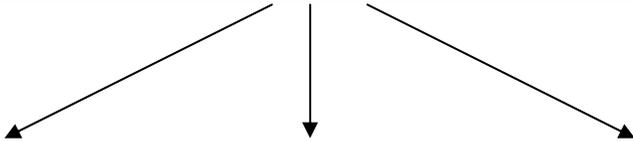


# DIABETIC FOOT ULCER ASSESSMENT AND MANAGEMENT ALGORITHM

<u>ASSESSMENT/DIAGNOSIS</u>		
<ul style="list-style-type: none"> <li>• Complete history</li> <li>• Nutritional Assessment</li> </ul>		
<p style="text-align: center;"><b>Assess for Infection</b></p> <ul style="list-style-type: none"> <li>• +/- culture swab</li> <li>• CBC</li> <li>• X-ray/<i>ESR</i> to rule out <i>osteomyelitis</i></li> <li>• Probe to bone</li> </ul>	<p style="text-align: center;"><b>Vascular Assessment</b></p> <ul style="list-style-type: none"> <li>• <i>ABI</i> + <i>toe pressures</i></li> <li>• Early referral to vascular surgeon if indicated</li> </ul>	<p style="text-align: center;"><b>Neurological and Musculoskeletal Assessment</b></p> <ul style="list-style-type: none"> <li>• Assess for <i>sensory, autonomic, motor neuropathy</i></li> <li>• Assess shape of feet for deformity</li> <li>• Assess feet for callous, swelling</li> </ul>



<u>TREAT THE CAUSE</u>	<u>TREAT PATIENT CONCERNS</u>	<u>TREAT THE WOUND</u>
<ul style="list-style-type: none"> <li>• Provide optimal offloading</li> <li>• Ensure proper footwear</li> <li>• Ensure/teach proper foot care</li> <li>• General considerations:               <ul style="list-style-type: none"> <li>• Treat concurrent medical conditions</li> <li>• Encourage optimal glycemic control</li> <li>• Encourage smoking cessation</li> <li>• Encourage medication compliance</li> <li>• Maximize nutrition</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Manage pain</li> <li>• Provide emotional support</li> <li>• Assess and consider financial situations</li> <li>• Provide patient and family education</li> </ul> <p style="margin-top: 20px;">Refer to: Recommendations on care of wound bed</p>	<ul style="list-style-type: none"> <li>• Prevent/control infection</li> <li>• Determine potential for healing</li> <li>• Address <i>vascular insufficiency</i>/ischemia</li> <li>• If no healing evidenced within <b>FOUR</b> weeks with optimal patient and wound management or if wound deteriorates, consult an <i>advanced wound clinician</i></li> </ul> <p style="margin-top: 20px;">Refer to: Recommendations on care of wound bed</p>

## DIABETIC FOOT ULCER

### INTRODUCTION:

- Diabetic foot ulcers are most commonly seen on weight bearing surfaces. Foot deformities common in patients with diabetes can accentuate bony prominences and predispose the patient to pressure and the development of ulcers. Poor fitting shoes and the lack of protective sensation further exacerbate this problem
- Common locations of diabetic foot ulcers include the plantar surface at the hallux, 1st metatarsal joint, heel (and tarsus region in *Charcot foot*), nail fold, nail bed and on the bottom, tips or between toes



*Diabetic foot ulcer*



*charcot foot*

- Ulcers may be small at the surface but have large subcutaneous abscesses. Always probe a diabetic foot ulcer with a sterile swab/probe to determine the depth of wound and the possibility of bone involvement
- *Exudate* may vary. Infected diabetic foot ulcers may or may not have pus
- It is common for callus to build up on plantar ulcers requiring frequent *debridement*
- Prevention through control of risk factors is key:
  - Optimal glycemic control
  - Optimal control of hyperlipidemia
  - Optimal control of hypertension
  - Optimal treatment for renal disease, peripheral vascular disease
  - Education re: *neuropathy* (proper foot care and footwear)
  - Smoking cessation
  - Other disabilities (e.g. post-polio weakness, visual impairments, lack of exercise)

