Don’t “MONKEY” Around with Lower Extremity Ulcerations!

Boone Hospital Wound Healing Center

Kimberly Jamison, MD, FACP, FAPWCA, PCWC

Kim Mitchell, RN, CNM

Lower Extremity Ulcers

• Most Common:
  • PAD
  • Venous
  • Diabetic
  • Atypical
  • Cancerous
  • Trauma
  • Mixed Disease

Peripheral Arterial Disease (PAD)

• Definition
  – Narrowing of the arteries that supply blood to the legs causing pain, numbness, intermittent claudication and/or tissue death. (NIH, 2010)

Epidemiology

- PAD affects ~8 million people in the United States (AHA)
- Prevalence dramatically increases with age
- Affects both men and women
- Diagnosis challenging
  ~50% are asymptomatic
- 40% of Coronary Artery Disease (CAD) patients have PAD
- The prevalence of PAD is 20% higher in the diabetic population

Growing Rate of PAD in the U.S.

Comorbidity for PAD is high with lower survival rates than some forms of cancer

PAD significantly under-diagnosed; less than 1 in 3 patients

An estimated 30% of individuals in the U.S. afflicted with PAD die within 5 years.

10 million people in U.S. with PAD growing 5% to 10%

Source Frost & Sullivan 8/2009

1. Peripheral vascular disease and diabetes,” Diabetes in America, 2nd ed, Palumbo PJ, Melton LJ

3/23/2011
How does this impact healthcare?

- With 61.8 million Americans affected by one or more of these atherosclerotic diseases, PAD is responsible for:
  - 958,775 deaths annually at a cost of about $329.2 Billion
- PAD coalition, an organization committed to raising public and clinician awareness of PAD. [www.padcoaliton.org](http://www.padcoaliton.org)
- PAD leads to CLI which results in 150,000 amputations per year in the US and Europe.
- Patients with PAD face a 10-year drop in life expectancy.
- Patients with PAD have approximately the same 5-year mortality rate as those patients with breast and colorectal cancer.

PAD coalition, an organization committed to raising public and clinician awareness of PAD. [www.padcoaliton.org](http://www.padcoaliton.org)

Epidemiology: Diabetes

- PAD is more than twice as common among people with Diabetes.
- Elevated A1C associated with increase risk independent of known risk factors.
- A1C of 7.5 correlated with 5x greater probability of developing more severe complications, claudication and hospitalization.


Risk Factor for PAD

- Diabetes
- Smoking
- Disproportionate prevalence in non-Hispanic Blacks
- Slightly higher prevalence in males
- Increasing age
- Hypertension
- Dyslipidemia
- Inflammatory markers
- Hyperviscosity and hypercoagulable states
- Hyperhomocysteinemia
- Chronic renal insufficiency

## Progression of Signs and Symptoms

<table>
<thead>
<tr>
<th>Early signs</th>
<th>Severe PAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cramping</td>
<td>• Foot pain at rest</td>
</tr>
<tr>
<td>• Fatigue</td>
<td>• Non-healing foot or toe wounds</td>
</tr>
<tr>
<td>• Heaviness</td>
<td>• Gangrene</td>
</tr>
<tr>
<td>• Nocturnal pain</td>
<td></td>
</tr>
<tr>
<td>• Pain or discomfort (thighs, calves or hips) during activity &quot;Intermittent Claudication&quot;</td>
<td></td>
</tr>
<tr>
<td>• No symptoms</td>
<td></td>
</tr>
</tbody>
</table>

## 6 P’s of Intermittent Claudication: What can you assess in the home?

1. Pulselessness
2. Pain
3. Pallor
4. Paresthesia
5. Paralysis
6. Poikilothermy (cold)

## Critical Limb Ischemia (CLI)

"Critical limb ischemia is a manifestation of peripheral arterial disease that severely restricts limb perfusion resulting in a mismatch between metabolic tissue demands and oxygen delivery”

Andrew J. Feiring, MD, FACC
Diagnosis & Complications of CLI

Determined by patient’s symptoms, history and physical and diagnostic tests.

