

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.





Lets 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

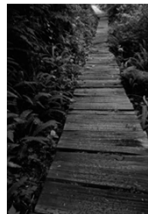


- Previous amputation
- Past foot ulcer history
- Peripheral neuropathy
- Foot deformity
- Peripheral vascular disease
- Visual impairment
- Diabetic nephropathy (especially patients on dialysis)
- Poor glycemic control
- Cigarette smoking
- ADA Task Force - 2008

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"

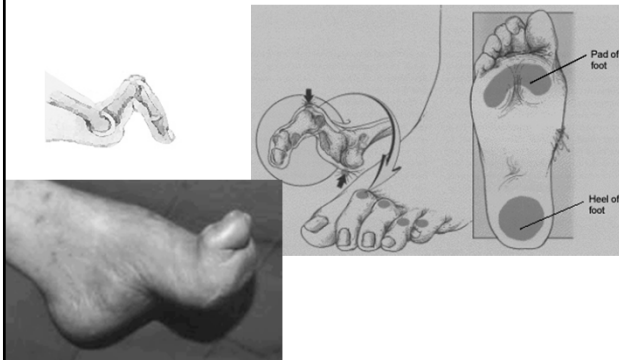
- Needle in foot
- Pebble in shoe
- Stepped on a nail
- Cut too deep
- Shoes were rubbing
- Others?



Common Causes of Ulcers

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

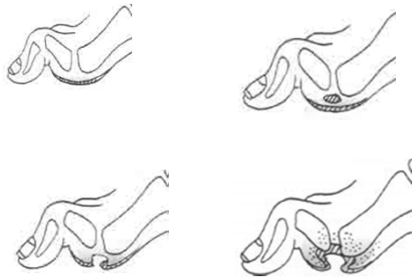
Foot Motor/Nerve Deformities



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

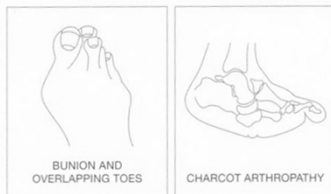


Walking Cast for Neuropathic Ulcers



Emotional aspects
Impact on BG

FOOT DEFORMITIES



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 Arterial Disease Assessment



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



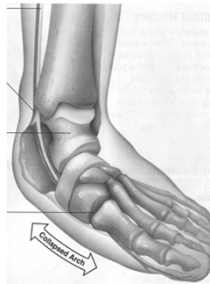
Neuropathy Leads to Lower Extremity Complications

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.



45 yr old, type 2 on orals, Random BG 201mg/dl

• Neurovascular theory:

joint destruction secondary to autonomically stimulated hyperemia and periarticular osteopenia associated with trauma.



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



AMERICAN DIABETES ASSOCIATION
FOOT EXAMINATION POCKET CHART
 THE DIABETIC FOOT EXAMINATION

ASSESSMENT / TEST	CLINICAL REASON
Patient history	Prevent foot ulceration Prevent amputation Diabetes >10 years A1C >7% Insulin use Neuropathy symptoms
Dermatologic examination	Diabetes Dry skin Ulcers or sores Injury or callus, ting or white spots Nail hygiene impairment
Screening for neuropathy	Loss of sensation at one or both sites Vibration perception threshold >12 VHz 10g monofilament sensation
Vascular examination	Ankle brachial index (ABI)
Biomechanical foot assessment	Plantar pressure distribution at ankle and great toe Walking patient without Inspection of patient's shoes History for deformity

Comprehensive Foot Examination and Risk Assessment
 A report of the Task Force of the Foot Care Interest Group of the American Diabetes Association, with endorsement by the American Association of Clinical Endocrinologists

Link to Task Force Report

AMERICAN DIABETES ASSOCIATION
 Order No. 5532-01
 To learn more about this chart, visit www.diabetes.org
 To make this chart available to other students, visit MyDiabetes at www.diabetes.org or call 1-800-368-6788

1st Step - Watch Pt Walk



Foot Exam - Patient History

- Previous foot ulceration
- Previous amputation
- Diabetes > 10 years
- A1c \geq 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

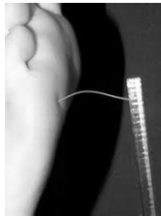
- Semmes-Weinstein monofilament 10g
- Vibration perception threshold testing
- Tuning Fork 128 Hz

Significant Finding

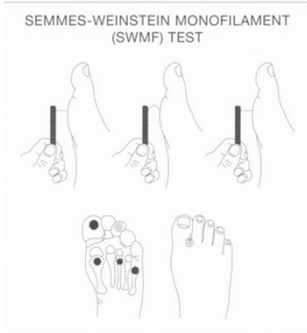
- Lack of perception at one or > sites
- Vibration perception threshold >24 volts
- Abnormal vibration perception

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

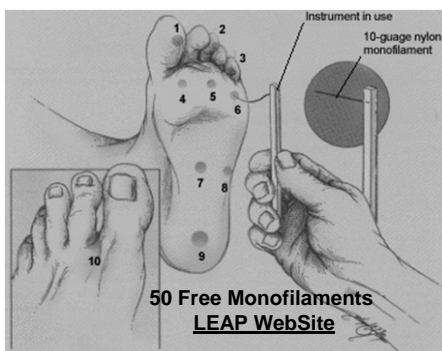


Monofilament (MF)

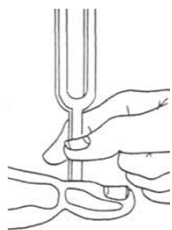
Procedure *(Int Consensus Grp)*

- 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 al
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

