Lower Extremity Assessment of the Person with Diabetes

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Objectives:
1. Describe risk factors for lower extremity complications
2. Discuss prevention strategies.
3. Demonstrate steps involved in lower extremity assessment.
4. State 3 diagnostic tools that help assess sensation and blood flow.

Resource Page
Underline = Link
We have added hyperlinks that you can click on for more information.
So, if you see words underlined click on them to review additional information.
Let's take a look at Lower Extremities

**Lower Extremity Complications**
- Combination of vascular, neurological, and musculoskeletal dysfunction
- After Lower Extremity Amputation (LEA), people have higher mortality rates and subsequent amputation

**Lower Extremity Amputations Dropping over past 10yrs**
- 60% of amputations in 7% of pop
- Higher in men, elderly, minorities, Chronic Kidney Disease (CKD)
- Lower extremity complications represent 20% of hospitalizations for elderly
- Amputations cost $40,000
- Amputation associated w/ earlier death compared to revascularization
- 10 yr survival after LEA
Diabetes and Lower Extremity Ulcers

- Up to 15% of DM patients have ulcers in their lifetime
- Mortality with foot ulcers is twice usual

Risk factors for Foot Ulcers/Amputation

- Previous amputation
- Past foot ulcer history
- Peripheral neuropathy
- Foot deformity
- Peripheral vascular disease
- Visual impairment
- Diabetic nephropathy (especially patients on dialysis)
- Poor glycemic control
- Cigarette smoking
- ADA Task Force - 2008

Pathway to Amputation – Pecoraro, Frykberg

Minor Trauma (environmental) + Faulty Healing (intercurrent pathophysiology: circulation, WBC/platelet function) + Ulceration

Predicts 72% of amp
“I didn’t notice”

- Needle in foot
- Pebble in shoe
- Stepped on a nail
- Cut too deep
- Shoes were rubbing
- Others?

**Common Causes of Ulcers**

- Neuropathy and peripheral vascular disease
  - Autonomic: blood pooling, swelling
  - Motor: atrophic musculature, deformity, joint stiffness
  - Resulting increased plantar pressure, trauma

**Foot Motor/Nerve Deformities**
What Leads to Ulcers

- 86% single precipitating event leading to ulcer
  1. Tight shoe

3 classes
  1. Neuropathic
  2. Ischemic (hard to heal)
  3. Neuro-ischemic (worst)

Pressure Area Breakdown

Neuropathic Diabetes Foot Ulcers
Walking Cast for Neuropathic Ulcers

Emotional aspects
Impact on BG

Circulation Issues lead to Lower Extremity Problems
- Peripheral Arterial Disease
- Vascular Disease
- Smoking
Peripheral Arterial Disease Assessment

- Physical Exam – Skin
  - Pale or blue, purple
  - Dependent rubor, blanching when elevated
  - Cool to touch, loss of hair, nonhealing wounds
  - Diminished pulses – Check Ankle Brachial Index (ABI)

- Treatment
  - Protect feet, avoid constriction
  - Increase walking, stop smoking
  - Medications/Surgery

Peripheral Vascular Disease – Venous Disease

- On exam
  - Skin brownish, reddish, mottled
  - Skin warm to touch, may be edematous
  - May have stasis ulcers on lower leg
  - Pulses difficult to locate due to edema

- Treatment
  - Support hose, elevate feet, avoid constriction
  - Shoes that can accommodate feet
Pitting Edema

Venous Ulceration

Flexibility Assessment
Stiff joint syndrome
Neuropathy Leads to Lower Extremity Complications

Neuropathies
- Sensory
  - loss of sensation, painless trauma, repetitive low grade stress
- Motor
  - muscle atrophy, unbalanced tendon pulling, bone/gait changes, deformities, claw foot
- Motor + Sensory changes = ulcerations
- Autonomic
  - decreased perspiration, fissures, Charcot’s foot

Diabetes and Charcot Foot
- Damaged nerves
- Blocked blood vessels
- Shifting bones
- Collapsed arch joints

Charcot’s
- Neurotraumatic theory:
  bony destruction due to loss of pain sensation and proprioception + repetitive and mechanical trauma to foot.
- Neurovascular theory:
  joint destruction secondary to autonomically stimulated hyperemia and periarticular osteopenia associated with trauma.

