Indian Health Service
Best Practice for Diabetic Foot Care
A Strategy for Primary Care Clinicians

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Bemidji Area Indian Health Service
Learner Objectives

1. List risk 4 factors for diabetic foot complications
2. Be able to conduct a complete diabetic foot exam
3. List 3 interventions associated with decreased risk for foot complications
4. State 4 educational objectives for patients at high risk for foot complications
5. Describe 4 components of the chronic care model related to improving diabetic foot care
Protecting the Diabetic Foot
A Strategy for Primary Care Clinicians (1)

- Screening for High Risk Patients
- Practical Interventions
- Implementation into Practice
Why Is Foot Care Important for People with Diabetes?

• ~40% will develop peripheral neuropathy
• ~20% have an acute foot problem on foot exam
• ~15% will develop an ulceration (cost ~ $13-30K each)
• 5-10% progress to amputation (cost ~ 50K/yr each)
• 43% with ulcer and 47% with amputation die in 5 years
• Most amputations can be prevented with resources currently available in primary care
• Most patients with diabetes get their care from primary care providers

CDC, 2008; Harris, 1993; Kumar, 1994; Borrsen, 1990; Reiber, 1999; Stockl, 2004; Rith-Najarian, 2001; Moulik, 2003
# Foot-Related Risk Factors for Ulceration

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Ulcer</th>
<th>LEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropathy</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Deformity</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Limited Joint Mobility</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Prior Ulcer/LEA</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>PVD</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Onychomycosis</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

Pham, 2000; Lavery, 1998; Rosenbloom, 1996; Walters, 1992; Kumar, 1994; Fernando, 1991; Rith-Najarian, 1992; Mayfield 1996; Alder, 1999, Boyko, 2006
Non-Foot-Related Risk Factors for Ulceration and Amputation

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Ulcer</th>
<th>LEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Sex</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Duration DM</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>hyperglycemia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>hypertension</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>dyslipidemia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>smoking</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Vision &lt; 20/40</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Other complications</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Moss, 1996; Alder, 1999; Palumbo, 1995; Moss, 1992; Moss, 1999; Litzelman, 1997; Lee, 1993; Boyko, 1999; Nelson, 1988; Selby, 1995; Lehto, 1996; Eggers, 1999; Boyko 2006
Simple Criteria to Identify High-Risk Feet in People with Diabetes

- Insensate to 10-gram monofilament
  - or Insensate to 128-Hz tuning fork
- Foot deformity
- Prior ulcer or amputation
- Absent pulse or abnormal ABI pressure

Diabetes Care, 31:1679-85, 2008; Diabetes Res Clin Pract, 70:8-12, 2005
Feet Can Last a Lifetime, NIH/NIDDK, 2002
Screening Tests

- Press perpendicular to point of bending, hold
- 1 second and release (Demonstrate on hand)
- Patient closes eyes and acknowledges sensation of pressure with a “yes”
- Test both feet, 4 sites each: Great toe and 1st, 3rd, and 5th metatarsal heads (not heel or dorsum)
- Insensate in one or more area confers risk

Vibration Sensation Testing  
128 Hz Tuning Fork

• Tested over the tip of the great toe bilaterally
• An abnormal response can be defined as when the patient loses vibratory sensation and the examiner still perceives it while holding the fork on the tip of the either toe

Singh JAMA 293:217–228, 2005  
Development of Foot Deformities

Bunions – hallux valgus
Foot Deformities Associated with Risk for Amputation

Bunions – hallux valgus
Foot Deformities Associated with Risk for Amputation
Foot Deformities Associated with Risk for Amputation
Charcot Foot
Selected Clinical Assessment of Peripheral Arterial Vascular Status and Abnormal Thresholds

<table>
<thead>
<tr>
<th>Vascular Test</th>
<th>Abnormal Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedal Pulses</td>
<td>Absent</td>
</tr>
<tr>
<td>Ankle Brachial Index (ABI)</td>
<td>&lt; 0.8</td>
</tr>
<tr>
<td>Toe BI</td>
<td>&lt; 0.6</td>
</tr>
</tbody>
</table>

Pham Diabetes Care 2000;23:606-11
Wang, Circulation 2005;112:3501-3508
Arterial Anatomy of the Foot

- Dorsalis Pedis artery
- Posterior tibial artery
Ankle Brachial Index

1. Measure Doppler brachial pressures in each arm
2. Measure Doppler Pressure in each ankle
3. **Calculate ABI**: \( \text{ABI} = \frac{\text{Ankle BP}}{\text{Brachial BP}} \) *Divide the ankle press by the greater of the two brachial pressures*

From Hurley et al, The Diabetic Foot, 1993
Correlation of POAD Symptoms by ABI Category

<table>
<thead>
<tr>
<th>Severity Category</th>
<th>ABI Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1.0–1.4</td>
</tr>
<tr>
<td>Borderline</td>
<td>0.90–0.99 or &gt; 1.4</td>
</tr>
<tr>
<td>Mild</td>
<td>0.70–0.89</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.40–0.69</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt; 0.40</td>
</tr>
</tbody>
</table>