The four hallmarks of CLI include:
1. Ischemic rest pain
2. Presence of a nonhealing wound
3. Tissue necrosis or gangrene
4. Absence of palpable leg pulses

- Complications:
  - Marked increase in rate of loss of limb
  - 20% mortality at 6 months
  - Annual mortality rate in patients with CLI is 25%
  - ABI may be predictive of morbidity and mortality (Heart Outcomes Prevention Evaluation study)

Note: ABI NOT indicated in patients with Diabetes due to calcification of the vessels

Assessment - Baseline

Thorough history & physical exam which includes:
- Review of the patient and family medical history
- Completion of a thorough lower extremity assessment that may include:
  a. Palpation
  b. Auscultation - Handheld Doppler
  d. Semmes-Weinstein Monofilament
  e. Tuning Fork

Assessment - Handheld Doppler

- Every patient with an extremity wound should receive an assessment of pulses using the Hand Held Doppler
  - even if pulses can be palpated
  - Assesses macro circulation
  - Used to auscultate flow velocity
**Assessment - Neuropathy**

- Sensory neuropathy evaluation should be a standard part of the lower extremity assessment
  - Semmes Weinstein Monofilament 5.07 (10 gram): determines loss of protective sensation
  - Tuning fork: detects defects in vibratory sensation
- Normally associated with diabetes
- Affect persons with PAD as well

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**Non-Invasive Studies: Once in the clinic...**

**Non-Invasive Studies Include:**
- Ankle Brachial Index (ABI)
- Toe Brachial Index (TBI)
- Segmental Pressures
- Pulse Volume Recordings (PVR)
- Waveforms
- Arterial Ultrasound
- TcPO2
- Skin Perfusion Pressures (SPP)

National guidelines-indicate necessity to rule out arterial disease for any patient with a lower extremity ulcer.

American Diabetes Association suggest all patients 50 years old or greater with diabetes be evaluated for PAD

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**Ankle-Brachial Index (ABI)**

Ankle-Brachial Index (ABI)

- Doppler derived lower extremity pressures are compared to the upper extremity to yield a ratio of pressure
- >1.30 indicates non-compressible vessels – common in diabetics
- Healing is associated with an ABI > 0.9

Toe Pressures

- The small vessels in the toes do not calcify, so toe pressures are more reliable in the diabetic population
- CLI = toe pressures less than 30mmhg

Segmental Pressures

Assesses pressure at multiple levels on the limb or digit
Segmental Pressures with PVR

Arterial Ultrasound
Continuous-Wave Doppler Ultrasound
- Assess lower extremity PAD anatomy, severity, and progression
- Provide localizing information in patients with poorly compressible arteries
- Quantitative data after successful lower extremity revascularization

Duplex Ultrasound
- Establish the diagnosis of lower extremity PAD and its anatomic location
- Define severity of focal extremity arterial stenoses
- Select candidates for endovascular or surgical revascularization

Transcutaneous Oximetry (TcPO2)
What can it tell us?
- If wound healing is compromised by hypoxia
- If the hypoxia is reversible
- If the patient is likely to respond to HBOT
- If the patient has reached a therapeutic level
- Which amputation site is most likely to heal post-operatively

Normal: 50-90
Healing: above 40
Hypoxia: below 20
Skin Perfusion Pressures (SPP)

<table>
<thead>
<tr>
<th>Results</th>
<th>(mmHg)</th>
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<tbody>
<tr>
<td>30 → 40</td>
<td>Mild Ischemia</td>
</tr>
<tr>
<td>40 → 50</td>
<td>Cautionary Zone</td>
</tr>
<tr>
<td>&lt; 30</td>
<td>Ischemic Wound</td>
</tr>
</tbody>
</table>

Wound healing probable
Consider Treatment (Medical Tx or other conservative Tx)
Monitor Patient Closely
Wound healing is unlikely
Do not debride
Referral Needed

-Sufficient Perfusion - for Healing
Safe to debride

Measures the pressure at which blood flow first returns to the capillaries following a controlled release of occlusion from a blood pressure cuff.

