

# From the Bottom Up: Foot Care in Diabetes and the Role of the Endocrinologist

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## About the Author



Dr. Daniel Shafran is a specialist in Internal Medicine and co-founder of the Edmonton Diabetes & High Risk Foot Clinic. He completed medical school at the University of Calgary, residency at the University of Toronto, and a fellowship in General Internal Medicine at the University of Alberta. He is a Staff Physician at the Royal Alexandra Hospital's Diabetic Foot Clinic and attends on the Internal Medicine wards at the Misericordia Hospital. At the Edmonton Diabetes & High Risk Foot Clinic, he has gathered internal medicine, endocrinology, wound care nurses, foot care nurses, mental health professionals, dietitians, pharmacists, diabetes educators, and insulin pump trainers to work collaboratively under one roof to provide comprehensive care to Albertans living with diabetes.

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## Introduction

Diabetic foot ulcers (DFUs) are a common, serious, and costly complication of diabetes. By some estimates, up to a third of people living with diabetes (PWDs) will develop a DFU in their lifetime.<sup>1</sup> The 5-year mortality rate in patients with a DFU is approximately 30%, and the mortality rate can be as high as 70% in patients with an above the foot amputation.<sup>2</sup> In Canada, hospital admissions for DFUs are 25% more expensive than other common costly conditions such as heart failure and pneumonia, and this is prior to accounting for additional costs associated with treatment of DFUs, such as outpatient antibiotics, rehabilitation, prosthetics, therapeutic footwear, and continuing care.<sup>3</sup> Endocrinologists and other diabetes specialists are well positioned to identify patients at high risk of developing DFUs. By providing early or preventive treatment for DFUs, there is perhaps nothing more

impactful that one can do to improve the quality of life of patients living with diabetes.<sup>4</sup>

## Understanding Diabetic Foot Problems

Diabetic neuropathy impacts motor, sensory, and autonomic nerves, which can act together to create conditions in which a DFU can develop. Motor neuropathy leads to foot deformity and biomechanical abnormalities; sensory neuropathy reduces patients' protective sensation; and autonomic neuropathy alters the local homeostatic response, resulting in abnormal moisture or dryness of the skin.<sup>2</sup> Neuropathy therefore provides ideal conditions for callus formation, which, left untreated, and subject to chronic, repetitive impact, may induce the formation of a DFU.

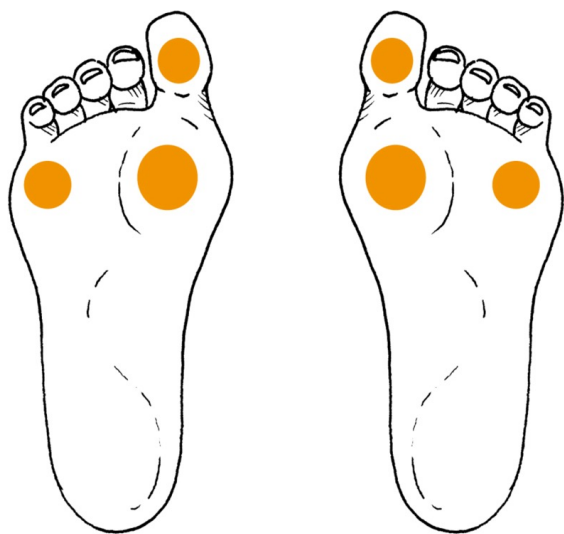
There are also age, body habitus-related, and financial challenges, common in PWDs, that impair patients' ability to examine or care for their feet: reduced flexibility or increased abdominal obesity

may prevent one from being able to adequately inspect their own feet; reduced vision, whether from age-related vision loss or retinopathy, may reduce the utility of such an exam; attempts to trim one's own toenails (if one is able to reach his or her toes) may result in inadvertent self-inflicted injury of the nail bed. Financial constraints prevent some patients from purchasing updated, properly-fitted footwear or obtaining professional foot care.

## Screening for Sensory Neuropathy

Endocrinologists are well placed to screen for and discuss the risks of diabetic foot disease with their patients as part of providing comprehensive diabetes care. Diabetes Canada and the International Working Group for the Diabetic Foot (IWGDF) recommend annual foot exams for most patients, and exams at more frequent intervals for patients at higher risk.<sup>5,6</sup> A review of the risk factors that place a patient at higher risk of developing a DFU is helpful: they are peripheral neuropathy, history of ulcer or amputation, structural foot deformity, limited joint mobility, peripheral arterial disease, microvascular complications, increased hemoglobin A1c (HbA1c), and onychomycosis.

Screening for sensory neuropathy is a quick and straightforward process. The IWGDF suggests the use of either a monofilament or tuning fork as adequate to assess for the loss of protective sensation. Loss of sensation to a Semmes-Weinstein 10g monofilament is the strongest predictor of risk for developing a DFU, conferring a relative risk of 2.5 to 7.9.<sup>7</sup> Monofilament testing need only be performed at three sites on each foot<sup>6</sup> (**Figure 1**).



**Figure 1.** Testing sites for loss of protective sensation using a 10g Semmes-Weinstein monofilament. Source: IWGDF<sup>6</sup>

Despite the fact that testing for neuropathy is quick and inexpensive, some studies have shown that screening is only performed in a third of PWDs.<sup>8</sup> Few screening tests exist in clinical practice for such life-altering diagnoses that are as quick, inexpensive, and noninvasive as neuropathy screening; therefore, it should be performed at every initial diabetes consult and, as mentioned above, at least annually thereafter.

