The AGONY of the FEET

Prevention and management of diabetic foot ulcers

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Nearly 25 percent of people with diabetes will develop a diabetic foot ulcer during their lifetime.[1] These ulcers open the door to infection, and the longer a diabetic foot ulcer persists, the greater the risk of hospitalization and possible amputation. Diabetic foot ulcers lasting 30 days or longer actually carry a four-fold risk of infection and 85 percent of lower limb amputations in people with diabetes are preceded by ulceration.[1] The good news is that at least 40 percent of amputations in diabetic patients can be prevented with a team approach to wound care.[2]

Risk factors for diabetic foot ulcers include previous amputation, past history of diabetic foot ulcers, peripheral neuropathy, foot deformity, peripheral vascular disease, visual impairment, poor glycemic control and cigarette smoking.[3] The most common sites for diabetic foot ulcers are the toes, followed by the plantar metatarsal heads and the heels.[4]


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Keeping these facts in mind, it's best to prevent diabetic foot ulcers all together. Multidisciplinary programs that focus on prevention, education, regular foot examinations, aggressive intervention and optimal use of therapeutic footwear have demonstrated significant reductions in the incidence of lower-extremity amputation.[5]

Foot inspection

Foot inspection should be performed on bare feet in a well-lit room, and should include a dermatological assessment. Referral for specialty foot care is recommended if any of the following are discovered:[3]

- Dryness or cracking of skin
- Infection between the toes (fungal)
- Ulceration
- Calluses or blistering
- Temperature differences between each foot
- Structural deformities, including claw toes, hammertoes and Charcot arthropathy

It is also important to inspect the patient's shoes, looking for unusual wear or other signs that the shoes may be rubbing against the skin.

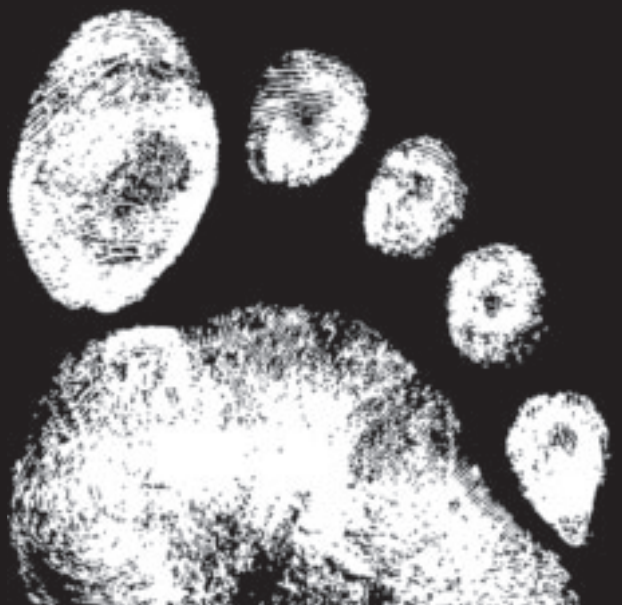
Neurologic Assessment

More than 60 percent of diabetic foot ulcers are caused by underlying neuropathy as the result of hyperglycemia-induced metabolic abnormalities that lead to nerve cell injury and death.[2] Diabetic neuropathy has no known cure. Treatment for diabetic neuropathy focuses on slowing the progression of the disease by keeping blood glucose levels under control.

Autonomic neuropathy leads to a decline in the functionality of the sweat and oil glands, resulting in dry skin that is susceptible to tears and subsequent infection. Loss of sensation in the feet occurs as part of peripheral neuropathy and exacerbates the development of ulcerations. When trauma occurs to someone with a loss of sensation in the feet, the wound can go unnoticed and progressively worsen as a result.[4] The highest rates of neuropathy are among people who have had diabetes for more than 25 years. Diabetic neuropathies also appear to be more common in people who are unable to control their blood glucose, as well as those with high cholesterol and hypertension and those who are overweight.[6]

Preventing Diabetic Foot Ulcers

- Keep blood sugar levels under control. Poorly controlled diabetes leads to peripheral vascular disease and neuropathy.
- Check feet daily for injury or signs of pressure.
- Promptly treat any wounds that may appear on the feet.
- Wash feet regularly with a mild soap, making sure to dry thoroughly between the toes.
- Apply a pH-balanced moisturizing cream to feet to prevent dryness and cracking of skin.
- Make sure calluses and ingrown toenails are regularly treated by a foot care specialist.
- Make sure shoes fit well. Shoes that are too tight can cause friction and shear that can lead to skin breakdown.
- Consider elective surgery to correct structural deformities that cannot be accommodated by therapeutic footwear.
- Regularly assess protective sensation in the feet using the Semmes-Weinstein test with a monofilament.