Invasive Studies

Invasive Studies Include:
- Traditional Angiography - produces x-ray pictures of the blood vessels in the legs using a contrast dye to highlight the arteries
- Magnetic Resonance Angiography (MRA) - uses magnetic fields and radio waves to show blockages inside the arteries
- Computed Tomographic Angiography (CTA) - uses specialized CT scans and contrast dye to show blockages inside the arteries

Angiography
Choosing the Right Diagnostic Option

- There are several diagnostic options for detection and assessment of PAD
- The preferred test depends on
  - The indication for the study
  - The available technology and expertise
  - Patient factors

Example:
The patient with an implantable pacemaker is not a candidate for MRA - magnetic resonance angiography

Identify Co-Existing Factors

Disease Management
- Nutrition panel
  - Assesses for potential delayed healing due to malnutrition
- Serum studies
  - Assesses for underlying disease processes
- Cultures & biopsies
  - Assesses infection and pathology
- Blood sugar studies
  - Assess control and diagnose disease

Pharmacologic therapies
- Platelet inhibitors
- Anti-lipid medications
- Angiotensin-converting enzyme inhibitors
- Topical nitroglycerin superior to a wound
- Natural blood thinners
Angioplasty and Stent Placement

**Goal** - open a closed or strictured conduit to re-instate blood flow

**Angioplasty**
- Minimally invasive
- Effective on localized blockages in larger arteries
- Catheter is inserted to reach the blocked artery
- Tiny balloon is inflated inside the artery to open the clog.

**Stent Placement**
- Used to hold the artery open

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Atherectomy

- Plaque removal from the artery
- Minimally invasive
- Advancing technology
- Effectiveness depends on location and extent of blockage
Bypass Surgery

- Creates a detour around narrowed or blocked section
- Re-establishes direct pulsatile flow
- Effective for extensive artery blockages.
- Limb salvage is greatly improved

Overview: Arterial Ulcerations

General Appearance
- Shiny, taut, dry skin with hair loss
- Thick toenails
- Absent or ↓ pulse, ↓ skin temp
- "Punched out" wound edges
- Pale or necrotic ulcer base
- Absent or ↓ granulation
- Minimal exudate; no edema
- Gangrene, necrosis or infection common
- Frequently painful

The Reality of Amputation

- Increased Patient mortality
- Lengthy recovery time
- Possible need for prosthesis
  - Cost of vascular reconstruction is less than amputation with prosthesis and rehab
- Lower quality of life
- Lower self-esteem
- 50% of diabetics will require a contralateral amputation within 2 year
### Major Amputation Indications

- Overwhelming infection threatening the patient's life
- Rest pain cannot be controlled
- Extensive necrosis has destroyed the foot
- Inability to re arterial flow

### Arterial Ulcer Care

**Reinstate arterial flow - key to wound healing**

Then...
- Adequate debridement
- Dressing choice based on wound needs
- Treatments that stimulate angiogenesis
  - Negative Pressure Wound Therapy
  - Biologic products
    - Bioengineered tissues
    - Growth factors
  - Hyperbaric Oxygen Therapy

Home Assessment:
- Pulses
- Extremity Temp
- Extremity Color

### Lifestyle changes

- Avoid: leg crossing, trauma, cold, friction, constrictive clothing, moisture between toes, bare feet
- Routine professional foot care
- Foot wear to off-load high risk pressure areas
- Supervised walking program
- Decreased sedentary lifestyle
- Nutritious diet regimen
Treatment Options

- Lifestyle Changes
- Pharmacologic therapies
- Angioplasty
  - With or without stenting
- Atherectomy
- Bypass
- Amputation

