ABC’s of Diabetic Foot Care

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Objectives

- Apply comprehensive assessment skills in the diabetic foot.
- Identify appropriate treatment modalities
- Review steps in prevention of wounds
- Case Scenarios/Discussions
Diabetes Statistics

- Diabetes kills more people annually than breast cancer and AIDS combined. *American Diabetes Association*, 2009

- Half of people with diabetes don't know they have it. *American Diabetes Association/International Diabetes Fed.*

- Quiet. Slow. Deadly. Expensive: Chronic Diseases Account for 75% of our Healthcare Costs. *CDC*

- 25% of all medical care is consumed by 1% of the population and nearly 50% is consumed by 5%. *AHRQ, 2013*

- One Day with Diabetes in the USA: $670 million in cost, 5000 newly diagnosed, 280 lives, 180 limbs. We can do better. Today. *American Diabetes Association, 2014*

- Seconds Count: Every 7 seconds someone dies from diabetes. Every 20 seconds someone is amputated. *International*

- Approximately 23.6 million Americans (7.8%) and 246 million people worldwide (5.9%), have diabetes mellitus. Complications include heart disease, stroke, hypertension, renal disease, retinopathy, peripheral artery disease, and peripheral neuropathies.
Diabetic statistics

- The cost of diabetic foot ulcers is greater than that of the five most costly forms of cancer. *Barshes, et al, 2013*

- Peripheral neuropathies can lead to an insensate foot, nonhealing foot ulcers, and an increased risk for amputation.

- Diabetic Foot Ulcers are twice as costly to US Medicare as those with Diabetes alone. *Rice, et al, ISPOR, 2013*

- *The global economic burden of diabetes was estimated to be 1.31 trillion and 2015, with nearly 35% the results of indirect contrast, such as labor force dropout due to mortality and morbidity, according to WHO data. May 1, 2017 David Armstrong.*

- *More than 90% of people with diabetic peripheral neuropathy are unaware they have it. Bongaerts, et al, Diabetes Care, 2013*  

- More than 60% of nontraumatic lower-limb amputations occur in people with diabetes.

- In 2006, about 65,700 nontraumatic lower-limb amputations were performed in people with diabetes. - [http://www.diabetes.org/diabetes-basics/statistics/#sthash.ux7lo9bf.dpuf](http://www.diabetes.org/diabetes-basics/statistics/#sthash.ux7lo9bf.dpuf)
Cellular and Bio-physiological Events in Normal Wound Healing
Acute & Chronic Wound Differences

**Acute Wounds**
- Low necrotic burden
- Low bacterial burden
- Low exudation
- Low senescent cells
- Low matrix metalloproteinase (MMPs)*
- Often revitalized by one debridement

**Chronic Wounds**
- High necrotic burden
- High bacterial burden
- High exudation (chronic wound fluid)
- High MMPs*
- May require maintenance debridement

*MMPs are a family of protein degrading enzymes*
Diabetes Effects on Wound Healing

- Hypoxia
- Keratinocyte dysfunction
  - Fibroblast dysfunction
- Higher MMPs
- Impaired angiogenesis
  - Impaired neovascularization
- Decreased host immunity
- Neuropathy

- ROS and AGEs
- Hyperglycemia

Impaired Wound Healing
Foot Care

- The scope for the foot and nail care nurse is regulated by each state’s nurse practice act.
- Know your Scope of Practice depending on Profession. Nurse, Physician, PA, NP, Podiatrist, aide, patient care tech etc.
  - If you do not know ask and contact evidence based resources.
- Some states or facilities may require a provider’s order for nail debridement, while other states do not.
- Clinical practice settings also very based on community needs and resources.
Scope of Practice

Care may include:

- Screening and referral, hygiene and routine skin care
- Advanced interventions such as nail debridement, callus reduction, padding, off-loading, and wound care.

“None of us are as smart as all of us” - Ken Blanchard
Foot Care

- Assessment, hygienic skin and nail care, interventional skin and nail care, patient education and referral.
Goal of Foot Care

- Prevention of thermal, mechanical and chemical injuries to the feet
- Early detection of foot and nail problems
- Maintenance of skin and nail integrity or referral when indicated
- Enhancement of patient self-care and monitoring skills.
Early Detection is Key

- Simple foot exam
- 3 minute exam
Assessment

- Hx. Review of disease processes, previous foot problems, medications and home remedies or current treatment.
- Self care deficits, vision, arthritis, obesity or cognitive deficits
- Incorporates inspection and palpation
- Condition of skin and nails, perfusion and sensorimotor function
- Skin is assessed for temperature, presence of hair, integrity, calluses, edema, erythema, and discoloration
  - Between toes—moisture, cracks, fissures etc
  - Nails for thickening, subungual debris, discoloration and nail folds
Circulation

