ABSTRACT

Diabetic peripheral neuropathy is an important quality-of-life issue for half of the 18.2 million people living with diabetes who are affected. With the condition comes extreme pain and possible progression in severity that ultimately leads to foot ulcers, infections, and amputation. Early recognition and management of independent risk factors can prevent or delay adverse outcomes. As diabetes educators, clinicians need to help patients to understand the importance of lifestyle modification (ie, attention to diet, exercise, and weight loss) with the aim of reaching their target goal of a hemoglobin A1C <7%. Diabetes self-management education is the cornerstone of care for people with diabetes and, as such, should play a key role in the therapeutic regimen prescribed by all clinicians involved in the care of patients with diabetes. Optimal diabetes management requires an organized, systematic approach with involvement of a coordinated, collaborative, collegial multidisciplinary team of healthcare professionals. In many settings, the podiatrist may be at the center of this team together with the endocrinologist—both of whom may use a variety of strategies and tools to help patients manage their care. These include: use of diabetic neuropathy checklists and diabetes self-management education tools, adoption of clinical practice guidelines, and implementation of practice changes. In addition, the American Diabetes Association emphasizes that early recognition and management of independent risk factors will help to treat early and/or prevent some of the complications that lead to amputation. These include, but are not necessarily limited to, treatment of hyperlipidemia and the use of angiotensin-converting enzyme inhibitors for blood pressure management.


In December 2004, the American Diabetes Association (ADA) conducted a nationwide telephone survey of more than 8000 individuals (n = 8119) with diabetes to determine the extent of their knowledge regarding diabetic peripheral neuropathy (DPN).† Surprisingly, more than half of the survey respondents (56%) were unaware of this condition. Furthermore, 62% of the respondents with symptoms of diabetic neuropathy believed that their symptoms were associated with diabetes, yet only 42% had been told by their doctor that in fact the cause specifically was their diabetes. One in 7 individuals (15%) who had discussed symptoms of DPN (eg, pain) with their doctors reported that they were not told the cause of their symptoms, and only 1 in 4 (25%) were given a diagnosis of DPN.† The findings of this national survey point to the need for educational initiatives for patients and healthcare professionals to better recognize the signs and symptoms of DPN, as well as available diagnostic tests and pharmacologic treatments. A collaborative, multidisciplinary approach to care should be employed and supported by evidence-based clinical practice guidelines.
DPN is an important quality-of-life issue for half of the 18.2 million people living with diabetes who are affected. These individuals may have extreme pain to the point of being disturbed by the mere touch of bed sheets on their skin. Ultimately, the condition may progress in severity contributing to the development of foot ulcers, infections, and amputations. These complications are the major causes of lower-extremity morbidity and disability for people with diabetes. Thus, early recognition and management of independent risk factors can prevent or delay adverse outcomes.

It is vital to be proactive before the development of the first foot ulcer. This requires early identification of independent risk factors, stratification of risk, early treatment that is targeted at the individual needs of the patient, and optimal diabetes management. As diabetes educators, clinicians need to help patients to understand the importance of lifestyle modification: attention to diet, exercise, and weight loss, with the aim of reaching their target goal of a hemoglobin A1c <7%.

IDENTIFYING AND MANAGING RISK FACTORS

Through the years, the foot complications of diabetes that lead to amputation have not changed much from those described by Dr Elliott Joslin in 1934 in a landmark paper published in the New England Journal of Medicine entitled, “The Menace of Diabetic Gangrene.” Then, as now, DPN was a precipitating factor enabling traumatic injuries to the foot caused by burns or poorly fitted shoes. Joslin noted that burns were a frequent cause of injury to the diabetic foot. Burns may be of a thermal nature (from exposure to hot water or radiant heaters) or of a chemical nature (caused by over-the-counter corn and callus cures). Joslin identified footwear as playing an important role in the causation of foot ulcers in the presence of diabetic peripheral sensory neuropathy. Properly selected and professionally fitted footwear is important for all people with diabetes. However, sometimes even when patients are provided with proper footwear, things may go awry. For example, a patient with loss of sensation in his feet coupled with diabetic retinopathy and impaired visual acuity may unwittingly wear his shoes on the wrong feet, causing pressure and irritation that may lead to ulceration. Finally, Joslin implicated dermatophytosis as a common and potentially serious condition for patients with diabetic neuropathy. Treatment of tinea pedis and onychomycosis is an important consideration for the following reasons: interdigital fissures can become secondarily infected, leading to cellulitis and a limb-threatening infection; thickened, dystrophic, mycotic toenails can puncture the skin on adjacent toes, leading to ulceration, infection, and amputation. Patient education with respect to the implications of sensory loss and the recognition of risk factors for foot ulcers and amputation is essential for improving the outcomes of all patients with DPN.