PAD coalition, www.padcoalition.org

Venous Leg Ulcers: Diagnosis and Treatment

Chronic Venous Insufficiency (CVI)

- Damage to the vessel and/or valve increases venous pressure
- Altered blood flow in veins due to damage of the vein walls
- Fluid congestion
- Edema
- Staining of the skin (hemosiderin deposits)
**Disease Impact**

- **Financial Impact**
  - $775 million – $1 billion spent on outpatient treatments annually (US)

- **Physical Impact**
  - Decreased mobility, loss of productivity

- **Psychosocial Impact**
  - Impaired quality of life
    - pain, social isolation, depression, negative self-image

  *Angle N, et al. (1997).*

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**Chronic Venous Insufficiency Risk Factors**

- Phlebitis or Thrombus
- Obesity
- Pregnancy/Childbirth
- Family history
- Advanced age
- Female
- Prolonged standing
- Trauma

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**Venous Circulation**

- Superficial veins
- Deep veins
- Perforating veins
- One-way valves
- Calf muscle pump

*Figure 4 Distribution of valves in veins of the lower limb*
Venous Circulation

- Perforator Valves connect the deep venous system with the superficial system.
- Incompetent perforators can cause backflow or reflux and lead to chronic edema and ulceration.

Identifying Venous Insufficiency

- Thorough assessment including assessment of the lower extremity
- Diagnostic evaluation
  - Venous Duplex Doppler
    - Reflux in deep, superficial and perforators
    - DVT
    - ABI or Toe pressures
  - Skin changes
  - Increased proteolytic activity
  - Decreased growth factor availability
  - Oxygen deprivation
    - White blood cell trapping
    - Increased risk for infection
  - Chronic intractable lymphedema

Venous Insufficiency: Clinical Presentation

- Edema
- Venous stasis dermatitis
- Venous stasis ulcer
Classic Appearance of Chronic Venous Insufficiency

- Medial leg, malleolar (“gaiter” area)
- Almost always associated with edema
- Inverted champagne bottle

Classic Appearance of Venous Leg Ulcers

- Irregular and poorly defined margins
- Copious yellow slough or dark red granulation
- Hyperpigmented peri-ulcer
- Highly exudative
- Ache - relieved on elevation and with compression

Clinical Assessment CVI and Venous Ulcers

- Physician multi-system H&P
- Clinical Presentation
  - Nurse Assessment: handheld Doppler, measure ankle/calves bilaterally, pulses, monofilament (always assess for arterial comorbidity)
  - Lab values: CBC, Chemistry, Pre-albumin, HbA1C (diabetes), sickle cell prep and hemoglobin electrophoresis (if sickle cell disease suspected)
- Non-invasive vascular testing
- Additional studies as indicated
Clinical Assessment
CVI and Venous Ulcers

• Non-invasive Venous Duplex Scan to assess the superficial and deep systems along with perforators and other valves, reflux (backflow), and DVT

• Biopsy if older than 3 months or if treated for 6 weeks without improvement

• If worsening despite comprehensive care consider risk for pyoderma gangrenosum, IgA monoclonal Gammapathies and Wegener’s granulomatosis.

Adequate arterial perfusion must be confirmed prior to compression therapy

• Arterial Evaluation may include:
  – Palpation of Pulses
  – Handheld Doppler
  – ABI: Ankle-brachial Assessment
  – Toe Pressures (diabetic patient & renal patient)
  – SPP: SensiLase (skin perfusion pressure)
  – PVR: Pulse Volume Recording
  – TCPO2 (transcutaneous oxygen measurement)
  – Vascular consultation

Venous Duplex Doppler

• Confirms diagnosis
• Must assess for reflux in:
  • Superficial veins
  • Deep veins
  • Perforators
• Assists in determining:
  • Level of compression needed
  • Safe use of compression
  • Rule out acute DVT
  • Possibility of surgical intervention
Rule Out Atypical Etiology

Dependant upon causative factors

Examples:
- Hypercoagulable processes
- Post radiation treatment
- Malignancy
- Autoimmune process
- Brown Recluse Spider Bite
- Etc..........