- Palpation of pulses
- Skin temperature, color, hair, edema, and capillary refill.
- Pedal sensations
- Always wearing socks, properly fitting shoes, checking shoes
- Muscular Strength
- The foot is inspected for bunions, hammertoes, claw toes, or Charcot deformity
Skin Assessment Components

**Atrophic changes**
- Shiny, hairless extremities
  - Recommend vascular consult
- Structural changes of the foot

**Does the Shoe Fit**
Skin Assessment Components

**Review sensory status**
- Intact or altered
  - Location
  - LOPS (loss of protective sensation), two point discrimination, heat/cold, deep pressure, pin prick, vibration
  - Sensory - insidious
  - Motor
  - Autonomic

“Loss of protective sensation is a major component of nearly all DFUs.¹ It is associated with a seven-fold increase in risk for ulceration¹”
Diagnostic tests for diabetic peripheral neuropathy include:

- Vibration perception tested with tuning fork
- Monofilament screening test
- Nerve conduction velocity measurements
# Risk for Lower Extremity Amputation

## TABLE 4.

Risk Categories for Lower Extremity Amputation \(^{a,b}\)

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No loss of protective sensation in feet</td>
</tr>
<tr>
<td>1</td>
<td>Loss of protective sensation in feet</td>
</tr>
<tr>
<td>2</td>
<td>Loss of protective sensation in feet with high plantar pressure (callus or deformity) and/or poor circulation</td>
</tr>
<tr>
<td>3</td>
<td>History of plantar ulceration or neuropathic fracture (Charcot)</td>
</tr>
</tbody>
</table>

\(^a\)Loss of protective sensation is assessed using a 5.07 monofilament at a minimum of 4 locations on each foot.  
\(^b\)US Department of Health and Human Services.\(^21\)
Comprehensive Management Guidelines Based on Risk Category

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Follow-up Visits</th>
<th>Self-inspection</th>
<th>Insoles</th>
<th>Footwear</th>
<th>Patient Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Yearly</td>
<td>Daily</td>
<td>Optional</td>
<td>A well-fitting shoe</td>
<td>Every visit</td>
</tr>
<tr>
<td>1</td>
<td>Every 6 mo</td>
<td>Daily</td>
<td>Non molded soft insert</td>
<td>Off the shelf with low heels soft soles, adjustable closures. Extra depth in toe box</td>
<td>Every visit</td>
</tr>
<tr>
<td>2</td>
<td>Every 3 mo</td>
<td>Daily</td>
<td>Molded custom orthoses</td>
<td>Extra depth in toe box Rigid rocker soles</td>
<td>Every visit</td>
</tr>
<tr>
<td>3</td>
<td>Monthly</td>
<td>Daily</td>
<td>Molded; custom orthoses</td>
<td>Extra depth Custom molded shoes Rigid rocker soles ankle/foot orthoses</td>
<td>Every visit</td>
</tr>
</tbody>
</table>

*From Hoard & Hupp and Brasseaux. 26,27

*More frequent visits are required if patient requires nail and callus care.

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Skin Assessment Components

DERMATOLOGICAL

Describe integrity
Edema
Review sensory status
Moisture
Atrophic changes
Turgor/texture
Observe nail composition/hair quality
Look/feel color and temperature variations
Observe skin folds
Geronto-dermatological changes
Inquire about allergies and previous medical history
Callus
Assess vascular status
Lesions (rashes, scars, bruising, hemosiderin, nevi etc)
Nail Debridement

- Clippers
- Orange stick
- File
- Fine curette
- Stainless steel diamond nail file
Before and After

(a)

(b)
Mycotic and Dystropic nails

- high-velocity electric podiatry file with a variety of burrs.
Callus Reduction

- Electric podiatry file
- Pumice stone
- Emery board depending on the size and thickness of the callus
Callus

- Indicates area(s) of high pressure or repetitive stress/trauma
Callus
Padding and Cushioning

- Silicone jell or foam
- Lambs wool
- Non-adherent silicone pads
  - Adhesive pads should be avoided to the skin but could be applied to the insoles.
Pressure Reducing Strategies

- Total Contact Cast
- Removable Cast Walkers
  - CROW boot
  - DH walker
  - Prefab walker
  - Patella Tendon Bearing brace (PTB)
- Wedge shoes
- Multi-Podus splint boot
- Surgical shoes or shoes with pressure relief insoles
- Healing Sandals
- Crutches, Walkers and wheelchairs
- Orthotic
Infection Control and Self Care

