

WOUND MANAGEMENT AND FOOT CARE: THE PATIENT WITH DIABETES

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Co-editor, Acute and Chronic Wounds: Current Techniques and Management, 2012

Objectives

1. Summarize pathophysiologic mechanisms that lead to foot ulcerations in patient with diabetes.
2. Using foot risk classification scale, list key assessment parameters and prevention interventions for patient with diabetes.
3. Describe evidence based advanced wound care therapies for management of diabetic foot ulcers.

Magnitude of DFU problem

- 15% will develop DFU during lifetime
- 1 in 4 patients with diabetes have a DFU at any one time
- Leads to as many as 80% of nontraumatic amputations
- Increased risk of: Premature death, MI, Fatal stroke
- Reflective of serious disease and comorbidities:
 - Neuropathy
 - PAD
 - Altered neutrophil function
 - Diminished tissue perfusion
 - Defective protein synthesis

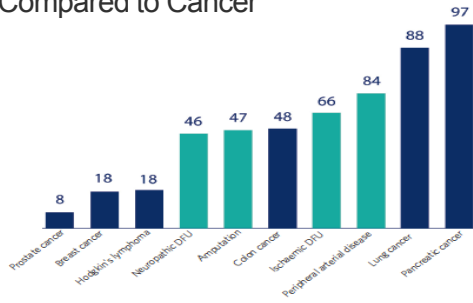


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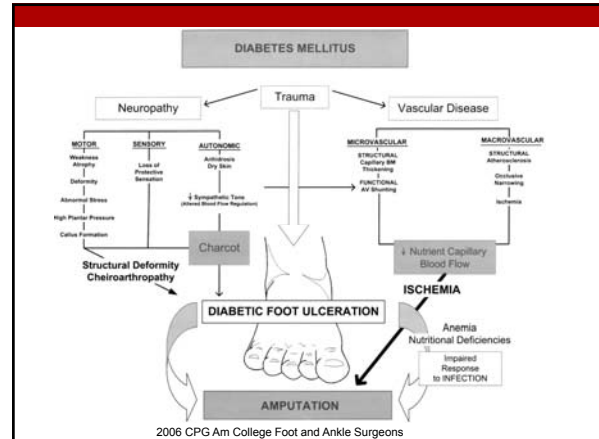
Magnitude of the Problem

- Reflective of serious disease and comorbidities:
 - Neuropathy
 - PAD
 - Altered neutrophil function
 - Diminished tissue perfusion
 - Defective protein synthesis
- Optimal Prevention and Treatment Program critical
 - Minor trauma often precipitating event
 - Incorrect or delayed treatment increases risk of serious complications

Relative Risk 5 Year Mortality (%) DFU Compared to Cancer



International Best Practice Guidelines: Wound Management in Diabetic Foot Ulcers. Wounds International, 2013. Available from: www.woundsinternational.com




Pathologic Mechanism: Neuropathy

- Sensory: loss of protective sensation, insensate (LOPS)
- Motor: foot deformities (hammer toes)
- Autonomic: dry skin, fissures, cracks, callus, bounding pulse


Typical Ulcer Features:

- Insensate
- Callus
- Pink wound bed surrounded by callus
- Warm foot with bounding pulses
- Plantar surface and dorsum of clawed toes




Pathologic Mechanism: Ischemia

- PAD 2-4 times as prevalent with diabetes than without diabetes
- Ischemia contributory factor to DFU in up to 50% of patients.
- Macrovascular disease
- Microvascular disease
- Typical Ulcer features:
 - Painful
 - Necrosis or Pale wound bed
 - Tips of toes, nail edges, lateral borders of foot
- Only 15% of DFU purely ischemic



Pathologic Mechanism: Neuroischemia

- +/- Intact arterial supply
- +/- small vessel dysfunction
- +/- neuropathy / foot deformity
- +/- external trauma
- Typical features:
 - Some degree of sensory loss
 - Minimal callus
 - Poor granulation
 - Cool foot/absent pulses
 - Ulcers on margins of foot and toes
 - HIGH risk of infection
- 50% of DFU



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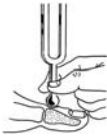
Foot Care: 5 steps of Prevention

1. Regular inspection and examination of at risk foot.
2. Identify and classify at risk foot.
3. Education: patient, family, providers
4. Offloading and callous management (appropriate footwear).
5. Treatment of non-ulcerative pathology.