45 yr old, type 2 on orals, Random BG 201mg/dl
Tx during acute phase = Casting for 3-6 mo’s then custom footwear
Stairway to Amputation

- Neuro + Peripheral Arterial Disease
- Injury or callus
- Wound
- Infected
- Cellulitis
- Gangrene
- Amputation

1st Step – Watch Pt Walk
Foot Exam – Patient History
- Previous foot ulceration
- Previous amputation
- Diabetes > 10 years
- A1c ≥ 7%
- Impaired Vision
- Neuropathic Symptoms
- Claudication

Foot Exam – Dermatologic Exam
- Dry Skin
- Absence of hair
- Ingrown nail edges, long or sharp nails
- Interspace maceration
- Ulceration
- Cleanliness

Visual Inspection/Palpation
- Breaks in the skin
- Erythema
- Trauma
- Pallor on elevation
- Dependent rubor
- Changes in the size or shape of the foot
- Nail deformities
- Extensive callus
- Tinea pedis
- Pitting edema

VA Guidelines 2004
Foot Exam – Screening for Neuropathy

Test
- Semmes-Weinstein monofilament 10g
- Vibration perception threshold testing
- Tuning Fork 128 Hz

Significant Finding
- Lack of perception at one or > sites
- Vibration perception threshold >24 volts
- Abnormal vibration perception

Loss of Protective Sensation

- Monofilament Testing
  - 5.07 touched to plantar surface and top of foot
  - C shape delivers 10 gms pressure
  - Test four sites
    - Plantar surfaces of
      - Each great toe
      - 1st, 3rd and 5th metatarsal head

Monofilament Testing
Monofilament (MF) Procedure *(Int Consensus Grp)*
- Demonstrate procedure on pts forearm or hand
- Have pt close their eyes
- Test four sites in random sequence
  - (if callus or ulcer, test adjacent surface)
- Bow the MF and ask, “Do you feel it touch you, yes or no?”
- Randomly test at each site 3 times (one of which is a “sham” application – MF not applied)

5.07 monofilament = 10gms linear pressure

Tuning Fork to Detect Polyneuropathy
- 128 tuning fork
- Plantar halax
- Compare sensation to that of examiner

Back to Basics in Diagnosing Diabetic Polyneuropathy with the Tuning Fork! Meijer, et all *Diabetes Care, Vol 28, #9 Sept 2005*
Tuning Fork (TF) Procedure
- Demonstrate sensation to pt on wrist or elbow w/ and without vibration
- Ask pt to close eyes
- Apply TF perpendicularly with constant pressure to dorsum of hallux (1st great toe) just proximal to nail bed. Place your index finger of the hand beneath the pts toe to feel vibration and verify.

Tuning Fork Procedure
- Use initial sham test and apply non-vibrating TF to be sure pt does not mistake pressure for vibration and ask.. Is the TF vibrating? (No is right answer)
- Use “on-off” method to score.
- Conduct testing 2xs on each great toe

Tuning Fork Procedure
- On each test:
  - Ask pt to ID beginning of vibration
  - ”Is it vibrating”?
  - Ask pt to ID cessation by dampening TF.
  - ”Tell me when the vibrating stops”
  - The number of correct responses = 0-8
  - At least 5 incorrect responses = peripheral neuropathy
Foot Exam – Vascular Exam

Test
- Palpation of pulses
  - dorsalis pedis
  - tibial
- Ankle – Brachial Index (ABI)

Significant Finding
- Absent pulses
  - ABI <0.90, consistent w/ peripheral arterial disease

Vascular Status Assessment
- Posterior tibial pulse
- Dorsalis pedis pulse
- Temperature
- Appearance

Dorsalis Pedis Pulse
Taking the DP Pulse

Posterior Tibial Pulse

Taking the Posterior Tibial Pulse
The Ankle-Brachial Index

\[ \text{ABI} = \frac{\text{Lower extremity systolic pressure}}{\text{Brachial artery systolic pressure}} \]

- The ankle-brachial index is 95% sensitive and 99% specific for PAD
- Establishes the PAD diagnosis
- Identifies a population at high risk of CV ischemic events
- The “population at risk” can be clinically and epidemiologically defined:


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ABI Procedure

Ankle Brachial Index

- Measure highest systolic reading in both arms
  - Record first doppler sound as cuff is deflated
  - Record at the radial pulse
  - Use highest of the two arm pressures
- Measure systolic readings in both legs
  - Cuff applied to calf
  - Record first doppler sound as cuff is deflated
  - Use doppler ultrasound device
    - Record dorsalis pedis pressure
    - Record posterior tibial pressure
  - Use highest ankle pressure (DP or PT) for each leg
- Calculate ratio of each ankle to brachial pressure
  - Divide each ankle by highest brachial pressure


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Using the ABI: An Example

Right ABI
80/160=0.50

Brachial SBP
160 mm Hg

PT SBP 40 mm Hg
DP SBP 80 mm Hg

Left ABI
120/160=0.75

ABI (Normal >0.99)

Brachial SBP
160 mm Hg

PT SBP 120 mm Hg
DP SBP 80 mm Hg

Highest of PT or DP SBP

Interpreting the Ankle-Brachial Index

<table>
<thead>
<tr>
<th>ABI</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>1.00–1.29</td>
<td>Normal</td>
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<tr>
<td>0.91–0.99</td>
<td>Borderline</td>
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<tr>
<td>0.41–0.90</td>
<td>Mild-to-moderate disease</td>
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<tr>
<td>≤0.40</td>
<td>Severe disease</td>
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<tr>
<td>≥1.30</td>
<td>Noncompressible</td>
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</tbody>
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Adapted from Hirsch AT, et al. J Am Coll Cardiol. 2006;47:e1-e192. Figure 6.