### ASSESSMENT/DIAGNOSIS

- Complete History
  - Medical history including a history of previous ulceration, amputation, surgery and/or trauma
  - *HgbA<sub>1c</sub>*
  - Tobacco use and motivation to stop smoking

- Check condition of **BOTH** feet
- Assess footwear for abnormal wear patterns, seams, ridges or other areas of *friction* or pressure
- Foot care hygiene practices
- **Nutritional Assessment**
  - Consult dietitian if indicated
  - Measure height, monitor weight at regularly scheduled intervals
- **Rule Out Infection**
  - Refer to recommendations on care of wound bed
- **Vascular Assessment**
  - Assess perfusion by comparing both feet and lower legs
  - Patients with diabetes and co-existing foot pathology should have pressure studies done for a baseline assessment. Refer patient to a vascular lab
  - Patients with diabetes should be referred to a vascular surgeon if any of the following are present:
    - Rest pain in the foot with no palpable pulses
    - **ABI** <0.5, ankle pressure <50mmHg or **toe pressure** <30mmHg (see caution box)
    - Gangrenous toes
    - Lack of a palpable pulse in a foot with an existing ulcer
    - Any ulcer that has not shown signs of healing in four weeks with optimal wound management and offloading

## CAUTION

Approximately 30% of patients with diabetes have incompressible (calcified) vessels at the level of the ankle with a very small group having incompressible (calcified) vessels in the toe as well. Suspect incompressible (calcified) vessels when the following is noted:

- Ankle pressure >300 mmHg
- Ankle pressure >75mmHg higher than brachial pressure
- ABI** >1.3

**Toe pressures** is the recommended assessment for the patient with diabetes.

- **Neurological/Musculoskeletal Assessment**
  - ***Sensory, Autonomic, Motor Neuropathy Assessment***
    - ***Sensory neuropathy*** involves the loss of protective sensation. Sensation should be checked using a **10g Semmes-Weinstein monofilament**



*Semmes-Weinstein monofilament*

- **Autonomic neuropathy** involves poor temperature regulation. Assess for temperature, dry skin, loss of hair on lower limbs
- **Motor neuropathy** involves damage to nerves in the muscles of the foot. Assess motor strength and range of motion in ankle, foot and toes
- **Musculoskeletal Assessment**
  - Assess shape of feet for deformity: Claw toes, Pes Cavus (abnormal high medial longitudinal arch), hallus rigidus, hammertoe **and Charcot** changes. **Note: Acute Charcot** changes may mimic **cellulitis**. X-ray and additional laboratory investigations may be necessary



*Acute charcot changes*

- Assess feet for callus. Ulcer may be embedded under thickened callus. A qualified professional (physician, podiatrist/chiropract, foot care nurse) must pare down the callus
- Assess feet for swelling. Swelling predisposes the patient to diabetic foot ulcers, impedes healing, has implications for footwear

## **PREVENTION AND TREATMENT**

*Patient and family education is an essential component of prevention and treatment of diabetic foot ulcers*

### **Treat the Cause**

- **Provide Optimal Offloading**
  - **Surgical Offloading**
    - Orthopedic surgery
    - Debriding callus
    - Managing ingrown toenails
    -

- **Mechanical Offloading**
  - Total contact cast
  - Wheelchair, crutches, walker
  - Pneumatic walker - a removable cast which uses inflatable and adjustable air cells to shift the weight away from the ulcer



*Pneumatic walker*

- Bedrest
  - Shoe insole/insert
  - **Orthotics**- a full contact semi rigid, soft insert designed to redistribute pressure, reduce impact, *shear* and stabilize involved joints. A suitable prescription should include a complete diagnosis, reflecting the risk category of the patient. Orthotics must be casted and fitted appropriately by an experienced professionally trained clinician
  - Shoe modifications (refer to Appendix A)
- **Ensure Proper Fitting Footwear**
    - Proper fitting footwear must be used for all weight bearing activities. Avoid walking in bare feet or slippers
    - A prescription for footwear may be required and should include the diagnosis and risk category
    - Footwear must be functional and should include the following characteristics:
      - match the shape of the foot
      - have a removable insole
      - have visible means of closure such as laces, velcro
      - have an adequate toe box to accommodate forefoot shape and deformities
      - have a broad sole to provide sufficient stability
      - have easily modifiable upper and sole material
      - have upper material made of leather or comparable material to allow for breathability, durability and mouldability
      - have a smooth protective lining
      - have a shock absorbent midsole with adequate thickness for protection
      - have a heel height (difference between rearfoot and forefoot at breast of the shoe) that does not exceed one inch
      - should not allow movement of the foot inside the shoe