Indications for Biopsy

Biopsy for histological diagnosis if ulcer is:
- Greater than 3 months in duration
- Not responsive after 6 weeks of therapy
- Irregular in appearance
- Or there is concern for underlying inflammatory conditions or carcinoma

Comprehensive Plan of Care: Venous Insufficiency and Ulcer

- Management of co-morbidities
- Nutritional support
- Hydration
- Optimal wound cleansing, antibacterial therapy, moist wound care and debridement
- Vascular consult and surgery if appropriate
- Eliminate edema
- Bio-Engineered skin
- Grafting
- Consider biopsy
- Other: insure rule out other etiologies
Comprehensive Plan of Care: Venous Insufficiency and Ulcer

- Avoid prolonged sitting, dependent position, standing and elevate limb above the level of the heart whenever possible.
- Diuretics, topical steroids (dermatitis), oral anti-pruritics, oral antibiotics
- Vascular consult, sclerotherapy, ablation, vein stripping, bypass, valve repair, angioplasty and stenting

Venous Leg Ulcer Care

- Debride devitalized tissue
- Monitor colonization
  - Treat invasive infection, cellulitis
- Manage exudate
  - Prevent maceration and excessive granulation
- Prevent desiccation
- Control matrix metalloprotease (MMP’s)
- Control edema - compression

Primary Treatment for VLU

Edema Control

Compression
Physiology of Compression Therapy

- Facilitates calf-pump action
- Forces fluid from the interstitial spaces back into the vascular and lymphatic compartments
- Reduces hydrostatic volume and pressure
  - Reduction of superficial vein distention
  - Restoration of damaged valve function
- Reduces pain and aching
- Increases healing rate of venous ulceration
- Increases the removal of fibrin improving overall skin condition

Moffatt & Haynes (1997)

Prior To Using Compression Therapy

- Ensure adequate arterial flow
  - ABI ≥ 0.8 or greater
  - Toe pressure >40 mm Hg
  - Skin Perfusion Pressure > 40 mm Hg
- Identify location (deep, superficial, perforators) and severity of reflux
- Ensure there is not a DVT

Not all edema is the same
Principles of Compression

- Provide at least 30-40 mmHg
- Must provide gradient sequential compression
- Must be sustained
- Compression may be inadequate:
  - If a large, incompetent perforator vein feeds the base of the ulcer
  - As sole therapy for recurrent ulcers

Education Related To Compression Therapy

- Signs and symptoms of ischemia
  - Numbness/tingling
  - Cyanosis
  - Increased pain
- How to remove compression wraps
  - Unwrap
  - Dull scissors
- Who to call and when to call
Compression Options

- Paste Bandages
- Multilayer compression wraps
- Short and long stretch wraps
- Tubular Compression Garments
- Velcro Strapping Compression Products
- Compression pump therapy
- Compression Stockings

Dynamic/Layered Compression Devices

Image courtesy of Systagenix

Pros
- Provides continuous compression
- Sustained up to 7 days
- Provides 30-40 mm Hg if applied correctly
- Good for non-compliant

Cons
- Cannot be removed at night or for hygiene
- “Hot”
- Must be applied evenly by trained personnel
- Injury from inappropriate application
Wrap from the toes to the knee

Protect Boney Prominences

Pressure points at risk of injury under compression
Compression Options
Pneumatic Compression Pumps

Pros
• Quickly reduces edema
• Effective when edema is severe and/or refractory

Cons
• Costly
• Requires prior alternative compression therapy
• Requires special equipment
• Requires periods of immobilization

Compression Options
Stockings

Retrieved 11/10/10 at: celestehealthresources.com

Retrieved 11/10/10 at: makemeheal.com
**Compression Options**

**Stockings**

**Pros**
- Can be removed at night and for hygiene
- **Maintains** edema control
- Come in a variety of colors and styles