Wang, *Circulation* 2005; 112:3501-3508
Video of Foot Exam
Protecting the Diabetic Foot
A Strategy for Primary Care Clinicians (2)

• Screening for High-Risk Patients
• *Practical Interventions*
• Implementation into Practice
Pathways to Diabetic Limb Amputation: A Basis for Prevention

Pecoraro Diabetes Care 1990;13:513-21
Component Causes Present in Casual Pathways Leading to Foot Ulcers in Persons with Diabetes

Reiber, Diabetes Care, 1999;22:157-62
# Strategies to Prevent or Delay Development of Common Component Causes of Foot Ulceration and Amputation

<table>
<thead>
<tr>
<th>Component Cause</th>
<th>Intervention Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropathy</td>
<td>Good glycemic control, Education on Risk for foot injury</td>
</tr>
<tr>
<td>Minor Trauma</td>
<td>Clear Walking Space, Nightlights, Protective footwear</td>
</tr>
<tr>
<td>Deformity</td>
<td>Accommodative footwear, Education to support footwear</td>
</tr>
</tbody>
</table>
| Edema           | Footwear accommodative to of edema  
|                 | Reduce edema: pharmacologically, compression stockings |
| Callus          | Regular removal of callus  
|                 | Footwear that minimizes callus development |
| Infection       | Education on reporting problems early |
| Ischemia        | Reduce risk for atherosclerosis (hypertension, and lipid control, smoking cessation)  
|                 | Revascularize for critical ischemia |

Reiber, Diabetes Care, 1999;22:157-62
Association of Patient Education and Amputation Prevention

<table>
<thead>
<tr>
<th>Program</th>
<th>Reduction in LEA Rate</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterans, Tucson USA</td>
<td>70%</td>
<td>Malone, 1989</td>
</tr>
<tr>
<td>Kisa, Sweden</td>
<td>80%</td>
<td>Larrson, 1995</td>
</tr>
<tr>
<td>Kings College, London</td>
<td>44%</td>
<td>Edmonds, 1999</td>
</tr>
<tr>
<td>Geneva, SZ</td>
<td>85%</td>
<td>Assal, 1993</td>
</tr>
<tr>
<td>Madrid, Spain</td>
<td>50%</td>
<td>Calle-Pascual, 2001</td>
</tr>
</tbody>
</table>
Evidence-Based Education and Treatment Objectives for All Patients with Diabetes

• *Low-Risk Feet*
• Control Glucose
• Control Blood Pressure
• Control Lipids
• Smoking Cessation

Evidenced-Based Footcare Educational Objectives for Patients with Diabetes

High-Risk Feet

• Daily washing and inspection
• Clear walking area of dangerous objects
• Appropriate footwear (selection, fitting, & use)
• Use slippers indoors – No barefoot
• Proper Nail and Callus Care (no bathroom surgery)
• Avoid extreme temperatures
• Avoid soaking
• Report problems promptly (Infections, ulcers, cuts that do not heal)

Calle-Pascual, 2001; Reiber, 1999; Ward, 1999; Barth, 1991; Malone, 1989; Edmonds, 1986
Footwear and Prevention of Foot Lesions

- Reduced Peak Planter Pressures > 50%
- Reduced callus formation > 30%
- Ulcer recurrence rates reduced > 50%
- LEA rate reduced > 70%

Viswanathan Diabetes Care 2004;27:474-477
Chanteleau, Diabet Med 1994;11:114-6
Ashry, J Foot Ankle Surg 1997;36:268-71
Edmonds, Q J Med 1986;60:763-71
Footwear Anatomy 101

Collar
Upper
Toe Box

Heel counter
Insert
Shank
Sole

Added depth
Rocker sole
Footwear Selection

• Normal feet: standard shoes
• Insensate feet: quality walking shoe or added depth shoe
  • Adjustable upper
  • Firm heel counter
  • Padded insert and collar
  • Broad sole with nominal lift
• Insensate feet + Minor deformity: added depth shoe + custom insert
• Major Deformities: custom molded shoes

Tovey, Diabet Med 1984;1:69-71; Dahmen, Diabetes Care. 2001;24:705-9
Custom-Molded Inserts and Extra-Depth Shoes
Fitting Shoes

• Select shoes that match the shape of the foot
• Measure both feet while standing
• Fit while wearing standard socks
• Fit largest foot
• 1 cm length between longest toe and shoe tip

Tovey, Diabet Med 1984;1:69-71
Footwear Precautions

• Break-in:
  • Start half-hour on first day
  • Then increase by half-hour increments per day
  • Inspect for redness after wearing
• Change shoes 1 to 2 times daily
• Check for foreign bodies
• Replace when worn out
Medicare Therapeutic Footwear Benefit

• Three steps:
  1. Physician Certification for Therapeutic Footwear (MD, DO)
  2. Footwear Prescription (usually a Podiatrist)
  3. Fitting and dispensing (usually a Pedorthist)

Routine Podiatry Care for People with Diabetes

Associated with:

• Increased self-foot care knowledge and 30% reduction in callus
  • *Ronnemaa Diabetes Care, 1997;20:1833-1837*