1. Regular Inspection and Examination


At least once per year by provider

1. History and Exam:
 - ✓ Feet lying and standing
 - ✓ Inspect shoes/socks
 - ✓ Bare foot walking?
 - ✓ Tingling or pain in lower leg especially at night?
 - ✓ Skin color, temperature, edema
 - ✓ Deformities in feet/toes or bony prominence?
2. Sensory Exam:
 - ✓ Plantar surface: Semmes-Weinstein 10 g monofilament
 - ✓ Dorsal surface: Vibration (tuning fork) or Discrimination (pin prick) or Tactile sensation (cotton ball)



Sensory Exam

- Close eyes
- Sitting position
- Apply to arm first so know what to expect
- "Tell me when you feel that pressure (yes/no) and where (right/left foot)."
- Not over callous or ulcer
- Test each site 3 times:
 - LOPS = 2 out of 3 incorrect answers at any one site



2. Identify and classify *at risk* foot

Risk Group	Definition (ADA; Boulton et al, 2008)	Clinical Screening
0	No risk of foot ulcer	
1	Diabetic Neuropathy and/or Foot Deformity	Callus Undetected monofilament, tuning fork or cotton ball Deformity or bony prominence
2	Peripheral Vascular Disease and/or Diabetic Neuropathy	Skin discolored on dependency DP or PT pulse absent
3	History of Foot Ulcer or Lower Extremity Amputation	Ulcer present Previous ulcer

Other Risk Classification Schemes:

SIGN**: Scottish Intercollegiate Guideline Network) (low, medium, high)

IWGDF: International Working Group on Diabetic Foot (0-3)

UTRFS: University of Texas Foot Risk Stratification (0-3)

Monteiro-Soares, Boyko, et al (2011)

3. Education: patient, family, providers

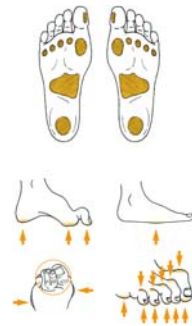
- Structured, organized, several sessions
- Goal: To enhance motivation & skills of individual for self care
- Goal: Recognize potential foot problems and steps to take in response



Examples of Foot Care Instructions:

- Bakker, Apelqvist & Schaper (2012)
- Driver et al (2012).

4. Appropriate footwear



- Off-the shelf shoes OK when sensation intact
- Modified footwear
 - Inside of shoe 1-2 cm longer than foot
 - > Internal width & depth
 - > Abnormal loading (hyperemia or callus formation)
- Pedorthist or orthotist


Footwear



American Board for Certification in Orthotics and Prosthetics, Inc. has been credentialing practitioners and organizations since 1948

Ankle Foot Orthosis (AFO)

5. Treatment of non-ulcerative pathology

Pathology	Eg	Cause	Treatment
Hyperkeratosis 	Corns and Calluses	Repetitive pressure & friction	<ul style="list-style-type: none"> • Regular sharp debridement by provider. • Modify footwear. • Do NOT use chemical callous removers. • No "self surgery"
Fungal infections (Tinea)	<ul style="list-style-type: none"> • Onychomycosis • Interdigital fissure 	Moisture entrapment & callous	Topical & systemic anti-fungal Change socks more often Dry feet thoroughly
Nail conditions	<ul style="list-style-type: none"> • Ingrown • Thickened • Deformity 	<ul style="list-style-type: none"> • Nail cutting technique • Vascular changes 	Regular nail care with foot care specialist

5. Treatment of non-ulcerative pathology



DFU Classification Systems

Additional Systems:

- Wagner Scale
- UT ulcer class.

		PEDIS Classification System			
		Grade 1	Grade 2	Grade 3	Grade 4
Descriptors	Perfusion	Normal	Non-critical PAD	Critical limb ischemia	
	Extent/size (cm ²)				
	Depth tissue loss	Full thickness	Deep	Bone and / or joint	
	Infection	None	Mild	Moderate / severe	SIRS*
	Sensation	Intact	LOPS		

* Systemic inflammatory response syndrome

2006 CPG Am College Foot and Ankle Surgeons
http://total-contact-casting.com/diabetic_foot_disorders/diabetic-foot-disorders.html

Principles Wound Management

- Relieve Underlying Etiology
 - Mechanical factors
 - Enhance/restore arterial perfusion





Severely impaired healing:
(Revascularization Indicated)

- ◆ ABI <0.6
- ◆ Toe pressure <50mmHg
- ◆ TcPo2 <30mmHg

Principles Wound Management

- Address cofactors
 - Glucose management (<140 mg/dL)
 - Reduce/control edema
 - Nutrition
 - ✓ Protein (~1.5 grams/kg/24 hours)
 - ✓ Vitamins and Minerals
 - Emotional/Psychosocial support






Principles Wound Management

- Create optimum healing environment
 - Tissue debridement
 - Inflammation and infection control
 - Manage topical dressings:
 - ✓ Control exudate
 - ✓ Maintain moist wound environment
 - ✓ Fill deadspace
 - ✓ Deliver topical antimicrobial if indicated
 - ✓ Protect surrounding skin to maintain integrity
 - Epithelial edge advancement



Debridement


- Initially
- Regularly via sharp debridement with scalpel, scissors, forceps

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Infection in the Diabetic Foot

