blood flow
- Important to treat patient to restore blood flow prior to treating wound itself
  - Without adequate blood flow, cannot heal wound despite the best wound care
- [https://www.youtube.com/watch?v=I4jxjWlbWyg](https://www.youtube.com/watch?v=I4jxjWlbWyg) Good review of Peripheral Vascular Disease
VENOUS LEG ULCERS (VLU)

Introduction

- 70% to 90% of all leg ulcers
- Afflicts 1% of general population and 3.5% of those over 65 with recurrence rate of 70%
- Women affected 3 times more than men
- Up to 26% of patients with venous ulcers have concomitant arterial disease
- Average annual incidence rate in Medicare patients is 2.2% and in private insurers it is 0.5% (Rice et al, 2014)
- Annual US payer burden is ~$14.9 billion (Rice et al, 2014)
- 15% of VLU never heal
- Patients are often non-compliant with compression and thus have frequent recurrence
  - 15%-71% of venous ulcers are recurrent lesions (Kimmel et al, 2013)
Venous System

Vein Anatomy

Anatomy of a Vein
Venous System Overview

- Low pressure system that carries blood from extremities back to the heart
- Anatomy of vein similar to anatomy of artery
  - 3 layers: Outer tunica externa, middle tunica media, and inner intimal layer
  - Thinner layers, making veins able to expand more than arteries
- 3 types of veins
  - Deep: Femoral, popliteal and tibial; parallel arteries
  - Superficial: Greater and lesser saphenous veins; Located in subcutaneous tissue. Drain blood from skin and subcutaneous tissue and helps in temperature regulation
  - Perforating: Perforates the fascia; Connect deep and superficial veins
Venous System Overview

• Major difference from arteries, veins have bicuspid valves that only allow blood flow towards heart;
• Valves prevent retrograde blood flow, thus decreasing increased venous backpressure, or **venous hypertension**

• Since pressure in veins is so low, the body relies on 2 pumps to assist with blood flow to heart
  • Respiratory Pump: Powered by breathing
  • Calf Muscle Pump: Powered by ambulation or calf muscle contractions. Helps push the blood towards the heart

Function of the Venous Pump

• Calf muscle contracts, pumping blood from lower extremity via veins with one-way valves
• When valves are incompetent, it allows blood to leak back down into interstitial space, thus causing edema and hemosiderin staining
Venous Stasis
Etiology of Venous Insufficiency and Associated Tissue Damage

- Mechanism behind these ulcers is poorly understood.
- **Sustained venous hypertension** is common factor in all patients with venous insufficiency ulcers.
- First common complaint is swelling of legs which can be accompanied by discomfort and feeling of heaviness in legs.
  - This is relieved by elevation.

Pathophysiology

- Increase hydrostatic pressure \(\Rightarrow\) venous hypertension \(\Rightarrow\) dermal ulceration.
- Disorders associated with or capable of inducing venous disease:
  - Thrombosis of deep venous system
  - Postphlebitic syndrome
  - CHF
  - Incompetent valves
  - Obesity
  - Pregnancy
  - Superficial vein regurgitation
  - Muscle weakness
Pathophysiology

• All increase venous pressure resulting in edema and ulceration

• Research by Browse and Burnand in 1982 reputed early theory of insufficiency of blood being the primary culprit in development of venous ulcers.
  • Instead, they found excessive pressure may provoke extravasation of erythrocytes and fibrinogen (increase in vascular permeability) resulting in fibrin cuffs developing at the capillary level leading to cellular dysfunction and cell death and skin ulceration

Pathophysiology

• Recent years new additional theory suggests a “white blood cell-trapping theory” where an accumulation of white blood cells block the capillaries resulting in local ischemia and inflammatory process

• Why venous ulcers are often called “venous stasis”

• Contributing factors
  • Malnutrition
  • Hypoalbuminemia
  • Immobility
  • Trauma
Risk Factors Contributing To Venous Ulceration