- Disinfected or sterilized instruments and single-use items
- Personal protective equipment, gloves, disposable gown and cap when using electric podiatry file or electric podiatry suction, eye protection (with magnification if required) and single-use disposable respirators, or the N-95 mask with disposable filters, reduce exposure to microbial dust.
  - Eye protection (with magnification if required) and single-use disposable respirators, or the N-95 mask with disposable filters, reduce exposure to microbial dust. These precautions are necessary because the nurse may inhale dust containing microbials when reducing calluses and nails leading to rhinitis or asthma.
- Evidence-based risk management strategies to minimize exposure to nail dust include effective and efficient dust extraction systems, proper maintenance of equipment, appropriate drilling technique, education and training, and personal protective equipment.
- Patient positioning
- Rest/ stretching
Proper Attire
Cleansing Tools

- Sanitize
- Disinfect
- Concentration of solution
- Contact time
- Sterilize
- Autoclave
What do you do?
Classification & Staging of Diabetic Ulcers

- The diabetic foot is classified on the basis of etiology
  - Wagner's classification of diabetic ulcer
  - University of Texas Diabetic Foot Classification System
Identify Cause

- Determine and eliminate source
- Assess blood flow
  - Assess vascular status, Color and temperature changes
    - Doppler, ABI, toe pressures
    - Palpate pulses, capillary refill
    - Toe pressures
- Look, listen, touch, smell
- Referrals to appropriate providers
- Identify goals of wound healing
- Debride callus
- Treat infection
- \textbf{Cleanse-WOUND CLEANSING} May not be ordered, ALWAYS necessary removes bacteria, surface contaminants, residual dressing, protects the healing wound
- Choose appropriate topical treatment
Risk Factors for Infection

- A positive probe-to-bone test
- DFU present for more than 30 days
- A history of recurrent DFU’s
- A traumatic foot wound
- The presence of PAD in the affected limb
- A previous lower extremity amputation
- Loss of protective sensation
- The presence of renal insufficiency
- A history of walking barefoot

If infection suspected, take appropriate cultures, preferable soft tissue (or bone when osteomyelitis is suspected and proper referrals

“Treat the **WHOLE** patient- Not just the **Hole** in the **patient**”
Risk Factors, Treatment and Prevention

- Treat the Underlying Disease Process
  - Optimal Diabetes Control
  - Treat ischemia
  - Restoring Pulsatile Blood Flow
  - Address neuropathy
- Address physical cause of trauma
- Effective Local Wound Care
- Infection Control
- Pressure Reducing Strategies
- Bioburden
- Smoking
- Nutrition
- Medications that affect healing
Moisture balance: Optimal Dressing Selection

- Moist Wound healing
  - Location of wound
  - Extent (size/depth)
  - Amount and type of exudate
  - Tissue type on the wound
  - Compatibility with other therapies
  - Condition of periwound
  - Wound bioburden and risk for infection
  - Avoidance of pain and trauma with changes
  - Quality of life
Dressing Categories

- **Primary dressing**
  - The dressing that comes into contact with the wound bed

- **Secondary dressing**
  - The dressing used to cover and protect the primary dressing

- Absorptive
- Antimicrobials
- Biologicals & Biosynthetics
- Calcium Alginate
- Collagens
- Composite Dressings
- Contact layers
- Debridement
- Elastic Bandages
- Foams
- Gauze Dressings
- Honey Active Leptospermum
- Hydrocolloids
- Hydrogels (Amorphous, Impregnated, sheets
- Iodine
- PHMB
- Silicone Sheets
- Silver Solutions
- Transparent Films
- Wound Fillers
Amount of Drainage

Slight
- Hydrogel
- Gauze
- Thin Film

Heavy
- Hydrocolloid
- Hydrofiber
- Collagen
- Foam

Dressing Options

When used as primary
## Typical Features of DFU and Differentiation

<table>
<thead>
<tr>
<th>Feature</th>
<th>Neuropathic</th>
<th>Ischaemic</th>
<th>Neuroischaemic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation</td>
<td>Sensory loss</td>
<td>Painful</td>
<td>Degree of sensory loss</td>
</tr>
<tr>
<td>Callus/necrosis</td>
<td>Callus present and often thick</td>
<td>Necrosis common</td>
<td>Minimal callus Prone to necrosis</td>
</tr>
<tr>
<td>Wound bed</td>
<td>Pink and granulating, surrounded by callus</td>
<td>Pale and sloughy with poor granulation</td>
<td>Poor granulation</td>
</tr>
<tr>
<td>Foot temperature and pulses</td>
<td>Warm with bounding pulses</td>
<td>Cool with absent pulses</td>
<td>Cool with absent pulses</td>
</tr>
<tr>
<td>Other</td>
<td>Dry skin and fissuring</td>
<td>Delayed healing</td>
<td>High risk of infection</td>
</tr>
<tr>
<td>Typical location</td>
<td>Weight-bearing areas of the foot, such as metatarsal heads, the heel and over the dorsum of clawed toes</td>
<td>Tips of toes, nail edges and between the toes and lateral borders of the foot</td>
<td>Margins of the foot and toes</td>
</tr>
<tr>
<td>Prevalence (based on 35)</td>
<td>35%</td>
<td>15%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Case Studies - Discussion
Neuropathic DFU
Ischemic DFU
Neuroischaemic DFU
Prevention

Does the patient know their ABC’s
- The ADA recommends blood glucose below 7 percent, with the normal range generally considered to be 4 to 6 percent.
- "B" represents normal blood pressure of 130/80 or lower.
- "C" involves keeping LDL cholesterol below 100 and HDL 40 or higher.