Types of Diabetic Neuropathy[6]

Diabetic peripheral neuropathy can involve all three types of nerve dysfunction: sensory, autonomic and motor.

- Sensory dysfunction results when the patient develops a lack of protective sensation, particularly on the feet. Those with sensory neuropathy can sustain an injury and never even feel it.
- Autonomic dysfunction leads to reduced perspiration, which compromises the skin's integrity. Dry skin can easily develop cracks without proper moisturization, and this can lead to skin breakdown and infection.
- Motor neuropathy develops in patients with foot deformities such as bunions, hammertoes and claw toes. Foot ulcers tend to develop on these areas, which are exposed to excessive friction. An altered gait resulting from foot deformities also can lead to unusual points of friction and ulcer formation.

The neurological assessment should include the Semmes-Weinstein test and one of the following: vibration using a tuning fork, pinprick sensation, ankle reflexes or vibration perception threshold (VPT). Abnormalities with any of these assessments should prompt a referral to a neurologist.[3]

Semmes-Weinstein test. The Semmes-Weinstein test uses a monofilament, or nylon strand specifically calibrated in stiffness to represent a baseline level of sensation. It is placed against the foot until it bends slightly. At this point, the clinician asks the patient if he or she feels anything. A person with normal sensation should be able to feel the pressure of the monofilament. If the patient does not feel the pressure in at least four out of ten predefined areas, it is reasonable to assume that diabetic neuropathy is present, and extra precautions should be taken to protect the foot. In fact, many prospective studies have confirmed that loss of pressure sensation using the monofilament is highly predictive of subsequent ulceration.

Tuning fork. The tuning fork is a widely used, inexpensive method for testing vibratory sensation over the tip of the great toe on each foot. If the patient can no longer feel the vibration when the fork continues to vibrate, he or she is at risk for ulceration.

Semmes-Weinstein Test

Ankle reflexes. Ankle reflexes are tested with the patient kneeling or resting on a table with the ankles in a neutral position. The ankle is then struck with a tendon hammer. Total absence of an ankle reflex is regarded as an abnormal result.

Vibration perception threshold (VPT). The biothesiometer or neurothesiometer is a handheld device to measure vibration perception. With the patient lying on his back, the stylus of the instrument is placed over the top of the big toe. The amplitude is increased until the patient can detect the vibration, and the resulting number is known as the VPT. A VPT greater than 25 volts is considered abnormal, putting the patient at risk for ulceration.

Tests for Vascular Assessment[3]

Peripheral vascular disease (PVD) is a contributing factor associated with recurrent diabetic foot ulcers in up to 50 percent of cases. Cell abnormalities develop in the arteries inside the calf as a consequence of the persistent hyperglycemic state. Smoking, hypertension and hyperlipedemia are other factors that commonly contribute to the development of PVD in people with diabetes.[2] The vascular assessment should include palpation of the posterior tibial and dorsal pedis pulses and determination of the patient's ankle-brachial index (ABI), if indicated.[1] Abnormalities with either of these assessments should prompt a referral to a vascular specialist.[3]

Using foot assessment results to create a treatment plan[2]

After thoroughly assessing the patient, you may wish to assign a foot risk category according to the chart on the next page, as recommended by the Task Forces of the Foot Care Interest Group of the American Diabetes Association. Two other popular tools for classifying diabetic ulcers are the Wagner Ulcer Classification System and the University of Texas Wound Classification System.

Risk Category	Definitions	Recommended Treatment	Suggested Follow-up
0	No loss of pressure sensitivity, no PVD, no foot deformities	Patient education including advice on proper footwear.	Annually
1	Loss of pressure sensitivity with or without foot deformity	- Consider specialized footwear. - Consider surgery if deformity cannot be managed with shoes. - Continue patient education.	Every 3-6 months
2	Loss of pressure sensitivity and PVD	- Consider specialized footwear. - Consider vascular consultation for combined follow-up.	Every 2-3 months (with a specialist)
3	History of ulcer or amputation	- Same as category 1 - Consider vascular consultation for combined follow-up if PVD is present.	Every 1-2 months (with a specialist)

What to do if a diabetic foot ulcer develops

The aim of therapy should be early intervention to allow prompt closure of the lesion and prevent recurrence once it heals. Once an ulcer has formed, rest, pressure relief and debridement are considered vital to the healing process.[5] There are multiple ways to offload pressure from the wound, including contact casting, half shoes, removable cast walkers, wheelchairs and crutches. Overall wound condition, required frequency for assessment, presence of infection and patient compliance are all factors to consider when choosing the appropriate offloading device.[2] When evaluating a diabetic foot ulcer, it is important to document the size, depth, appearance and location of the wound throughout treatment.[5]

Choosing wound dressings

Proper selection of wound dressings is another important aspect of managing diabetic foot ulcers. Published clinical evidence is largely lacking regarding comparisons between the effectiveness of various dressings, however, clinical experience shows that maintaining a moist wound environment, absorbing excessive exudate, daily wound inspection and not increasing the risk for infection are critical for healing.[2]

Patients with diabetic foot ulcers are at significantly higher risk for infection, complications, and unfortunately, amputations. For these reasons, extra caution should be taken when selecting a dressing for these wounds. Once the wound has been assessed, the appropriate dressing can be selected based on the characteristics presented.

