Diabetic Foot Health:
Evaluation – Care – Prevention
What Podiatrists Would Like Team Members to Know About Foot Health and Diabetes

James Whelan, DPM
Foot and Ankle Center of Nebraska and Iowa
Diabetes Education Center of the Midlands
Annual Seminar
Mar 16, 2018

Objectives
• To review common foot pathology in diabetic patients
• To review the evaluation and workup of the diabetic foot
• To review prevention techniques and treatment options for common diabetic foot pathology

The Facts: Diabetes Related Foot Problems
• 30 million people in US affected by DM
  American Diabetes Association
• 15% DM develop LE ulcer during the course of their disease

Why do we care?
Neuropathy
— 1.7 times ↑ to develop foot ulceration
— 12X ↑ presence of foot deformity
— 36X ↑ prior amputation or ulceration
The Facts: Diabetes Related Foot Problems

Neuropathy

MOTOR
- Weakness
- Atrophy
- Deformity

SENSORY
- Loss of Protective Sensation

AUTONOMIC
- Anhidrosis
- Dry Skin
- Abnormal Sympathetic Tone
- High Plantar Pressure
- Callus Formation

Charcot
- Structural deformity
- Digits
- Trauma

Why do we care?

- 1% of persons with diabetes will develop Charcot joint disease
- Risk for ulcer formation and subsequent amputation

The Facts: Diabetes Related Foot Problems

Diabetic Neuropathy

Painless Ambulation
- Ligamentous laxity
- Joint instability
- Joint & Osseous Fragmentation
- Deforomity of Charcot Foot
- Deformity of Charcot Foot
- Amputation

Vasculopathy
- Time to healing DFU
- Duration of infection and delivery of Abx
- Rarely leads to ulceration directly, compounding factor for 65% of DM foot ulcers
- Prevalence of low to high level PAD in DM b/w 10-40%
The Facts: Diabetes Related Foot Problems

Vascular Disease
- Structural
- Atherosclerosis
- Occlusive Narrowing
- Ischemia

Trauma

Microvascular
- Structural
- Chipping
- Nutrient

Macrovascular
- Structural
- Perfusion
- Anemia

Neuropathy

Foot ulceration is the most common single precursor to lower extremity amputations among persons with diabetes.

JFAS, Diabetic Foot Disorders, Clinical Practice Guidelines

Why are we so focused on prevention?

Impact of Ulcerations

"Foot ulceration is the most common single precursor to lower extremity amputations among persons with diabetes."

80% of nontraumatic LEAs are preceded by foot ulceration

THE GOOD NEWS

Diabetic Foot Problems are very preventable!

- Amputations usually start out as preventable, easy to treat problems
  - Calluses, ingrown toenails

The Facts: Current Data and Trends

- Risk of death @ 5 years for patient with DFU 2.5X to DM without a DFU
- More than ½ DFUs become infected
- 20% of moderate/severe DFUs lead to some level of amputation

Armstrong et al, "Diabetic Foot Ulcers and Their Recurrence", NEJM, June 15, 2017, pp2367 - 2375
The Facts: Current Data and Trends

- PAD independently increase risk of nonhealing DFU, infection and amputation
- Mortality after diabetes related amputation exceeds 70% at 5 years for all patients with diabetes and 74% at 2 years for those receiving renal replacement therapy


New Insights Into Preventing Diabetic Foot Disease

- A more holistic approach is needed
- Prevent low-risk DM from moving to the high-risk category
  - Manage HbA1C, blood pressure, cholesterol and smoking cessation
- This requires multi-disciplinary approach

Lifestyle and Family History

- DM that smoke have 4x ↑ risk developing LE PVD
- Poor food choices and low physical activity levels HbA1C levels
- Familial h/o CVA or CAD ↑ risk of LE arterial complications
- Inherited foot types → biomechanical deformities → skin breakdown

What’s all the hype about?

- HbA1C of 6.5% is value associated with DM
  - Correlates to FPG of 126mg/dl or random plasma glucose test of 200mg/dl

HbA1C Recommendations

- American Association of Clinical Endocrinologists (AACE) 6.5%
- American Diabetes Association (ADA) 7%
- American College of Physicians (ACP) 7% - 8%

So much confusion!
**“Instant Nutritional Assessment”** Seltzer et al.