- Anything that causes sustained venous hypertension can cause venous insufficiency related tissue damage
- Vein Dysfunction: Blood clots can damage veins. Varicose veins are dilated veins often caused by congestive heart failure, pregnancy, obesity and tight clothing
- Calf Muscle Pump Failure: Anything that affects the contraction of the calf muscle. Immobility or prolonged standing in one place.
- Trauma: Fluid is pooling in interstitial space so any opening in the skin from trauma will allow a place for that fluid to leak out
- Previous Venous Insufficiency Ulcer: Recurrence rates ~81%. Often due to patient noncompliance
- Advanced Age: Valve degeneration and normal age-related skin and tissue changes
- Diabetes: Increased risk of microvascular disease and impaired immune response

Physical Therapy Tests and Measures for Venous Insufficiency

- Some of these we already discussed with arterial insufficiency ulcers; can help identify venous insufficiency as well.
- Clinical Assessment for DVT: Gold standard is venogram or ultrasound. However, we can use the Homan’s sign to screen a patient for DVT
- ABI: Common to see mixed ulcers with both arterial and venous involvement. Must make sure patient has good blood flow before initiating compression therapy
- Trendelenburg’s test: See next slide
- Doppler Ultrasound: More subjective test; need to interpret changes in sound you are hearing.
- Venous Filling Time: Same as you would do for arterial
Trendelenburg’s Test

• Testing for peripheral venous circulation
• Elevate the leg to 60°
• Place a tourniquet around the proximal thigh
• Have the patient stand and note the method of venous filling
• Normal – filling within 30 seconds
  • If the superficial veins fill rapidly with the tourniquet in place, the valves of the communicating veins are incompetent
  • If sudden additional filling occurs after the tourniquet is released, the valves of the superficial veins are incompetent

Classification

• Clinical-Etiology-Anatomy-Physiology (CEAP): How venous disease is classified based on severity
• Developed in 1994 by American Venous Forum to serve as a basis for scientific analysis of chronic venous disease (CVD) and treatment options (Kimmel et al, 2013)
• Broke down venous leg management into 5 principles:
  1. Compression
  2. Local wound care
  3. Surgical intervention
  4. Medical treatment
  5. Advanced technology
## CEAP

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>C1</td>
<td>Teleangiactasias or spider veins &lt;3 mm</td>
</tr>
<tr>
<td>C2</td>
<td>Varicose veins ≥ 3 mm</td>
</tr>
<tr>
<td>C3</td>
<td>Leg edema</td>
</tr>
<tr>
<td>C4</td>
<td>Skin and subcutaneous tissue changes</td>
</tr>
<tr>
<td></td>
<td>• C4A: Hemosiderin deposition</td>
</tr>
<tr>
<td></td>
<td>• C4B: Lipodermatosclerosis</td>
</tr>
<tr>
<td>C%</td>
<td>Healed venous ulcer</td>
</tr>
<tr>
<td>C7</td>
<td>Current venous ulcer</td>
</tr>
</tbody>
</table>

### Characteristics

- **5PT:**
  - **Pain:** Usually mild; Better with elevation and compression
  - **Position:** Medial malleolus, medial lower leg, areas of trauma
  - **Presentation:** Irregular shape, red granular base, may have slough or fibrin, large amount of drainage
  - **Periwound:** Dermatitis or cellulitis often seen
    - **Hemosiderin Staining:** Hemosiderin is by-product of breakdown of RBC that leaks into interstitial space, thus staining the skin
    - **Lipodermatosclerosis:** “Hyperpigmentation and accompanying erythema, induration and plaque-like structural changes that occur due to long-standing venous insufficiency”
  - **Pulses:** Normal typically; may be decreased due to edema or concomitant arterial disease
  - **Temperature:** Normal to mild warmth
Hemosiderin Staining

Lipodermatosclerosis
**Prognosis**

- Again depends on severity of disease and how long the patient has been living with it
- Biggest factor in how well patients will heal and stay healed is use of compression
  - This is a long-standing diagnosis and needs lifelong treatment with compression
- However, if good wound care is employed and the patient is compliant with compression and still is not healing, it is prudent to consider doing a biopsy of the wound to rule out another source for the wound, such as malignancy or another disease process such as Pyoderma gangrenosum
  - Sickle Cell Disease ulcers also can present like VLU

**Goals of Treatment of Venous Insufficiency Ulcers**

1. Decrease venous pressure
2. Decrease edema & prevent reoccurrence
3. Optimize wound healing environment
4. Prevent recurrence due to chronic nature of disease
Physical Therapy Interventions