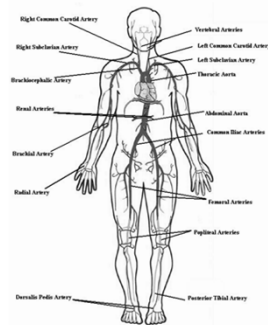
- On each test:
 - ↓ Ask pt to ID beginning of vibration
 - "Is it vibrating?"
 - ↓ Ask pt to ID cessation by dampening TF.
 - "Tell me when the vibrating stops"
 - ↓ The number of correct responses = 0-8
 - ↓ At least 5 incorrect responses = peripheral neuropathy

Foot Exam - Vascular Exam

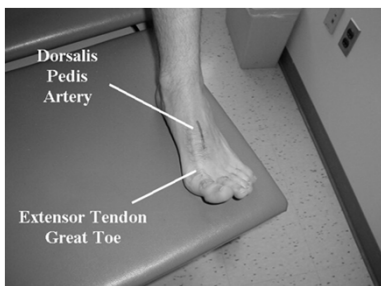
<u>Test</u>	<u>Significant Finding</u>
<ul style="list-style-type: none"> ▣ Palpation of pulses <ul style="list-style-type: none"> ↓ dorsalis pedis ↓ tibial 	<ul style="list-style-type: none"> ▣ Absent pulses
<ul style="list-style-type: none"> ▣ Ankle – Brachial Index (ABI) 	<ul style="list-style-type: none"> ▣ ABI <0.90, consistent w/ peripheral arterial disease

Vascular Status Assessment

- ▣ Posterior tibial pulse
- ▣ Dorsalis pedis pulse
- ▣ Temperature
- ▣ Appearance



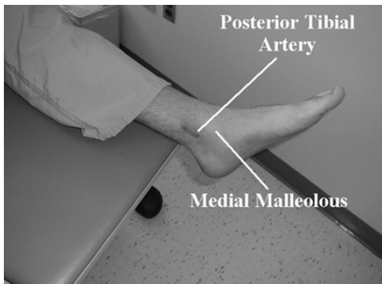
Dorsalis Pedis Pulse



Taking the DP Pulse



Posterior Tibial Pulse



Taking the Posterior Tibial Pulse



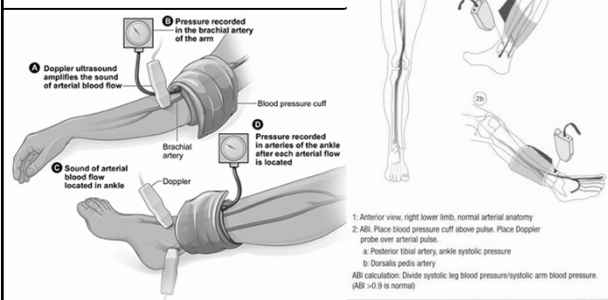
The Ankle-Brachial Index

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

- 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:

Lijmer JG. *Ultrasound Med Biol* 1996;22:391-8; Feigelson HS. *Am J Epidemiol* 1994;140:526-34; Baker JD. *Surgery* 1981;89:134-7; Ouellet K. *Arch Surg* 1982;117:1297-13; Carter SA. *J Vasc Surg* 2001;33:708-14

ABI Procedure

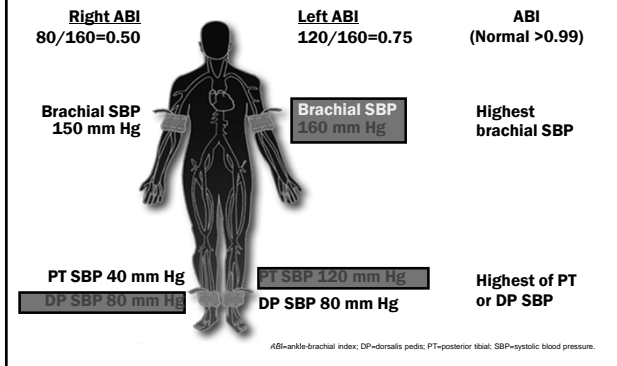


http://www.nhlbi.nih.gov/health/nci/Diseases/pad/pad_diagnosis.html

Ankle Brachial Index

- ▣ **Technique**
- ▣ 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

Using the ABI: An Example



Interpreting the Ankle-Brachial Index

<u>ABI</u>	<u>Interpretation</u>
1.00–1.29	Normal
0.91–0.99	Borderline
0.41–0.90	Mild-to-moderate disease
≤0.40	Severe disease
≥1.30	Noncompressible

Adapted from Hirsch AT, et al. J Am Coll Cardiol. 2006;47:e1-e152. 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

Cat	Definition	Action	Re Assess
0	No LOPS No PAD	Prevention Ed	Yearly
1	LOPS ± Deformity	Special foot wear Consider prophylactic surg if deformity can't be safely accommodated in shoe. Pt. Ed	3-6 mos
2	PAD ± LOPS	Consider prescriptive footwear. Vascular consult.	2-3 mos (by specialist)
3	Hx of amp ulcer	Same as Categ 1 Vascular consult prn	1-2 mos (by specialist)

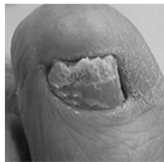
Lower Extremity Assessment – High Risk

- 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

ADA – Stds of Care 2008

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

- 13 **LEAP Patient Education Booklet** -Easy to read booklet on the basics of foot care. Print out to make free copies for your patients.
- 13 **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

Lower Extremity Resources

- 13 **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.**
- 13 **Order 10 Free Monofilaments**
Find out if your patient has lost protective sensation. Request your set of reusable monofilaments and charting tools.
- 13 **LEAP Mono filament Instructions**
Clear and straightforward steps to using a 10gm mono filament to detect loss of protective sensation.

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Wrap up notes

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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