PATIENT EDUCATION: THE CORNERSTONE OF CARE

Diabetes self-management education is the cornerstone of care for people with diabetes. Once sensory loss has been identified, patients with DPN must be counseled as to the implications of loss of sensation and advised on ways they can substitute other sensory modalities. In the absence of sensation, patients can perform visual inspections of their feet with the use of a mirror to look for breaks in the skin, changes in skin color, or changes in the size or shape of the foot. They also may use their sense of touch to identify changes in skin temperature as well as the presence of drainage on their skin. The sense of smell should be employed to identify malodor associated with infection or necrosis of the skin.

THE TEAM APPROACH

Optimal diabetes management requires an organized, systematic approach with involvement of a coordinated, collaborative, collegial multidisciplinary team of healthcare professionals. In many settings, the podiatrist may be at the center of this team together with the endocrinologist—both of whom may use a variety of strategies and tools to help patients manage their care. These include use of diabetic neuropathy checklists and diabetes self-management education tools, adoption of clinical practice guidelines, and implementation of practice changes. For example, in terms of initial and ongoing evaluation of the patient, checklists that mirror guidelines from organizations such as the ADA are available, and are useful for clinicians and patients alike. The ADA has a checklist available for the patient to respond to questions about symptoms of peripheral neuropathy (www.diabetes.org) (Figure). This checklist is free, and can be utilized as part of an initial evaluation. Other strategies and assessment tools...
include performance measures that require visual inspection of the feet, evaluation of pedal pulses, and monofilament testing at least once annually. Using these diagnostic parameters, patient outcomes can be measured in terms of neuropathic status.

Beyond assessment, patients with diabetes who are at risk for developing microvascular complications also can be helped via the implementation of educational programs. It has been demonstrated that diabetes self-management education increases adherence to standards of care. For clinicians, patient outcomes can be improved when guidelines for standards of care are available at the point of service, whether that is a private practitioner’s office or a clinic. The ADA regularly updates its clinical practice recommendations. They may be accessed at: http://care.diabetesjournals.org/content/vol28/suppl_1. This site contains the current ADA position statements, technical reviews, and consensus statements related to clinical practice, as well as the evidence grading system used to evaluate the data upon which their recommendations are based.3

Finally, in terms of practice changes, clustering office visits to enable patients to see their podiatrist, endocrinologist, ophthalmologist, and diabetes nurse practitioner during 1 intensive session also is extremely effective—especially if, for example, the clinician’s practice is in a hospital setting. The National Diabetes Education Program (NDEP) is a helpful online resource that can help individual practitioners organize diabetes care and, on a broader scale, assist in the design and implementation of more effective health-care delivery systems (www.betterdiabetescare.nih.gov).

**American Diabetes Association Standards of Medical Care**

As emphasized earlier, working as a team to minimize the risks and/or consequences of DPN requires knowledge and implementation of the most current practice guidelines. At the present time, the ADA recommends optimal glycemic control with an A1c goal of <7%. Lowering A1c is associated with reduction of both the microvascular and neuropathic complications of diabetes. This was demonstrated in the Diabetes Control and Complications Trial (DCCT), as well as in the United Kingdom Prospective Diabetes Study (UKPDS), for patients with type 1 and type 2 diabetes, respectively. In addition, the ADA emphasizes that early recognition and management of independent risk factors will help to prevent or delay some of the serious complications that lead to lower-extremity amputations. Amputation and foot ulceration are the most common consequences of diabetic neuropathy and major causes of morbidity and disability in people with diabetes. Early recognition and management of independent risk factors can prevent or delay adverse outcomes.