### *Anatomy of a shoe*

- **Educate Patient and Family about Proper Foot care**
  - Foot care should be done on a regular basis and should include:
    - Visual and sensory inspection of both feet
    - Toenail care
    - Callus care
    - Use of daily emollient on dry skin (not applied between toes)
    - No foot soaks
    - Ensure feet are dried well
  - For patients unable to perform their own foot care, arrange for professional foot care services by either a podiatrist or certified foot care nurse
  - Feet should be assessed for risk factors by a qualified professional (e.g. family physician, endocrinologist, podiatrist or foot care nurse) four times a year
- **General Considerations**

The following are general treatment guidelines to consider in addition to the above specific treatment guidelines

  - Treat concurrent medical conditions (e.g. hypertension, hyperlipidemia)
  - Encourage optimal glycemic control. Consider referral to a specialized diabetes care and education service
  - Encourage smoking cessation
  - Encourage medication compliance
  - Maximize nutrition
    - Consult dietitian as indicated
    - Monitor intake
    - Provide adequate protein and calories to avoid protein depletion
    - Consider need for multivitamin with minerals (refer to Appendix B in recommendations for pressure ulcers)
    - Maintain good hydration (e.g. 1500-2000 mls per day of hydrating fluids)

### **Treat Patient Concerns**

- Manage pain if present (refer to recommendations on care of wound bed)
- Provide emotional support, assess and consider financial situation (consult social work if indicated)
- Provide patient and family education

### **Treat the Wound**

- Refer to recommendations on care of the wound bed
- Prevent and control infection (refer to recommendations on care of the wound bed)
- Address *vascular insufficiency*/ischemia if present. Refer to vascular surgeon to determine if re-vascularization is possible.
  - If re-vascularization is possible, the wound has potential to heal (see recommendations on care of wound bed)
  - If re-vascularization is not possible, the wound does not have potential to heal
    - The goal is to PREVENT/ TREAT INFECTION AND AVOID/ DELAY AMPUTATION

#### **Keep the wound dry and do not debride**

#### **Dry wounds**

- This is the one situation where an antiseptic is appropriate for treatment
- DO NOT cleanse with normal saline first
- Use Povidone iodine to paint the wound

#### **Wet Wounds**

- If wound is wet, consider a topical antimicrobial (see recommendations on care of wound bed)
  - DO NOT use Burrow's solution, Dakin's solution or Hydrogen peroxide
- 
- If no healing is evidenced within FOUR weeks with optimal patient and wound management, or if wound deteriorates, consult an *advanced wound clinician*

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## APPENDIX A

### SHOE MODIFICATIONS TO ASSIST WITH MECHANICAL OFFLOADING

**Rocker bottom soles** - used to reduce pressure and impact shock to affected areas, immobilize intratarsal joints, and help weight transfer from heel strike to push off



*Rocker bottom shoes*

**Balloon patching** – used to reduce pressure and shear from affected areas of the foot (other than the planter surface) by cutting a hole in the shoe around the sight and replacing with a large soft patch

**Flare** - adhered to the soles and heels of shoes to improve weight transfer and accommodate deformity or to reduce pronation and abduction

**Buttresses** - an extension added to the side of the shoe including both the sole and the upper to provide more extension stabilization than a flare. Used for more severe medial or lateral instability of the hind foot, or mid foot

**Extended Steel Shank** – steel bars used with the rocker sole to remove all movement and shearing in the shoe

**Metatarsal Bars** - extended bars made of strong neoprene material put on the soles of shoes to give the same results as a rocker sole. These are often more suitable for dressier types of shoes and may also be proximal to the affected joint