**Cons**
- Can be difficult to don
  - Use strongest compression level in which they can comply
- Must be fitted by trained personnel
- Elasticity value reduces over time
- Replace every 3-6 months
- Expensive

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**Compression Options**

**Stockings**

Prior to fitting for stockings:
- **Reduce edema as much as possible**
- **Measure immediately after compression removal or first thing in the morning**
- **Maintain edema until fitted**
  - Tubigrip
  - Single layer wrap

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**Maintain Edema Control Until Fitted for Compression Stockings**

**Tubigrip**

**Single Layer Long Stretch Wrap**
**Compression Stocking Donning**

- Chinese Slipper
- Talcum Powder
- Knee-Hi Nylons

**Typical Dressing Regimens**

Maintain a moist wound healing environment

- **Absorbent dressing during highly exudative phase**
  - Foam or alginate

- **Maintain moisture during minimally exudative phase**
  - Hydrofiber or hydrogel

**Advanced Options**

- MMP inhibiting dressings
- Anti-microbial dressings
- Skin substitutes
- Extra Cellular Matrix (ECM)
**Advanced Options**

- MMP inhibiting dressings
- Anti-microbial Dressings
  - Cadexomer Iodine
  - Silver
- Skin substitutes
  - Extra Cellular Matrix (ECM)

**Treatment Failure or Recurrence**

- Inadequate edema control
  - Recurrence rates of 79% in patients who did not adhere to compression therapy versus 4% in those who did.
- Inadequate patient education
- Inadequate follow up
- Unrecognized systemic or local disease
  - Hypercoagulable disorders
    - >40% have one or more thrombophilia (N=88 CVLUs)
  - Arterial insufficiency

  *Samson RH & Showalter DR. (1996); McKenzie, R. K & Ludlam, C. A et al. (2002)*

**Typical Clinical Course**

**Alternating phases of ulceration and temporary healing**

20% suffer from 10 or more episodes of ulceration.
If worsening despite treatment or excessively painful, consider other diagnoses

1. A. Barbul et al. Clinical Treatment Guidelines, Wound Rep Reg. 2006; 14: 645-711

Summary

- Recognition of all contributing pathologies
- Implement a comprehensive plan of care
  - Appropriate choice of topical dressing
  - Manage peri-ulcer skin conditions
  - Treat infection
  - Recognize and optimize systemic factors
    - Manage edema during the healing phase and...
Diabetes Facts

Diabetes Prevalence:
- There are 20.8 million diabetics in the United States – 7% of the population.¹
- Only 14.6 million have been diagnosed. The remaining 6.2 million are not aware they have the disease.¹

Diabetes and Amputations:
- More than 50% of non-traumatic lower-limb amputations occur among people with diabetes.¹
- In 2002, about 82,000 non-traumatic lower-limb amputations were performed in people with diabetes.¹
- The rate of amputation for people with diabetes is 10 times higher than for people without diabetes.¹

Diabetes and Heart Disease / Stroke:
- Heart disease and stroke account for about 65% of deaths in people with diabetes.¹
- Adults with diabetes have heart disease death rates about 2 to 4 times higher than adults without diabetes.¹
- The risk for stroke is 2 to 4 times higher among people with diabetes.¹

Diabetes and PAD:
- Diabetes Mellitus increases the risk of lower extremity PAD.²
- One in three patients with diabetes over the age of 50 has PAD.³
- The American Diabetes Association recommends screening for PAD in all diabetic patients older than 50 years.⁴