• Similar to other PT interventions
  • Education of patient and family
    • Guidelines
      • Control swelling
      • Protect feet and legs
      • Live healthy
      • When to call physician/clinician
  • Coordination with other ancillary services
    • Vascular surgery
    • Infectious disease
    • Dietician

• Precautions for treating Venous Insufficiency Ulcers
  • Concomitant arterial disease
  • Allergic reactions and sensitization
  • Inappropriate whirlpool use
    • Places limb in dependent position, thus increases edema
    • Increased temperature also increased edema
    • Adds moisture to an already wet wound
    • Increased risk of infection if whirlpools not properly cleaned

Local Wound Care

• Debridement of necrotic tissue

• Management of infection with appropriate antibiotics, either topical or systemic

• Protect periwound from excess moisture

• Absorb drainage

• Provide compression to assist with venous return

• Educate patient and family
Team Intervention

- Compression therapy
- Pharmacologic
- Moist wound therapy while controlling exudate
- Periwound care
- Leg elevation
- Exercise
- Pain management
- Patient education

Compression Therapy

- Works with exercise to facilitate movement of fluid from lower extremity back to heart
- Depending on patient’s need for vascular support, different levels of compression are available
- For venous disease, ~40mm Hg is needed; however, this is only for those who are ambulatory and able to work the calf muscles
  - In non-ambulatory patients, lower compression is better tolerated
Compression Therapy

- Be cautious when placing compression therapy on patients with ABI's less than 0.8 as this is suggestive of arterial disease
- Recommendations:
  - ABI 0.8-1.0, use high compression (40-50 mm Hg)
  - ABI 0.5-0.8, use light compression (18-24 mm Hg)
    - Use extreme caution; Some experts say any compression is contraindicated in this population
  - ABI 0.5 or below, compression is contraindicated
- Elastic bandages are relatively easy to apply, inexpensive and easily removed
- Usually removed at night

Different types of Compression Therapy

- Paste Bandages: Also called Unna boots; Consists of fine gauze impregnated with zinc oxide, gelatin and glycerin. Some may also have calamine. Applied without tension in circular fashion from base of toes to fibular head. Does not apply compression but simply does not allow the foot to swell any further. Must be changed every 7-10 days.

- Short-Stretch Compression Wraps: Used most frequently in Europe. Used frequently in lymphedema therapy

- Multilayer bandages: Provides graduated, sustained compression through series of layers providing protection, padding and compression. Can be changed weekly. Examples are Coban 2, ProFore and FourPress
  - Found to be have better healing outcomes than single bandages (Kimmel et al, 2013)
Paste Bandages

Unna Boot

• Video
Short Stretch Bandages

Multilayer Compression Bandage Systems

More compression at ankle than knee due to it being farther from heart
Coban 2

• Video

Profore

• Video
More Compression Therapy

• CircAid: Non-elastic, adjustable garment. Consists of a legging with interlocking, non-elastic bands and Velcro fasteners that surround the leg. Can adjust bands as edema increases or decreases, providing constant compression. Will have brochure available in lab.

• Tubular bandages: Give light compression; must be tapered at ankle so more compression is given at ankle than at calf
Circ-aid

- Video

Tubular Bandage
Graduated Compression Stockings

- Typically used once the ulcer is healed.
- Assists venous return by reducing edema.
- Client is measured and fitted for compression stockings when edema is absent or minimal.
- Can be difficult to don.
- Needs frequent replacement as elasticity is lost and adequate amount of compression is not sustained.

JOBST Compression Stocking
• **Compression Pump Therapy:** Consists of leg sleeve with 3-, 5- or 10-chambers with peak pressures of 45-60 mm Hg. Inflates first at ankle, then works up to thigh. Can be done 1-2 hours twice a day. Should be followed by application of compression bandage or garment.