- Hypoalbuminemia and Lymphopenia – identifies malnourished patients
  - Poor potential for wound healing
  - Impaired cellular defense mechanisms
  - Increased susceptibility to infection
- Correcting nutritional deficiencies may positively impact amputation healing


---

**Cornerstones To Prevention**

**Five key elements**
1. Identification of the at-risk foot
2. Regular inspection and examination of the at-risk foot
3. Education of patient, family and healthcare givers
4. Routine wearing of appropriate footwear
5. Treatment of pre-ulcerative signs and other complicating factors

---

**Risk factors for amputation**
- Charcot
- Impaired Vision
- Poor Glycemic Control
- Older Age
- Male Sex
- Ethnicity
  - Black and Hispanic

---

**Cornerstones To Prevention**

**1. Identification of the at-risk foot**

- Neuropathy LOPS
- Peripheral Vascular Disease (PVD)
  - Infection
- History of Prior Ulcer or Amputation
- Structural Foot Deformity
- Trauma

---
1. Identification of the at-risk foot

- Fundamental for effective preventive management of the DM foot

- The ADA and APMA consider two categories of risk for developing foot complications:
  - **High risk**
    - Loss of protective sensation
    - Absent pedal pulses
    - Foot deformity
    - History of foot ulcers
    - Prior amputation
  - **Low risk**
    - None of the above characteristics

### Cornerstones To Prevention

Five key elements
1. Identification of the at-risk foot
2. Regular inspection and examination of the at-risk foot
3. Education of patient, family and healthcare givers
4. Routine wearing of appropriate footwear
5. Treatment of pre-ulcerative signs and other complicating factors

### 2. Regular inspection and examination

- **History**
  - Duration of DM
  - Previous ulcer/infection/amputation
  - Pain/sensation
  - PAD or prior revascularization
  - ESRD
- **Physical Examination**
  - Inspection of foot
  - Palpation of pedal pulses
  - Inspection of circulation
  - Inspection of peripheral Neuropathy
  - Inspection of peripheral Neuropathy

- **Frequency**
  - Once a year
  - Once every 6 months
  - Once every 3-6 months
  - Once every 1-3 months

- **Feet at Risk**
  - Those with diabetes
  - Those with neuropathy
  - Those with PAD
  - Those with ESRD
Questions to ask in less than 1 minute

Does the patient have a history of:
- previous lower lower or lower limb amputation(surgery)?
- prior angioplasty, stent, or leg bypass surgery?
- foot wound requiring more than 3 weeks to heal?
- smoking or nicotine use?
- diabetes? (yes, what are the patient’s current control measures?)

Does the patient have:
- burning or tingling in legs or feet?
- leg or foot pain with activity or at rest?
- changes in skin color, or skin lesions?
- loss of lower extremity sensation?

Are the patient’s established regular products used?

Benefits of an Annual Comprehensive Diabetic Foot Examination

“If a patient sees his or her podiatrist along with one other member of the diabetic foot team, the relative risk reduction of a high level amputation will decrease, ... as much as 80 %.”

2. Regular inspection and examination

• Comprehensive Diabetic Foot Examination
  – Pulses
  – Sensation
  – Foot biomechanics (i.e., general foot structure and function)
  – Nails
  – Footwear assessment

“2019 ADA guidelines recommend once yearly foot examinations for high-risk patients; however, as determined by the treating physician, higher risk for amputation.

Risk Categorization System

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk Profile</th>
<th>Evaluation Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
<td>Annual</td>
</tr>
<tr>
<td>1</td>
<td>Peripheral neuropathy (LOPS)</td>
<td>Semi-annual</td>
</tr>
<tr>
<td>2</td>
<td>Neuropathy, deformity and/or PAD</td>
<td>Quarterly</td>
</tr>
<tr>
<td>3</td>
<td>Previous ulcer or amputation</td>
<td>Monthly or quarterly</td>
</tr>
</tbody>
</table>
2. Regular inspection and examination

- Neuropathy
  - Symptoms
    - Tingling/Shocking
    - Burning/Hot/Cold
    - Stabbing
    - Numbness
  - Exam
    - Monofilament
    - Tuning fork
    - Reflexes

- The Ipswich Touch Test
  - Lightly rest finger on first, third, and fifth toes for 1 to 2 seconds
  - Patients respond with a "yes" when they feel the physician's touch
  - Results parallel the monofilament in detecting LOPS

- Charcot Foot
  - Symptoms
    - Redness
    - Swelling
    - Deformity
  - Exam
    - Deformity
    - Joint Dislocation
    - Radiographs
2. Regular inspection and examination

- Vasculopathy
  - Symptoms
    - Calf muscle cramping
    - Claudication
    - Painless muscle fatigue
    - Toe ache at night
    - Rest pain
    - Edema
    - Temperature change
  - Exam
    - Palpate pulses
    - Non-invasive vascular studies

- Dermatological Conditions
  - Exam
    - Corns and calluses
    - Heel fissures
    - Ulceration
    - Maceration
    - Toenail deformity

- Musculoskeletal Symptoms and Altered Biomechanics
  - Exam
    - Hammertoes
    - Bunions
    - High-arched foot
    - Flatfoot
    - Limited joint mobility

What to look for in less than 1 minute

- Vascular exam:
  - Does the patient have patent pulses? Over both ankles?
  - Are there signs of arterial disease?
  - Does the patient have a history of ischemic episodes?
  - Does the patient have intermittent claudication?
  - Does the patient have a history of leg pain?

