Diabetic Foot Ulcers

Comprehensive Review
Successful Wound Management Strategies Series

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Advanced Practice Nurse / Adult Clinical Nurse Specialist
- Identify Diabetic/Neuropathic Ulcers.
- Understand adverse effects of Diabetes.
- Understand neuropathy, types of neuropathy and its effects on Diabetic Ulcer.
- Perform comprehensive clinical assessment of patients with Diabetic ulcers.
- Perform Diabetic Ulcer risk assessment.
- Diabetic Ulcer management strategies.
A diabetic neuropathic ulcer is defined as an injury causing loss of skin or tissue often on the feet due to lack of sensation (neuropathy).
16 million people in the U.S. have Diabetes Mellitus.
15% of patients with Diabetes will develop a foot ulcer.
20% of patients with DFU have PAD.
50% of patients with DFU have PN.
30% of patients with DFU have both PAD and Neuropathy.
13.9% Patients with DFU in 2008 had lower extremity amputations.
According to WHO by 2025, 300 million worldwide will have Type-II Diabetes Mellitus.
ADVERSE EFFECTS

- Damage to blood vessels / Decreased circulation (PAD & PVD)
- Damage to nerves - Neuropathy
- Decreased immune response
- Delayed response to tissue injury
- Defective Matrix production & deposition
- Deformity
Neuropathy involves functional disturbances, pathologic changes and degeneration of peripheral nerves, characterized by:

- Numbness and pain in hands and feet
- Tingling or burning sensation
- Sensitivity to touch or muscle weakness

Myers, B. (2012).
Neuropathy associated with Diabetes Mellitus can be classified as:

- Sensory Neuropathy
- Motor Neuropathy
- Autonomic Neuropathy
The most common type of diabetic neuropathy, causes pain or loss of feeling in the toes, feet, legs, hands, and arms.
DIABETIC | NEUROPATHIC FOOT ULCERS
SUCCESSFUL WOUND MANAGEMENT STRATEGIES

SENSORY NEUROPATHY

Healthy Nerves and Blood Vessels

Nerves and Blood Vessels Damaged by DPN
Motor Neuropathy

Leads to paralysis of the foot's intrinsic muscles resulting in muscle atrophy that predispose patients with diabetes to plantar ulceration by increasing plantar pressures and shear forces.
Autonomic Neuropathy increases the risk of neuropathic ulceration due to disturbances in sweating mechanisms, callus formation, and blood flow. It also affects heart, blood vessels, digestive system, urinary tract, eyes, lungs & sex organs.
Diabetic Peripheral Neuropathy

- Healthy tissue
- Diabetes-related metabolic or vascular conditions can cause capillary damage.
- Capillary damage can lead to nerve damage and loss of sensation especially in the extremities.
- Injury due to loss of sensation.
- Loss of sensation and circulation problems result in increased risk of infection, ulcers and gangrene.
✓ Health History: Allergies, Smoking, Medications etc.
✓ Duration of Ulceration: Current & Previous treatments
✓ Diabetes Management: Hemoglobin A1c
✓ Foot & Shoe Exam: Deformity, Improper shoes, Circulation / Pedal Pulses, Skin Color, Temperature, Neuropathy, Callous
✓ Mobility Status: Ambulatory, Wheelchair, Walker etc.
✓ Nutrition: Pre-Albumin, Vitamin D, Vitamin C
 ✓ Location of wound: Plantar | Lateral or Medial aspect
 ✓ Duration of Ulceration: When ulcer was first discovered
 ✓ Grading of Ulcer: Wagner grading scale
 ✓ Drainage or Odor: Type of drainage and odor; if any
 ✓ Wound edges: Calloused | Pink & soft | Rolled
 ✓ Presence of Pain: Assessing sensory loss
**Wagner Grading System**

1. **Grade 1**: Superficial Diabetic Ulcer

2. **Grade 2**: Ulcer extension
   1. Involves ligament, tendon, joint capsule or fascia
   2. No abscess or **Osteomyelitis**

3. **Grade 3**: Deep ulcer with abscess or **Osteomyelitis**

4. **Grade 4**: Gangrene to portion of forefoot

5. **Grade 5**: Extensive gangrene of foot
**Diabetes Management: Hemoglobin A1c Level**

A1c levels Measures Blood Glucose Control for 2-3 Months

**HgbA1c – 5.6%**  Wound Healing Rate 0.35cm² / day Wound Heals in 64 days

**HgbA1c – 11.1%**  Wound Healing Rate 0.001cm² / day Wound did not heal
Identify Compliance Issues = Patient Education
Better Blood Glucose Control (≤ 7.0) = Better Outcomes
Hyperglycemia = Delayed Wound Healing & Complications
**Screening: 2004 ADA recommendation**

“Consider” at age 50 years and every 5 years

**Diagnosis:** Claudication, absent DP/PT pulses, foot ulcer

**Limitations:** Underestimates severity in calcified arteries

### Interpretation

- **Normal**
  - ABI: 0.90 - 1.30

- **Mild obstruction**
  - ABI: 0.70 - 0.89

- **Moderate obstruction***
  - ABI: 0.40 - 0.69

- **Severe obstruction***
  - ABI: <0.40

- **Poorly compressible**
  - ABI: >1.30

- **2° to medial calcification**
  - ABI: >1.30

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*Note: ABI values are approximate and may vary.*
Ankle Brachial Index (ABI)

A. Ultrasound device amplifies the sound of arterial blood flow

B. Systolic pressure recorded in the brachial artery of the arm

C. Sound of arterial blood flow located in ankle

D. Systolic pressure sequentially recorded in the arteries of the ankle after each arterial flow is located
In an effort to standardize and simplify the detection of insensate foot, the 5.07/10-gm monofilament is recommended by the International Diabetes Federation and the World Health Organization as a device that can be used by health professionals at every level of care.

How to use MF10GM:

A standardised filament is pressed against part of the foot. When the filament bends, its tip is exerting a pressure of 10 grams (therefore this monofilament is often referred to as the 10 gram monofilament). If the patient cannot feel the monofilament at specified sites on the foot, he/she has lost enough sensation to be at risk of developing a neuropathic ulcer.
Diabetic Foot Ulcer
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Identifying “High Risk” Patients during admission assessment

1. Diabetic for > 10 years
2. Diagnosis of Neuropathy
3. Past History of Diabetic Foot Ulcers
4. Past History of Amputation associated with Diabetes or PVD
5. HgbA1c > 7.0%
6. Current or past history of Tobacco use
7. Ankle Brachial Index < 0.8
8. Diagnosis of Peripheral Vascular Disease (PVD)
9. BMI ≥ 35
10. Patient is able to ambulate self. (Ambulatory)
11. Diabetes managed with Insulin
12. Presence of foot or ankle deformity
13. Not able to conduct own visual foot exam

Total Score 13

SCORE INTERPRETATION:
- LOW RISK = 1 TO 3
- MEDIUM RISK = 4 TO 6
- HIGH RISK = 7 TO 13
- Patient Education
- Off-Loading
- Sharp Debridement
- Managing Bacterial Burden – Wound Cultures & Antibiotics
- Monitor HgbA1c levels and maintaining at Below 7%
- Maintaining wound moist