Education
- Healthy balanced diet
- Regular physical activity
- Smoking cessation
- Sustained weight loss in the overweight
# Treatment and Follow-up

<table>
<thead>
<tr>
<th>Priority</th>
<th>Indications</th>
<th>Timeline</th>
<th>Suggested follow-up by specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent (active pathology)</td>
<td>Open wound or ulcerative area, with or without signs of infection</td>
<td>Immediate referral/consult</td>
<td>As determined by specialist</td>
</tr>
<tr>
<td></td>
<td>New neuropathic pain or pain at rest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signs of active Charcot neuroarthropathy (red, hot, swollen midfoot or ankle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vascular compromise (sudden absence of DP/PT pulses or gangrene)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (ADA risk category 3)</td>
<td>Presence of diabetes with a previous history of ulcer or lower extremity amputation</td>
<td>Immediate or &quot;next available&quot; outpatient referral</td>
<td>Every 1-2 months</td>
</tr>
<tr>
<td></td>
<td>Chronic venous insufficiency (skin color change, or temperature difference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate (ADA risk category 2)</td>
<td>Peripheral artery disease +/- LOPS</td>
<td>Referral within 1-3 weeks (if not already receiving regular care)</td>
<td>Every 2-3 months</td>
</tr>
<tr>
<td></td>
<td>DP/PT pulses diminished or absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of swelling or edema</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (ADA risk category 1)</td>
<td>LOPS +/- longstanding, nonchanging deformity</td>
<td>Referral within 1 month</td>
<td>Every 4-6 months</td>
</tr>
<tr>
<td></td>
<td>Patient requires prescriptive or accommodative footwear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very low (ADA risk category 0)</td>
<td>No LOPS or peripheral artery disease</td>
<td>Referral within 1-3 months</td>
<td>Annually at minimum</td>
</tr>
<tr>
<td></td>
<td>Patient seeks education regarding: foot care, athletic training,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Twenty Steps Toward Foot Health in Diabetes

1. Inspect your feet daily for blisters, bleeding, or lesions between toes. Use a mirror to see the bottom of the foot and the heel.
2. Have a family or friend check your feet if you are unable to do so.
3. Have regular foot examinations by your diabetic foot care specialist. At least annually or more often.
4. Always remove both shoes and stockings when visiting your doctor.
5. Always wear well-fitted stockings or socks with your shoes. Padded hosiery may reduce pressure and be more protective.
6. Inspect the soles and inside your shoes for foreign objects before putting them on.
7. Shoes should be properly measured, comfortable, and easy to put on at the time of purchase.
8. Wear leather shoes with adequate room for the toes. Running or athletic shoes are best for recreational walking.
9. Change shoes every four to six hours.
10. In cold weather, wear insulated boots or heavier socks. Be sure the shoes allow enough room to allow for heavier socks.
11. If you’ve lost sensation, do NOT walk barefooted in the house, outside, or at the beach.
12. Do NOT use hot water bottles or heating pads to warm your feet. Use warm socks instead.
13. Do NOT soak your feet.
14. Do NOT use acids or chemical corn removers.
15. Do NOT perform "bathroom surgery" on corns, calluses, or ingrown toenails.
16. Wash feet daily and be sure to dry well between the toes. Apply moisturizing cream liberally, but avoid between the toes.
17. Test the temperature of the bath water with your ELBOW or THERMOMETER. Do NOT let hot water drip onto your toes.
18. Call your foot care specialist immediately if you detect a new lesion or if your foot becomes swollen, red, or painful. Stay off your foot until you see your doctor.
19. Learn all you can about your diabetes and how it can affect your feet.
20. Maintain good diabetes control and do not smoke.

SALSA 2014
References

http://www.woundsinternational.com/pdf/content_10140.pdf
http://diabeticfootonline.blogspot.com
http://www.dermnetnz.org/hair-nails-sweat/nails.html#plate
http://www2c.cdc.gov/podcasts/player.asp?f=7240
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2494620/#ffn_sectitle

*J Wound Ostomy Continence Nurs.* 2011;38(3):242-251. Published by Lippincott Williams & Wilkins

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