- Neurological exam:
  - Does the patient have sensory loss in the toes?
  - Does the patient have a Babinski sign?
  - Does the patient have a Hoffman sign?
  - Does the patient have a Achilles reflex?

- Musculoskeletal exam:
  - Does the patient have swelling or redness?
  - Does the patient have pain on palpation?
  - Does the patient have a limp?
  - Does the patient have limited joint mobility?
Cornerstones To Prevention

Five key elements
1. Identification of the at-risk foot
2. Regular inspection and examination of the at-risk foot
3. Education of patient, family and healthcare givers
4. Routine wearing of appropriate footwear
5. Treatment of pre-ulcerative signs and other complicating factors

3. Education of patients, family and healthcare providers about foot care

Items to be discussed with high risk patient:
- Perform daily foot inspection including between the toes
- Notify an appropriate healthcare provider if a blister, cut, scratch or ulcer has developed
- Avoid barefoot walking
- Do not wear tight, narrow shoes or those that have rough edges or uneven seams
- Inspect the inside of all shoes prior to wearing

High-risk foot education
- Patients should:
  - Control their blood sugar levels
  - Monitor foot problems
  - Use the correct type of footwear
  - Keep their feet clean and dry
  - Have regular foot examinations

3. Education of patients, family and healthcare providers about foot care

Items to be discussed with high risk patient:
- Wear socks without seams and change daily
- Wash feet daily and dry them carefully
- Do not use any kind of heater to warm feet
- Do not use any chemical agents to remove corns. A pumice stone can be used.
- Use emollients to lubricate skin but avoid between the toes
- Cut toenails straight across. Use an emory board to shape.
- Have your feet examined regularly by a healthcare professional
What you can teach in less than 1 minute?

Recommendations for daily foot care:
- Wash, dry, and inspect feet daily.
- Keep feet clean by removing dirt and moisture.
- Cut nails straight across and above the toe joint.
- Prevent corns and calluses by wearing shoes that fit well.
- See a health professional if you have any concerns about your feet.

Cornerstones To Prevention

Five key elements
1. Identification of the at-risk foot
2. Regular inspection and examination of the at-risk foot
3. Education of patient, family and healthcare givers
4. Routine wearing of appropriate footwear
5. Treatment of pre-ulcerative signs and other complicating factors

Footwear examination
- Type of shoe (athletic, oxford, comfort, etc)
- Fit
- Depth of toe box
- Shoewear, patterns of wear
- Lining wear
- Foreign bodies
- Insoles, orthoses

Foot Care Study in Diabetic Patients

Out of 23 male and female diabetic patients, only 3 had shoes that were the correct size.
Those 3 patients had been measured and fitted with diabetic shoes by a health professional.

Neil et al, Nephrology Nursing Journal, Feb 2003
4. Routine wearing of appropriate footwear

- Diabetics are less likely to develop pedal ulceration, foot infection, and go on to amputation if they are regularly wearing extra-depth diabetic shoes
  - Shoes and inserts protect feet from high pressures and shearing forces
  - Accommodate foot deformities

Cornerstones To Prevention

Five key elements
1. Identification of the at-risk foot
2. Regular inspection and examination of the at-risk foot
3. Education of patient, family and healthcare givers
4. Routine wearing of appropriate footwear
5. Treatment of pre-ulcerative signs and other complicating factors

5. Treatment of pre-ulcerative signs and other complicating factors

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Definition</th>
<th>Treatment recommendations</th>
<th>Suggested follow-up</th>
<th>Suggested follow-up if PAD is present</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 N Lo PS, no PAD, no deformity</td>
<td></td>
<td>Patient education including advice on appropriate footwear</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>1 LOPS + deformity</td>
<td></td>
<td>Consider prescription of accommodative footwear</td>
<td>Every 3-6 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider prophylactic surgery or combined follow-up if deformity is not safe to be</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>accommodated in shoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continue patient education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 PAD + LOPS</td>
<td></td>
<td>Consider prescription of accommodative footwear</td>
<td>Every 2-3 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider vascular consultation or combined follow-up if PAD is present</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continue patient education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 H/o ulcer/amputation</td>
<td></td>
<td>Suggested follow-up if PAD is present</td>
<td>Every 1-2 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider vascular consultation or combined follow-up if PAD is present</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Treatement types for pre-ulcerative lesions
- Removing abundant callus
- Protecting blisters or draining them if necessary
5. Treatment of pre-ulcerative signs and other complicating factors

