

Healthy feet are happy feet

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Diabetes is a costly health problem in the United States that places a substantial burden on the individual, society, and the economy. With 1.4 million adults diagnosed every year, it's one of the most common chronic diseases you'll encounter in the healthcare setting.

In this article, we'll discuss foot-related complications of diabetes, including one of the most frustrating complications of diabetes—diabetic peripheral neuropathy (DPN)—focusing on how it damages the patient's feet. But first, let's quickly review diabetes and its many complications.

Diabetes at a glance

National statistics indicate that 25.8 million people have diabetes in the United States. Approximately 18.8 million individuals have been diagnosed, but a staggering 7 million people with diabetes have yet to be diagnosed. Some 215,000 people under age 20, or 0.26% of that age group, have the disease. Among people age 20 and older, about 1.9 million were diagnosed with diabetes in 2010, accounting for 11.3% of the diabetic population. After age 65, it's also noteworthy that 26.9% have diabetes.

Type 1 diabetes is an autoimmune or idiopathic process typically diagnosed in people younger than age 30,

although it can develop in patients of any age—even those in their 60s and 70s. It's most often identified in those with a lean body type, although it can also strike people who are overweight. In type 1 diabetes, the body stops making insulin or makes only a scant amount.

In *type 2 diabetes*, the body either doesn't make enough insulin or has trouble using it. Without enough insulin, cells can't use the glucose in the blood to make energy. Instead of moving into cells, glucose remains in the blood. Over time, these high blood glucose levels begin to cause microvascular and/or macrovascular damage. Type 2 diabetes complications include cardiovascular disease, stroke, kidney failure, periodontal disease, retinopathy, and neuropathy.

Diagnosing diabetes

For decades, a diabetes diagnosis has been based on serial plasma glucose criteria obtained by testing either the fasting plasma glucose or the 2-hour value from a 75-g oral glucose tolerance test. A positive result for the fasting plasma glucose level was considered to be at least 126 mg/dL following no caloric intake for at least 8 hours. The American Diabetes Association (ADA) has adopted criteria to identify diabetes with an

HbA1c threshold, which measures the nonreversible glycosylation of hemoglobin molecules over a 2- to 3-month period, at or above 6.5%.

The 411 on DPN

Between 60% and 70% of people with diabetes have some form of nerve damage and pain, called neuropathy, according to the ADA. When nerve damage shows up in a diabetic patient's feet or hands, it's called DPN.

One of the most frustrating complications of diabetes, neuropathy is a form of nerve damage that often goes hand-in-hand with chronically elevated blood glucose levels. Some symptoms are subtle; others aren't. Patients may report burning pain, especially at night; tingling; or a pins-and-needles feeling in the feet. Numbness and weakness can also be symptoms of DPN. Any or all of these can eventually lead to an inability to distinguish between hot and cold, and difficulty feeling pain or distinguishing the texture of objects.

Static on the line

One of a complex group of disorders, DPN involves damage to the peripheral nervous system—the vast communication network that transmits information from the brain and



spinal cord to every other part of the body. Peripheral nerves also send sensory information, such as a message that the feet are cold, back to the spinal cord and brain. Like static on a telephone line, DPN interferes, distorts, and sometimes interrupts messages between the brain and the rest of the body.

Loss of sensation in the lower extremities caused by DPN, along with vascular insufficiency, increases the risk of traumatic injury, soft tissue breakdown, and infection. As a result of paresthesia, injuries to a foot can go unnoticed, undiagnosed, and untreated.

Subtle changes in foot sensation often signal more serious complications in the patient's future. The loss of protective sensation associated with DPN may delay discovery of injuries to the feet, allowing damage to worsen. When pressure or injury goes unnoticed, blisters or sores may develop on numb areas. Patients who can't feel their feet may keep walking on them, even if significant deformity or infection is present.

DPN may also cause muscle weakness and loss of reflexes, especially at the ankle, leading to a change in how the patient walks. Foot deformities, such as hammer-toes (middle-joint deformity of the second, third, or fourth toes) and midfoot collapse (severe lowering of the foot arch), may occur. Shoes that don't fit well can cause friction and pressure; the resulting injury can then become an entry point for microorganisms, increasing the risk of infection.

Foot lesions are commonly related to high blood glucose levels and the activation of protein kinase C, an enzyme that regulates protein function, leading to impaired tissue healing.

Microvasculature damage and the alteration of nerve perfusion cause deformities of the feet. The end waste products of glycogen metabolism accumulate and damage nerves. This process proceeds gradually, first attacking the protective cell sheaths, then cell contents.

Tune into your patient's history

Diagnosing DPN is often difficult because the symptoms are variable and clinical manifestations are diverse. A thorough neurologic exam is usually best. This involves taking an extensive patient history, which should include signs and symptoms, social habits (including any history of alcohol use and smoking), and a family history of neurologic disease or diabetes.