• With all compression therapy, close monitoring of patients with congestive heart failure should be done due to increased intravascular fluid burden
Therapeutic Exercises

• Very important in venous insufficiency that the patient exercises due to calf muscle pump
  • Ankle pumps, heel raises
  • Therapeutic exercises that target ankle plantar flexors
    • Improve strength and calf muscle efficiency
    • Gastrocnemius and soleus stretching

• Aerobic exercise also important to help with weight loss
When to Refer Out

- If any concern of Congestive Heart Failure (CHF), need to be sure to get this addressed and treated before adding compression as the heart may not be able to handle increased blood flow

- If it is felt that patient needs diuretics to address edema and/or fluid overload

- If it is felt the edema is caused by a deep vein thrombosis (DVT)

Surgical/Medical Intervention

- Medical:
  - Pentoxifylline:
    - Inhibitor of platelet aggregation which reduces blood viscosity and, in turn, improves microcirculation (Kimmel et al, 2013)
    - Found to be more effective than compression alone
  - Aspirin:
    - Similar effect as Pentoxifylline
  - Antibiotic therapy if wound appears infected
  - Hyperbaric Oxygen Therapy (HBO)
    - Difficult to get approved due to lack of research

- Surgical:
  - Debridement of wound
  - Skin Grafting and Skin Substitutes
  - Vein Surgery
    - **Ligation**: Tying off of veins to decrease venous hypertension
    - **Vein Stripping**: Fibrose dysfunctional veins with injection of fluid. Also helps decrease venous hypertension
  - **Endoscopic surgery**: Improves venous reflux and lipodermatosclerosis
    - Subfascial Endoscopic Perforator Surgery (SEPS) is gold standard
    - Ultrasound for ablation of perforator veins

- **FOOD FOR THOUGHT**: If perforator system is affected, surgery can be successful. If deep vein system affected, probably not.
Examples of Venous Stasis Ulcers
Summary

- Venous insufficiency most common type of lower extremity wounds
- Many different risk factors for venous insufficiency
- Life-long commitment to treatment of venous insufficiency with compression therapy

Mixed Etiology Ulcers

- Arterial insufficiency complicating a patient with a venous leg ulcer (VLU) leads to difficulties in treatment due to the standard protocols for leg ulcers associated with venous hypertension (Marston, 2011)
- Reported incidence of arterial insufficiency in patients with VLUs has ranged from 15% to 30% (Marston, 2011)
- Dr. Marston typically evaluates all patients with mixed arterial and venous ulcers with both arterial and venous Doppler studies
Mixed Etiology Ulcers

- It is widely accepted that patients with arterial complications can have compression, as long as it is used with caution.
- Per Marston, “Patients with an ABI between 0.6 and 0.9 or toe pressures between 50 and 80 can generally be treated with compression protocols, but at a slightly reduced amount.”
- If the patient has more significant arterial disease with symptoms such as severe claudication or rest pain, the patient would require revascularization before compression could be used.
- Another option for patients with mixed disease is for the patient to have venous ablation when there is superficial venous reflux to prevent recurrence of the venous ulcer.

Contrast of Arterial vs. Venous

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Arterial</th>
<th>Venous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Distal toes. Over bony prominences.</td>
<td>Between malleolus and lower calf. Typically medial malleolus</td>
</tr>
<tr>
<td>History</td>
<td>Smoking. Atherosclerosis.</td>
<td>Obesity, multiple pregnancies, DVT, trauma, jobs that require standing for long periods of time.</td>
</tr>
<tr>
<td>Drainage</td>
<td>Minimal</td>
<td>Moderate to large</td>
</tr>
<tr>
<td>ABI</td>
<td>Decreased. Less than 0.5 is severe</td>
<td>Normal</td>
</tr>
<tr>
<td>Surrounding Skin</td>
<td>Pale, loss of hair, shiny, cool.</td>
<td>Hemosiderin staining, lipodermatosclerosis</td>
</tr>
<tr>
<td>Wound Appearance</td>
<td>Dry, necrotic</td>
<td>May be granular. May also have slough. Usually shallow.</td>
</tr>
</tbody>
</table>
Conclusion

• Lower extremity wounds are a serious health problem in the United States

• Of lower extremity wounds, venous ulcers make up the majority
  • While not usually life-threatening, can have a serious impact on patients’ quality of life

• Arterial ulcers can be limb- and life-threatening and patients need surgical intervention before treatment of the ulcer can be effective

• Important for us as PTs to have a general knowledge of these types of wounds and their basic characteristics and be able to refer to other specialties if unable to treat effectively on our own

References