There are many wound care dressings on the market today. Due to all the variables with each individual and each wound, there are many options, but the pneumonic DIMES will help you choose a dressing. DIMES is well-published and it is a great guideline based on product function.[8] (See table on page 42).

Prompt medical attention is indicated if there is a deep infection with abscess, cellulitis, gangrene or osteomyelitis. Even without osteomyelitis, reconstructive surgery to correct bone abnormalities may be necessary to achieve final healing of the diabetic foot ulcer, especially if the deformities are subject to excessive pressure from ambulating or rubbing against shoes.[5]

Save Those Feet: Wound Salvage Teams

Diabetes around the world results in one major limb amputation every 30 seconds, or more than 2,500 limbs lost per day. Consultation with a multidisciplinary limb salvage team can be critical to facilitate timely diagnostic assessment and appropriate interventions – to do everything possible to prevent amputation.[9]

The core of the team typically starts with clinicians caring for the structural and surgical aspects of the foot (podiatric surgeons) along with clinicians caring for the vascular integrity of the lower extremity (vascular surgeons). For a more comprehensive care model, other specialties of the team may include internal medicine, endocrinology, infectious disease, physical therapy, plastic surgery, nursing, emergency medicine and prosthetics.[9]

Seven Basic Skills of a Limb Salvage Team[9]

The interdisciplinary limb salvage team uses seven basic skills to improve the quality and efficiency of patient care, thereby seeking to improve overall outcomes and reduce amputation rates.

1. Hemodynamic and anatomic vascular assessment and revascularization as necessary
2. Neurologic workup
3. Site-appropriate wound culture technique
4. Wound assessment that includes grading and staging of infection and ischemia
5. Site-specific bedside and intraoperative incision and debridement
6. Initiation and modification of culture-specific and patient-appropriate antibiotic therapy
7. Appropriate postoperative monitoring to reduce the risk of reulceration and infection

Conclusion

Projections indicate that 366 million people worldwide will have diabetes by 2030 – more than three times the number of people who had diabetes in 2000.[2] With this expected surge in diabetes, patient education and prevention and management of complications will become even more critical to prevent diabetic foot ulcers and possible amputations.

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The DIMES Model for Wound Assessment

D Debridement, the first step in preparing the wound to heal includes both cleansing and debriding necrotic material from the wound bed. With diabetes, the risk for infection is increased, so the need to prevent infection is also increased. There are many methods of debridement, however, the polyacrylate dressing is an efficient debriding agent that encompasses both autolytic and a method of mechanical debridement.

I As mentioned before, infection must be assessed and addressed immediately in individuals with diabetes. Systemic antibiotics may be indicated, but should always be used with caution, even in the person with diabetes. The number of antimicrobial dressings on the market has increased in the last several years, and so have the choices. Ionic silver is well accepted as an ingredient to address bioburden. The key to success is using an appropriate carrier dressing. A wound with minimal drainage could benefit from a hydrogel, but when diabetes is involved, an ionic silver hydrogel may be the best option. If the wound has drainage, a silver alginate or silver foam may be the better choice.

M The next component of wound bed preparation is to address the moisture balance, with the goal being to maintain an optimally moist wound bed. Based on the amount of drainage; an alginate, foam, hydrogel, or transparent film could be what the wound needs. Also consider that many products are available with and without an antimicrobial.

E After the first three components are addressed, the next step is to consider the edge environment. This is where "active" dressings come into play, such as collagen and extra cellular matrix dressings. Usually made of bovine (or porcine or avian) sources, these dressings help the body move toward healing.

S Supportive products, such as secondary dressings, are key to healing. They help the primary dressing stay in place. There are adhesive products such as bordered gauze or tapes. Silicone-based "tapes," which are truly atraumatic upon removal, can be another viable option, though no adhesive dressing is really ideal, especially for someone with diabetes. Remember, the secondary dressing should not be the source of additional trauma. Consider a rolled gauze to wrap around an extremity to hold the primary dressing in place. Also, elastic netting is ideal as an atraumatic secondary dressing for individuals with diabetes.