Ankle Brachial Index

- **False Negative Test: Diabetes Mellitus**
  - Vessels in diabetics are poorly compressible
  - Results in falsely elevated ankle pressure
- **Management**
  - Segmental Arterial Pressure indicated for ratio <0.9
  - Consider angiography or Magnetic resonance angiography
Biomechanical Foot Assessment –

Test
- Plantarflexion & Dorsiflexion of ankles, great toes
- Watch pt ambulate
- Inspect Shoes
- Inspect for deformity

Significant Finding
- Diminished joint mobility
- Decreased vision, gait imbalance, need for assistive devices
- Ability to see/reach feet
- Corn, calluses, bunions, prominent metatarsal heads, hammertoes, claw toes

Risk Stratification: Population Approaches
- Reality that we cannot give maximum resources to all
- Screening: Appropriate for all, baseline
- Patient education: All need to know risks and self care
- Monitoring condition: Varies with degree of pathology: risk stratification

Risk Classification and Referral / Follow-UP

<table>
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<tr>
<th>Cat</th>
<th>Definition</th>
<th>Action</th>
<th>Re Assess</th>
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<tbody>
<tr>
<td>0</td>
<td>No LOPS</td>
<td>Prevention Ed</td>
<td>Yearly</td>
</tr>
<tr>
<td></td>
<td>No PAD</td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>LOPS ± Deformity</td>
<td>Special foot wear</td>
<td>3-6 mos</td>
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<tr>
<td></td>
<td></td>
<td>if deformity can’t be safely accommodated in shoe. Pt. Ed</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PAD ± LOPS</td>
<td>Consider prescriptive</td>
<td>2-3 mos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>footwear.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(by specialist)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hx of amp ulcer</td>
<td>Same as Categ 1</td>
<td>1-2 mos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vascular consult prn</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(by specialist)</td>
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Lower Extremity Assessment – High Risk

- If one or more high risk conditions
  - Evaluate more frequently, refer to specialist
  - Neuropathy - examine each visit
- Multidisciplinary care important
  - Vascular specialist
  - Podiatrist
  - Orthotist
  - Certified Wound Ostomy Continence Nurse
  - Podorthist
  - Neurologist
  - Pain specialist
  - Endocrinologist
  - Advanced Practice Diabetes Specialists

Onychomycosis

- Chronic Infection 50% of nail problems
- We treat on skin but reluctant in nails
- Mean duration of > 10 years
- Rarely resolves spontaneously
- Spreads to other nails, skin, other people
- May be source of more serious infections
- Affects quality of life
- Vicks Vapor Rub?

Patient Education

- Proper footwear – no going barefoot, even indoors
- Daily foot inspection – look between toes and on sole of foot
- Prompt reporting of any foot lesions, discolorations or swelling

**LEAP Patient Education Booklet** - Easy to read booklet on the basics of foot care. Print out to make free copies for your patients.
Consider these Clinical Books as additional resources

Lower Extremity Resources

- **LEAP Patient Education Booklet** - Easy to read booklet on the basics of foot care. Print out to make free copies for your patients.
- **Online Course - LEAP Prevention and Treatment of the Neuropathic Foot**
  This course is recommended for health professionals working with patients having Diabetes or lower extremity neuropathy. This course will enable the health care provider to assess and treat the neuropathic foot and evaluate protocols (or treatment options).
  
  LEAP = Lower Extremity Amputation Prevention

- **Performing a Lower Extremity Assessment Video**
  An excellent 5 minute video designed for health care professionals which reviews the elements of a foot assessment. After click on link, look under LEAP Training on right hand column.

- **Order 10 Free Monofilaments**
  Find out if your patient has lost protective sensation. Request your set of reusable monofilaments and charting tools.

- **LEAP Mono filament Instructions**
  Clear and straightforward steps to using a 10gm mono filament to detect loss of protective sensation.
Wrap up notes
1. You have 1 year to complete this program and take the post test to receive your CE credit (from time of purchase)
2. Complete the post test - click test button
3. Complete program survey - we appreciate your feedback
4. Now, your certificate is ready to print out
5. Join us on Facebook for special events

Keep in touch!
Beverly Thomassian and Lainey Koski

Thank you for joining our Web Clinic