Patients should be screened for DPN at diagnosis, as well as during regular exams. This is believed to be essential because a patient with diabetes can have peripheral neuropathy without pain, especially in the early stages of neuropathy. Because of this, foot exams are crucial using simple clinical tests, such as pinprick and pressure sensation and vibration perception. Make sure both a 128-Hz tuning fork and a 10-g monofilament are available. Also evaluate ankle reflexes, and test temperature sensation to determine the patient's ability to feel temperature changes.

Pain: Stop it in its tracks

Many patients with diabetes report neuropathic symptoms in the form of chronic pain. This generally tends to occur in a period of time that's longer than 6 months in duration. Forty-six percent of patients with DPN ranked their nerve pain as bothersome 85% of the time. In some cases, a patient's pain is clearly related to complica-

tions of diabetes; in others, it isn't. Regardless of the cause, however, chronic pain and stress can make diabetes self-management more difficult and lead to even higher blood glucose levels. Pain must be addressed and managed so the patient can enjoy a satisfactory quality of life.

Pain is a highly personal and subjective experience. Providing the patient with a pain-rating scale may be useful. This covers questions such as the kind of pain felt, past experiences, pain location and timing, and any actions or measures that exacerbate or relieve the pain. Such a tool lets the patient and healthcare provider explore the causes and look for solutions together.

To date, medical management of DPN is mainly addressed by medications and nonpharmacologic treatment modalities for pain relief. Several classes of drugs are available for the healthcare provider to choose from. Some options include tricyclic antidepressants, such as amitriptyline and paroxetine; antiepileptics, such as gabapentin and pregabalin; and serotonin-norepinephrine reuptake inhibitors, such as duloxetine. Some commonly reported adverse reactions to these drugs are nausea, dizziness, sleepiness, and dry mouth. Capsaicin cream, a substance P inhibitor cream, may also be applied topically to painful areas.

Although opioids are frequently used in the treatment of neuropathic pain, their long-term efficacy remains uncertain. Many healthcare providers don't consider opioids to be first-line therapy for patients with neuropathy. Physical dependence and withdrawal symptoms, along with the common adverse reactions of constipation, drowsiness, nausea, headache, and dizziness, may limit the use of opioids.

Besides medications, nonpharmacologic treatment modalities such as acupuncture, physical therapy, occupational therapy, and biofeedback can help some patients.

Step away from foot ulcers

Foot ulcers, which may become chronic in patients with diabetes, are a serious complication of diabetes. Besides diminishing the patient's quality of life and causing an economic burden to all involved in the patient's care, foot ulcers may lead to amputation and disability.

All chronic wounds begin as acute wounds, and wound care is best handled by an interdisciplinary team. Information to gather during wound assessment includes the wound's cause, the amount and characteristics of any drainage, wound base appearance, and the condition of periwound skin. Also evaluate pain relating to the wound and dressing changes.

The treatment plan for a wound must also address pain relief. When does pain occur and how intense is it? How can we intervene to minimize it?

Some wounds are dressed after cleaning, whereas others remain open. Considerations for choosing a dressing are cost, frequency of dressing changes, and impediments to adherence to protocol.

Patients with diabetes are more likely to experience a nonhealing wound. Any patient with diabetes who develops a foot ulcer should be referred to a podiatrist. If the wound doesn't improve within 2 to 4 weeks, the patient should be referred to a wound-care clinic, if available.

Now let's consider some other diabetes-related complications affecting the feet.

Charcot joint: Potentially devastating

A neuropathic arthropathy, Charcot joint is a progressive nerve and bone deterioration that may result in foot deformity, ulceration, and loss of function. Charcot joint usually develops in people who've had diabetes for a long time, and it isn't always easy to detect. In an acute state, however, the patient may present with elevated temperature of the foot, erythema, and edema. The involved joint may be dislocated, insensate, and somewhat unstable. Be suspicious if the patient presents with a foot that's swollen despite adequate circulation.

Off-loading, or redistribution of foot pressure, is the primary focus of treatment for patients in the acute stage. Although patients with Charcot joint generally have severe neuropathy, they may still experience pain or tenderness. However, because of relative insensitivity, many patients who continue to walk create stress fractures and further disrupt the joint architecture. In these patients, the foot needs to be stabilized or strictly immobilized by splints or braces to prevent damage and decrease weightbearing. If this isn't done, the patient may develop a complication leading to a rocker bottom—a prominent heel bone with an outward rounded bottom of the foot—which makes the plantar surface prone to ulceration.

To prevent Charcot arthropathy, which often leads to Charcot joint, educate patients so they have the right tools to prevent problems. Teach them to seek consultation when appropriate, examine their feet daily, wear shoes that fit well, and always be on the outlook for potential problems. Patients with diabetes need to be aware that delay-

ing care can cause serious damage that may lead to amputation because healing is at best slower in a patient with diabetes.