- Treatment types for pre-ulcerative lesions
  - Treating thickened nails
    - Increased pressure from thick nails can cause ulcerations
  - Prescribing antifungal treatment for fungal infections
    - Nail fungus versus athlete’s foot
  - Treatment of ingrown toenails

5. Assessment and treatment for PAD

- DM 50 yo need baseline ABI
  - DM with abnormal results should have ABI repeated at least once a year
  - DM with a prior foot ulceration for PAD or cardiovascular disease should have ABI tests with evaluation of toe pressures annually
5. Treatment of pre-ulcerative signs and other complicating factors

**Diabetic Peripheral Arterial Disease**

(Significant History and Findings)

- **DIABETES**
- **PAD**

Invasive Vascular Studies
- Angiography
- DSA
- CT Angiogram
- MRI

Revascularization
- Angioplasty, Endovascular, Open Bypass Grafting

Follow-up
- Patient education
- Smoking cessation
- Protective shoes
- Periodic foot care
- Reconstructive foot surgery as needed

Noninvasive vascular studies
- Arterial doppler: waveforms, ABIs and toe pressures
- Transcutaneous oxygen tensions

Gangrene or extensive tissue loss in face of unreconstructable PAD

Consider amputation

5. Treatment of pre-ulcerative signs and other complicating factors

- Treating foot deformities with orthotics and diabetic shoes
  - Amputation risk when structural abnormalities properly assessed and accommodative and supportive devices to address these deformities provided
  - Custom diabetic insole utilized for any structural deformities

**DIABETIC SHOES – Preventing Amputations**

- Some podiatrists participate in a diabetic shoe program
- Most patients with Diabetes Qualify for a pair of Diabetic Shoes each year
  - Partial/ Complete Amputation
  - Ulceration
  - Pre-ulcerative Callus
  - Neuropathy with Callus
  - Poor Circulation
  - Foot Deformity

**Surgery of the Diabetic Foot**

- Significant history/findings

Presence of foot deformity
- Intact protective sensation
- Loss of protective sensation

Elective surgery
- To treat painful foot deformity

Prophylactic surgery
- To reduce risk of ulceration or avoid reulceration

**Significant history/findings**
5. Treatment of pre-ulcerative signs and other complicating factors

Key Questions That All Members of the Health Care Team Should Ask Patients About Foot Health

Patients should be referred to a podiatrist if the answers to these questions are “no” or “unsure”:

- Do you get a full foot exam by a podiatrist at least once each year?
- Do you know how diabetes can affect your feet?
- Do you know how to check your feet every day?
- Do you check your feet every day?
- Do you know what to do if you develop foot pain, redness, or sores?
- Do your shoes fit you correctly?

We have an ulcer – now what?

The goal is to prevent amputation
The Facts: Current Data and Trends

• With appropriate therapy, many DFUs will heal and avoid the need for some level of amputation
• Recurrence of DFUs in patients is common
  – 40% within 1 year
  – 60% within 3 years
  – 65% within 5 years


The Facts: Current Data and Trends

• High recurrence rate leads to paradigm shift from patient being “healed” to being in “remission”
• Concept of remission may provide better framework for
  – Patient education and understanding
  – Education of other health care professionals
  – Resource allocation
  – Organizational care
  – Risk communication
  – Identifying those patients best suited for palliative care due to undue medical and social burden to treat


Ideal Diabetic Foot Management Model

- No diabetic foot complications
- Appropriate Foot Care
- Appropriate Shoes and Bracing
- Regular Medical Professional Foot Checks
- Management of mild to moderate infections
- Ulcer Management
- Peripheral Arterial Disease
- Stable Charcot Deformity
- Management of limb-threatening foot and ankle conditions
- Severe soft tissue and osseous infections
- Critical Limb Ischemia
- Unstable Charcot Deformity

Patient in DFU Remission

- How many days ulcer free?

Goal is to avoid diabetic foot complications

Goal is to transition back to complication free state as efficiently as possible

Key Points

• Podiatrists play a key role in the early identification and treatment of foot problems in people with diabetes
• Podiatrists are important in the collaborative interprofessional team care approach for diabetes management
References


Thank you

jim.h.whelan@gmail.com