• 54% reduction in ulceration rates in case control study of 91 diabetic patients with a history of foot ulcers
  • *Plank, Diabetes Care 2003;26:1691-1695*

• 75% reduction in LEA rates in Medicare patients with diabetes and high-risk feet who received palliative podiatry foot care services
  • *Sowell, J Am Podiatr Med Assoc 1999;89:312-7*
Principles of Podiatry Care for People with Diabetes

• Lubricate skin
• Trim nails
• Reduce callus

Suico, 1998; Murray, 1996
Lubricate Dry Skin

• Autonomic neuropathy contributes to dry skin
• Instructed Patients to apply a moisturizing lotion daily
• Oil or water-based lotions are a matter of patient preference
• May need caregiver to assist
Nail Trimming: Normal Nails

• Use nail nippers, strait or curved.
• Good lighting, comfortable position, safety glasses
• Stabilize the toe with one hand, cut with the other
• Start at one edge and follow the curve.
• File any sharp edges with an emery board
Nail Trimming: Normal Nails (2)
Nail Trimming: Curved Nails

- Use nail nippers, straight
- Good lighting, comfortable position, safety glasses
- Start at one edge and follow the curve
- Avoid cutting into corners
- File any sharp edges with an emery board
Nail Trimming: Thick Mycotic

- Tend to be very brittle
- Can use nail nippers or dremel to trim off sharp edges
- Best to refer to a podiatrist or certified foot care nurse
Callus Debridement

- Good lighting, gloves, alcohol swab, and #15 disposable scalpel
- Wipe with alcohol swab, callus tissue will turn white
- Shave or pear down callus gradually
- Palpate intermittently to feel when you are close to pliable “normal” tissue, then stop.
Callus Debridement (2)
Protecting the Diabetic Foot
A Strategy for Primary Care Clinicians (3)

- Screening for High-Risk Patients
- Practical Interventions
- *Implementation into Practice*
Improving Chronic Disease Care: The Chronic Care Model

Wagner EH. Effective Clinical Practice. 1998;1:2-4
System Redesign: Foot Care Team

- Physician/PCP
- Nurse Educator
- Registrar and Patient Scheduling
- PHN
- Podiatrist
- CHR
- Surgeon
- Clinic Administration and leadership
Decision Support
Foot Care Guidelines

Diabetic Foot: Master DecisionPath

Upon Assessment
- Normal foot
  Sensate to 10-gm monofilament, no ulcer
- Low Risk Normal Foot
  Ulcer prevention in normal foot:
  Patient self-care education
  Any change in status reclassify foot
  SeeFoot Assessment and Treatment

- Abnormal foot
  Previous ulcer, insensate to 10-gm monofilament, or deformities present
- High Risk Abnormal Foot
  Ulcer prevention in abnormal foot:
  Protective footwear, self-care education,
  palliative podiatry care
  Any change in status reclassify foot
  SeeFoot Assessment and Treatment

Active Ulcer
- Superficial involvement,
  < 2 cm diameter and < 0.3 cm deep
  High Risk Simple Ulcer
  Treat simple ulcer:
  Debridement, wound care, non-weight bearing
  Failure to improve in 2 weeks, refer to specialist
  or obtain consultation
  SeeFoot Ulcer Treatment

- Extensive involvement, systemic findings:
  > 2 cm diameter or > 0.5 cm deep
  High Risk Complex Ulcer
  Treat complex ulcer:
  Hospitalize, debridement, vascular evaluation,
  antibiotics directed by culture
  Refer to specialist or obtain consultation
  SeeFoot Ulcer Treatment

Healed

Improved

1994–1996 System Redesign Foot Care Team

Moving the Guideline to Practice

Team Coordination

- Input from the team to customize Guidelines
- Delineation of roles
- Documentation
- Training needs
- Measures for monitoring and evaluation
Example of Customization Questions

Remove Shoes Every Visit
Inspect Feet for Acute Problems

No Ulcer  Ulcer

Annual Foot Exam

Low Risk
Routine Education and Yearly Screen

High Risk
Intensive Foot care education
Podiatry referral
Follow up 3 mo

Annual Foot Exams are performed by:

________________________

Documented on Form______
Form is located __________
Information from exam goes to
________________________

Staff trained to perform exam and refer high risk and acute problems

________________________
1994–1996 System Redesign
Reminders and Documentation Forms

• Exam & Risk Factors
• Assessment
• Treatment plan
• Referrals
Patient Chart Tab
Exam Selection Dialog
Document an Exam
Add Patient Education
Diabetes Curriculum Education – Foot Care
System Redesign: Foot Care Case
Manager
Information Technology
Electronic Diabetes Registry
My DM Patients – Panel Definition
Panel List and Flag List
Performance Layout Tab
National Measures Tab
Community Linkages
Referrals for Therapeutic Footwear
Community Linkage
Wound Care Outreach Clinic
Average Annual Incidence Lower Extremity Amputations (LEA) among Diabetic Patients according to Chronic Care Model Intervention Period in an Indian Health Service Primary Care Setting