Loss through amputation

Diabetes causes the vast majority of nontraumatic lower extremity amputations worldwide. Many patients who have one amputation will require another involving the opposite foot or a higher level of the same extremity. Once an opening or disruption in the skin occurs, the patient is at a greater risk for serious foot ulcers. Minor burns from simple acts, such as bath water that's too hot or using a heating pad on an insensate area, can have devastating consequences. Unsupervised toenail care leading to cuts or open areas in and around the toenail bed, wearing shoes that don't fit properly, and simple accidents leading to bruises, abrasions, scrapes, or blisters can become monumental and lead to amputation because the body's ability to recover from a simple injury is compromised.

Infections of the feet can spread up into the leg. Sometimes, the infection is so severe that part of the leg must be amputated, as well as the foot, to save the patient's life.

Gangrene is a nonspecific term for tissue death. When infections, arteriosclerosis, or other disorders that decrease blood flow completely block delivery of oxygen and nutrients to the tissue, tissue death or necrosis results and surgical intervention is usually required.

To avoid amputation, some patients undergo preventive surgery. The primary objective is to limit development of ulceration and infection. Surgeons aim to preserve as much foot function as possible. But an amputation may be required



when efforts to save the foot or leg are unsuccessful or the infection is causing extensive damage or life-threatening sepsis.

In all cases, surgeons save as much of a patient's foot or leg as possible. They also try to ensure that the remainder of the limb will heal so further surgery isn't necessary. An amputation may relieve the severe pain associated with an infection, and, by getting rid of the infection, reduces the need for strong antibiotics.

Patients function better with lower levels of amputation. Modern prosthetic devices are lightweight, making walking as easy as possible after an amputation. High-level amputations often yield a 40% to 70% 5-year mortality. This can be attributed to the sedentary and restricted lifestyles that often follow.

Having a foot or leg amputated is traumatic and means a major body image change for any patient. Allow the patient time to grieve and deal with losing a part of the body.

Champions for preventive care

The best wound care is to prevent wounds in the first place. So, one more reason to keep blood glucose levels in check is to keep the feet healthy. High blood glucose affects the heart and circulation to the feet—the body part that the blood has to travel the farthest to. Because these problems can become very serious, culminating in amputation, it's vital that patients be included in the treatment plan.

Initially, assess the patient's feelings about having diabetes. This will help you determine how willing the patient will be to learn

self-care skills and follow the treatment plan.

A collaborative team approach to diabetes management is most effective. Patients with diabetes should receive care from a team whose members have specific knowledge of and experience with diabetes. This team of specialists is responsible for empowering patients to focus on assuming control of their own healthcare. After they understand that diabetes is a chronic disease, most patients appreciate the need for commitment to their role in managing this disease and preventing complications.

Teaching tips

Research has shown that the use of simple language is the single most important determinant of patient satisfaction with education. With that in mind, start with the simplest information, and then advance to the more complex. Focus on practical information that the patient can apply to immediate problems.

Following a baseline evaluation by the healthcare provider, share the following tips with patients to help keep their feet healthy and happy:

- Manage blood glucose levels within the prescribed range.
- Check your feet every day. Look for red spots, cuts, swelling, and blisters. If you can't see the bottom of your feet, use a mirror or ask a family member to help you. Telescoping mirrors are available for purchase.
- Feel the feet for any irritation or tender spots.
- If you find a cut or any other injury, consult the healthcare provider immediately. Also report any numb-

ness, tingling, or burning pain in the feet or legs.

- Note any change in the size or shape of the feet.
- Look for shiny skin or thickened toenails.
- Wash your feet every day. Dry them carefully, especially between the toes. Use nonperfumed, alcohol-free lotions to keep the skin smooth and soft, but don't put any lotion between the toes.
- Visit the podiatrist for toenail trimming and removal of any calluses or corns.
- Wear comfortable shoes with low heels and thick soles. Change shoes frequently, and look for pressure points when removing your shoes. Wear socks without seams. Check for objects inside your shoes before putting them on, and throw away worn-out shoes and sneakers.
- Wear shoes or insoles that support weak spots before an ulcer strikes.
- Keep your feet warm.
- If your feet are swollen, wear lace-up shoes and loosen the laces as needed.
- Never walk barefoot, even at home.
- Avoid hot pavements and sandy beaches.
- Never use a heating pad or hot water bottle on your feet.
- To keep the blood flowing to your feet, don't sit with your legs crossed.
- To reduce swelling, elevate your feet when sitting.
- Schedule routine foot checkups.
- Stay active with exercise, as approved by the healthcare team.
- Lose excess weight.
- Don't drink alcohol or smoke.
- Remove socks and shoes on each visit to the healthcare team so your feet can be inspected.
- Consult with the healthcare team for tips regarding proper nutrition.

Healthy feet are happy feet

Diabetes self-management is a life-long commitment, and healthcare professionals must help motivate patients. Keep in mind that patients with diabetes can experience neuropathic changes as early as 7 years into the disease, and this puts them at risk for foot ulcers and early amputation.

Facilitating diabetes self-care means encouraging patients to become involved in their own care. Simplify the information patients need to avoid foot problems and other complications. Seize every opportunity to teach and continually hearten the patient toward

successful self-management and healthy, happy feet. ■

Learn more about it

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