Costs of Diabetes in the US

- Total National Annual Cost: $174 billion dollars.⁵
  - $116 billion is excess medical expenditures
  - $58 billion in reduced national productivity
- 15% of all diabetic patients may be expected to develop foot ulcers during their lifetime.⁵
- Incidence of diabetic foot ulcers is growing at a rate of 14% annually
- Prevalence of diagnosed diabetes will more than double between 2005 and 2050. (From 5.6% to 12%).⁵
- Obesity complicates the management of Type 2 diabetes.
- 2007 Medicare costs for diabetics aged 65+ were estimated at $9,713 per person.⁵
- Over half (56%) of all health care expenditures attributed to diabetes are used by those aged 65 and older.⁵

Cost of Diabetes and Complications

- Cost of Diabetes in the United States is $174 billion.
  - Additional Costs:
    - $116 billion in attributed medical costs.
    - $27 billion to directly treat diabetes
    - $58 billion to treat chronic complications
    - $31 billion in excess general medical costs
- Controlling potential complications is essential.
- Foot ulcers account for 80% of all chronic wound costs.⁵
Diabetic Lower Extremity Ulcers

Cascade of Events:
- Neuropathy
- Ischemic changes
- Injury
- Massive tissue disruption
  (tunneling, undermining, cavity formation)
- Cellular dysfunction leukocytes / macrophages
- Infection

Diabetic Lower Extremity Ulcers

- 63% of all diabetic ulcers are due to a combination of:
  - Neuropathy
  - Trauma
  - Deformity

- Many are further complicated by Peripheral Arterial Disease (PAD) and infection

Neuropathy

- Incorporates metabolic and vascular defects
  - Results in neuronal demyelination and atrophy
- Motor – muscle atrophy
- Autonomic – decrease in perspiration
- Sensory – loss of protective sensation
Trauma Resulting from Neuropathic Changes

- Motor neuropathy
  - Altered gait and foot deformities
- Autonomic neuropathy
  - Dry skin and fissures
- Sensory neuropathy
  - Unrecognized trauma
    - Ill fitting shoes
    - Stepping on pins, pebbles, etc

Deformity Resulting from Neuropathic Changes

Includes:

- Bunions
- Hammer-toes
- Prominent metatarsal heads
- Charcot joint

Deformity Resulting from Neuropathic Changes

- Cause high compressive & frictional forces around area of deformity = skin breakdown
- Directly related to ill fitting footwear

PAD and Diabetes

- Diabetes Mellitus increases the risk of lower extremity PAD.
- PAD leads to additional healing complications and increased risk for infection.
- One in three patients with diabetes over the age of 50 has PAD.
- The American Diabetes Association recommends screening for PAD in all diabetic patients older than 50 years.

Classification of Diabetic Ulcers

Why Should Diabetic Lower Extremity Ulcers be Classified?

- Part of a thorough practitioners ulcer assessment
- Assessment mandates common language between
- Standardizes charting
- Reproducible from clinician to clinician
- Required for HBOT

- Wagner Classification System
- Grade 0- pre ulcerative or healed
- Grade 1- superficial without penetration
- Grade 2- Full thickness through sub-q tissue
- Grade 3- Full thickness with infection
- Grade 4- Gangrene
- Grade 5- Gangrene with usual amputation

Can you make the Grade???
Care Plan Objectives

• Determine and Manage Etiologies
  - Comprehensive History and Physical Assessment
  - Non-invasive studies
  - Management of etiologies
• Laboratory Evaluation
  - Nutrition status
  - Glucose control
  - Co-morbid disease management
• Ulcer management
• Off-loading
• Patient Education

Determine and Manage Etiologies

• History and Physical
  - Patient and their family medical history
  - History of the ulcer
  - Thorough assessment of the patient
• Lower Extremity Assessment
  - Semmes Weinstein and Tuning Fork - Assesses for neuropathy
  - Hand-held Doppler - Dorsalis pedis and posterior tibial pulse signals
• Non-invasive studies
  - Vascular studies
  - Radiographic studies

Radiographic Studies

• X-ray – should be performed on all diabetic foot ulcerations to rule out foreign body presence
• MRI – recommended by ADA as best non-invasive diagnostic imaging for osteomyelitis
• Bone Biopsy - the definitive diagnostic study for osteomyelitis allowing for culture and sensitivity of the specimen
Management of Etiologies