- 40-80% DFU infection present
- ↑Risks for infection:
 - PMN function altered
- Muted inflammatory response
- Majority limited to soft tissue
- 20% develop culture positive osteomyelitis
- Multiple organisms (5-8 species)
- MRSA common when:
 - Previous ATB therapy
 - Prolonged healing time



Neuropathic ulcer 1st metatarsal head
<http://www.podiatrypractice.com.au>

IDSA Guidelines: Clinical Classification of Diabetic Foot Infections, 2012

Clinical Manifestation of Infection	IDSA Infection Severity	PEDIS Grade
No symptoms or signs of infection	Uninfected	1
Infection present as shown by presence of at least 2 of following: local swelling or induration; erythema; local tenderness or pain local warmth; purulent discharge	---	---
Local infection involving only skin & subcut. tissue; erythema >0.5 cm to <2cm periwound skin	Mild	2
Local infection with erythema > 2 cm or involving deeper structures (eg., abscess, osteomyelitis, septic arthritis, fasciitis) and NO systemic inflammatory response signs (SIRS)	Moderate	3
Local infection with signs of SIRS (more than two: temp >38 or <36 (C); Heart Rate >90; RespRate >20 or PaCO2 <32mmHg; WBC >12,000 or <4,000 or >=10% immature (band) forms	Severe	4

Superficial Infection: MILD

Non Limb Threatening

- Superficial ulcer
- <2cm periwound erythema (cellulitis)
- No systemic signs
- Common pathogen:
 - Average of 2.1 organisms
 - Aerobic gram positive cocci (Staph. aureus and strep)

Treatment

- Empiric *oral* antibiotics
 - Staph aureus and
 - β -hemolytic Strep
- Change antibiotic as needed with culture results
- Topical antimicrobial
 - Silver, Cadexomer iodine, medical grade honey, hydrofera blue
- 2 weeks

Deep Tissue Infection (Moderate to Severe Infection)

Life/Limb Threatening

- Deeper ulceration or undrained abscess
- Gangrene
- >2cm periwound erythema
- Plus edema lower leg
- Systemic symptoms (fever, ↑ WBC, hyperglycemia)
- MRSA common pathogen

Moderate to Severe Infection: Treatment

- Systemic antibiotics**
 - Parenteral for severe infection & some moderate
 - Duration of ATB based on severity and wound response (1-3 weeks)
- Topical Care**
 - Aggressive surgical debridement
 - Monitor closely to assess response to therapy
- Hospitalization for severe infection**

Kim, P.J. & Steinberg, J. S. (2013). Complications of the diabetic foot. *Endocrinol Metab Clin N Am* 42: 833-847. <http://dx.doi.org/10.1016/j.ecl.2013.08.002>

Topical Therapy: Dressings

Priority Considerations:

- Absorb exudate
 - Alginates and hydrofibers
 - Sodium impregnated gauze
- Fill wound bed and tunnels
 - Same as above
- Donate moisture
 - Hydrogel impregnated gauze
- Cover (secondary) dressing
 - Foam
 - Seldom hydrocolloids or transparent dressings
 - Adhesive or nonadhesive with roll gauze/Coban
- Antimicrobial topical product x 2 weeks
- Frequency of Change: initially daily then 2-3x/week

Diabetic Foot Ulcer: Closure of the Wound

- Autograft (split thickness skin graft)
- Skin equivalents (apligrft, dermagraft)
- Negative Pressure Wound Therapy (NPWT)

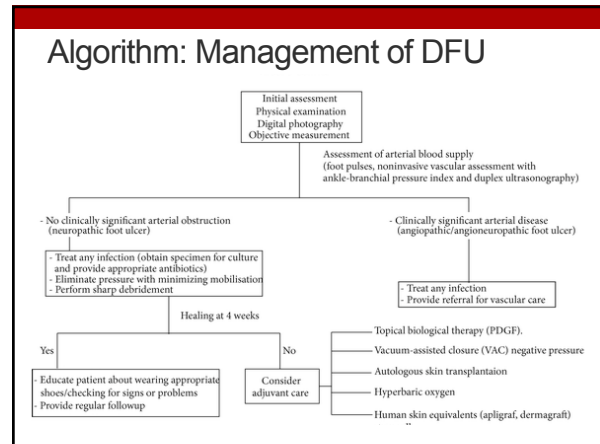
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Negative Pressure Wound Therapy

- Reduce edema/interstitial fluid
- Remove toxic cytokines, bacteria, MMP's
- Symmetrical contraction of wound edges
- Mechanical stretch stimulates cellular proliferation, angiogenesis and granulation tissue formation



<http://www.podiatrytoday.com>



Diabetic Foot Service: An Interdisciplinary Team

- Podiatrist
- PCP
- Vascular Surgeon
- Infectious Disease
- Diabetologist
- Diabetes Educator
- Wound Care Nurse
- Pharmacy
- Orthotist/Pedorthist

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Conclusion



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