## If You Discover a Diabetic Foot Ulcer

While most diabetes specialists are not expected to manage DFUs, all should be equipped to provide initial advice to a patient discovered to have a DFU, and to understand the importance of making an immediate referral to an appropriate specialty clinic. Initial treatment of a DFU requires addressing five areas: off-loading, wound debridement, wound dressings, treating infection, and perfusion.<sup>9</sup> Upon discovery of a DFU on the plantar aspect of the foot, diabetes specialists should instruct the patient to offload the foot as much as possible. Offloading can be supported with the use of off-loading devices such as a knee walker, crutches, walker, or wheelchair, wherever possible. Wounds on the lateral or dorsal aspect of the foot are often a result of ill-fitting footwear. Inspection of the patient's footwear can often confirm this and a quick fix—new footwear—can be recommended.

If a DFU shows signs of infection, antibiotics should be prescribed, though the ideal first-line empiric agent varies upon the nature of the infection. Mild infections without complicating features (such as receipt of recent antibiotics) can be treated with first generation cephalosporins. More severe infections should be treated with broad-spectrum antibiotics such as amoxicillin/clavulanate. Patients with a history of drug-resistant pathogens should receive appropriately-targeted antimicrobial therapy. Patients with evidence of severe infection or ischemia, gangrene, abscess, or hemodynamic changes should be directed to the nearest emergency department to receive urgent surgical consultation.<sup>10</sup> For a patient discovered to have a DFU, an immediate referral to a dedicated multidisciplinary high risk foot care team is essential. These teams must be able to offer regular debridement of nonviable tissue and the surrounding callus, select and apply appropriate wound dressings, treat infections or refer the patient to a specialist in infectious diseases, and workup and manage peripheral arterial disease. These teams may also include, or work closely with, orthopedic surgeons, vascular surgeons, interventional radiologists, podiatrists, podiatric surgeons, orthopedic

technicians, specialist nurses, and podiatrists/orthotists.<sup>9</sup> Indeed, multidisciplinary care teams have been shown to reduce the risk of major amputation compared to usual care.<sup>11</sup>

## Prevention and Avoiding Recurrence

Due to the high risk of recurrence of DFUs, patients with a history of DFU should not be considered healed or cured but should instead be considered “in remission”. The recurrence rate of a DFU at one year is 42%, and at five years is 65%.<sup>1</sup> Therefore, it is more likely than not that patients who have had a DFU will develop another one in the future. Patients should be counselled on three practices that may reduce their risk of developing a first or recurrent DFU. First, patients should perform daily foot inspections, or have someone else perform these inspections for them if they are unable to.<sup>6</sup> This facilitates the discovery of pre-ulcerative lesions, such as calluses, before they become wounds, and increases the likelihood that open wounds are treated earlier. Second, PWDs should be instructed to seek care from a foot care specialist if they discover corns, calluses, ingrown toenails, splinters, or other wounds; they should not treat these themselves.<sup>5</sup> Patients with a history of DFU are at the highest risk of ulceration, and should receive lifelong ulcer prevention from a foot care professional at regular intervals to ensure early and safe callus removal.<sup>6</sup> Third, the use of therapeutic footwear (which may include custom shoes, orthotics, or both) reduces the risk of ulceration by half.<sup>12</sup> All patients with a loss of protective sensation on the foot should wear footwear anytime their feet touch the ground—indoors or out.

## Emerging Technologies and Innovations

While much of modern DFU treatment is the application of basic principles such as debridement and offloading, new technologies show promise in reducing the incidence of DFUs and expediting their resolution. Intelligent insoles, equipped with multiple temperature and pressure sensors which are remotely monitored, are now commercially available. One such intelligent insole, manufactured by a Canadian company, showed a 71% reduction in ulcer incidence in a small study.<sup>13</sup> Extracorporeal shockwave therapy (ESWT), initially used for nephrolithiasis and now commonly used by physiotherapists for several musculoskeletal ailments, has been approved by the FDA for the treatment of neuropathic DFUs, based on randomized trials that showed over 10% more wounds

had completely healed by 20 and 24 weeks with the use of ESWT compared to sham therapy.<sup>14</sup> Other treatments, such as topical oxygen therapy, placenta-derived products, topical fibrin and leucocyte platelet patches, sucrose octasulfate dressings, and hyperbaric oxygen have modest evidence to support their use, and though they may be considered as adjunctive treatments in non-healing ulcers,<sup>6</sup> their use is not widespread.

## Conclusion

DFUs pose a significant threat to the quality of life and mortality of PWDs. Endocrinologists and other diabetes specialists can and should play a critical role in the screening, prevention, and where necessary, initial management of DFUs. Screening patients for loss of protective sensation—and indeed, for active wounds, which may exist unbeknownst to the patient with neuropathy—is often overlooked but of critical importance in identifying and treating DFUs. Patients found to have an ulcer require prompt referral to a specialized care team, and anyone with a history of ulceration requires lifelong preventative foot care and therapeutic footwear to reduce the very high likelihood of recurrence. While emerging technologies to assist with this challenge are being evaluated, the mainstay of treating DFUs remains a strict focus on basic principles, such as offloading and debridement of the wound, treating incident infections, and ensuring adequate perfusion. Endocrinologists and other diabetes specialists stand on the front line in the fight against DFUs and should play a pivotal role in the early detection and prevention of DFUs to enhance the overall well-being of individuals with diabetes.

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## Financial Disclosures:

**Honoraria/Speaking Fees:** CPD Network Association, Viatrix, Abbott, Dexcom, Eli Lilly, Novo Nordisk  
**Consulting Fees:** Dexcom, Eli Lilly, Novo Nordisk

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