The risk of ulcers or amputations is increased in individuals who have had diabetes for more than 10 years, are male, have poor glucose control, or have cardiovascular, retinal, or renal complications. The following foot-related risk conditions are associated with an increased risk of amputation:4

- Peripheral neuropathy with loss of protective sensation
- Altered biomechanics (in the presence of neuropathy)
- Evidence of increased pressure (erythema, hemorrhage under a callus)
- Bony deformity

**Figure. American Diabetes Association’s Symptom Checklist for Diabetic Peripheral Neuropathy**

- My feet tingle.
- I feel “pins and needles” in my feet.
- I have burning, stabbing, or shooting pains in my feet.
- My feet are very sensitive to touch. For example, sometimes it hurts to have the bed covers touch my feet.
- My feet hurt at night.
- My feet and hands get very cold or very hot.
- My feet are numb and feel dead.
- I don’t feel pain in my feet, even when I have blisters or injuries.
- I can’t feel my feet when I’m walking.
- The muscles in my feet and legs are weak.
- I’m unsteady when I stand or walk.
- I have trouble feeling heat or cold in my feet or hands.
- I have open sores (also called ulcers) on my feet and legs. These sores heal very slowly.
- It seems like the muscles and bones in my feet have changed shape.
- Other symptoms I have: _______________________

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**The muscles in my feet and legs are weak.**

**I’m unsteady when I stand or walk.**

**I have trouble feeling heat or cold in my feet or hands.**

**I have open sores (also called ulcers) on my feet and legs. These sores heal very slowly.**

**It seems like the muscles and bones in my feet have changed shape.**

**Other symptoms I have: _______________________

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• Peripheral vascular disease (decreased or absent pedal pulses)
• A history of ulcers or amputation
• Severe nail pathology

An annual comprehensive foot examination is recommended to identify high-risk foot conditions. The foot examination should include assessment of protective sensation, vascular status, foot structure, biomechanics, and skin integrity, along with a visual inspection of the foot. Patients with high-risk characteristics should have their feet examined at each visit to their primary care provider. Finally, the ADA recommends referral of high-risk patients to a foot care specialist for ongoing care and lifelong surveillance.

CASE PRESENTATION AND CONCLUSION

To conclude, let us turn our attention to a typical case presentation:

The patient is a 53-year-old man, a janitorial worker with type 2 diabetes diagnosed 6 years earlier but perhaps present for much longer. He presents with a sudden and unexpected swelling of his left foot with no history of trauma. He denies having fever or chills. Physical examination reveals moderate to severe erythema, swelling, and elevated skin temperature. His pedal pulses are bounding and he has absent deep tendon reflexes at the ankle. Furthermore, there is noted a loss of protective sensation, and dense peripheral neuropathy as evidenced by a vibratory perception threshold that is off scale (>45). With a body mass index of 35, the patient also is moderately obese. The patient is afebrile. Laboratory evaluation reveals a hemoglobin A1c of 8%, a normal white blood cell count with no shift in the differential, normal serum uric acid, and normal erythrocyte sedimentation rate.

Analysis of this case should lead the clinician to suspect an acute neuropathic osteoarthropathy (Charcot’s joint disease). The Charcot foot is a rare condition characterized by fractures and dislocations leading to collapse of the foot, deformity, and the development of foot ulcers. The etiology of this condition is believed to be multifactorial, however, diabetic neuropathy plays a critical role in its pathogenesis. Radiographs of this patient reveal multiple fractures of the metatarsal heads, with a fracture-dislocation at the base of the second metatarsal and dislocation of the first metatarsal-cuneiform joint. Prior to the development of neuropathic osteoarthropathy, patients may report having lancinating pains in their limbs like a “shower of electric needles.” The temporal relationship between DPN with symptoms of lancinating pain and the subsequent development of acute fractures and dislocations of the foot should serve as a red flag for the clinician in the identification of patients at high risk for the development of Charcot’s joint disease. It is very important for the clinician to have a high index of suspicion for this rare condition.

REFERENCES