- PAD and Osteomyelitis are two common secondary etiologies affecting healing of the diabetic ulcer
- Both must be identified and corrected/optimized for successful ulcer healing to occur
- Other etiologies also need to be identified and corrected/optimized for successful ulcer healing

Ulcer Management

- Diagnose and treat underlying etiologies
- Adequate debridement
- Dressing choice based on ulcer needs
- Treatments that stimulate healing
- Offload!!!!
- Multidisciplinary team

Adequate Debridement

**Surgical Debridement:**
- More aggressive absolute debridement in a surgical suite
- May include wide excisions and bone removal
- Expedites healing, rapid removal of necrotic tissue, decreases bioburden
Adequate Debridement

• Serial sharp ulcer bed preparation
• Removes senescent cells, necrotic tissue, converts a chronic ulcer to an acute wound, re-initiates healing cascade
• Centers that utilize sharp debridement exhibit the highest degree of healing.

Approaches to ulcer Care For the Diabetic Patient

• Simple dressings that meet the needs of the ulcer
• Antimicrobial therapy – topically and systemically
• Advanced Treatment Modalities
  – Growth Factors
  – Bio-engineered Tissue
  – Negative Pressure Wound Therapy
  – Hyperbaric Oxygen Therapy
• Plastic surgery – skin grafts/flaps

Advanced Treatment Modalities

• Advanced dressings can reduce costs up to 50% particularly when you consider the cost of an infection
• Utilizing the wrong dressing can increase the cost of treating ulcers and cause further complications for the patient
• Thoroughly assess the “state of the ulcer bed” before prescribing treatment plan/dressings
• Proper offloading is essential as adjunctive treatment to assure success of other treatment modalities
Off-Loading: A Standard of Care

Proper off-loading:
- Reduces pressure
- Reduces shear
- Reduces shock
- Transfers weight from sensitive or painful areas
- Corrects or supports flexible deformities
- Accommodates fixed deformities

Total Contact Cast
- Viewed as the 'Gold Standard' for offloading
- Patients cannot remove
- Allows for continued ambulation
- Must be trained to apply safely

Wedge Shoe
- Designed to offload the heel or forefoot
- Patients can remove
- Some may need other assistive devices to allow for safe ambulation
Surgical Shoe with Pressure Relief Insole

- Good patient compliance in wearing
- Can be removed by patient
- May not provide adequate offloading for some ulcers

Other Assistive Devices

- Wheelchair
- Crutches
- Walkers
- May require gait training to use properly
- Should be used in combination with offloading footwear for proper offloading

Orthotic For Ulcers That Don’t Heal
Orthotics For Ulcers That Do Heal

- Therapeutic footwear should be placed upon healing
- Prevents recurrence
- Accommodates deformities
- Distributes the pressure equally throughout the foot

Patient Education

- Must take an active role in their care
  - Ulcer management
  - Routine nail care
  - Disease management
- Decreases the chance of reoccurrence
  - Foot hygiene
  - Daily inspection
  - Proper footwear
  - Prompt treatment of new lesions
- Elective surgery to correct structural deformities before ulcerations occur

Hyperbaric Oxygen Therapy (HBOT)

Benefits
- Decreases edema through vasoconstriction
- Improves collagen production
- Increases tissue oxygenation
- Increased oxygen tension facilitates phagocytosis
- Promotes neo-angiogenesis
- Enhances granulation tissue formation
Become an Informed Patient Advocate

- Stay current on advanced therapeutic technologies
- Utilize resources
- Provide the patient choices
- Educate to allow for informed decisions
- Empower them to be an informed consumer

Comprehensive foot care programs can reduce amputation rates by 45-85%

Thanks for your time—QUESTIONS??

Don’t be “Upside Down” with Wound Care!!

Feel free to call us at anytime!!