Chapter 2

When Your Feet Go Numb: The Silent Danger of Diabetic Neuropathy

Neuropathy is defined as damage to the Nervous System. One of the causes of neuropathy is Diabetes. There are three types of neuropathy that are affected by diabetes. These are; sensory neuropathy, motor neuropathy and autonomic neuropathy. Approximately 50% of diabetic patients suffer from some form of neuropathy in the feet and legs, and they become the most affected. The possible cause of neuropathy in diabetes is that high amounts of sugar in the blood are found for a long period of time and therefore damage the nervous tissue. When blood sugar levels are high, we will also find them in nervous tissue. Sugar within nervous tissue is converted into substances like sorbitol and fructose. These secondary sugar substances accumulate in the nerve, causing inflammation and eventually irrevocable nerve damage.

Sensory neuropathy of the feet initially causes a burning sensation in patients, a sharp pain similar to a knife, pain like pressure on the foot and also mild pains in them. These symptoms can be worse at night. If sensory neuropathy is still in progress, it will eventually lead to total loss of sensation of the feet, causing numbness in the feet. When the protective sensation of pain in the feet subsides, any trauma to the feet will not be painful, and may go unnoticed for a long time. You may not be able to tell the difference between mild and sharp pain like a knife when they are located in the feet. You can do the pin prick test yourself and compare the sensation between the foot and the thigh. If there is a difference, you should let your doctor know at your next visit. Decreased sensation in the feet can have a significant impact on prognosis in patients with diabetic foot disease. Normally in people without neuropathy, if the feet are uncomfortable, the protective sensation of pain will change the way they walk. However, if you lose the sensation of pain, stepping on a nail or piece of glass can go unnoticed for a long time (Fig 2-1).

Fig 2-1

Fig 2 -2

Fig 2-3

If your shoes cause blisters in your feet, you may not feel the pain. Sensory neuropathy can occur with another type of neuropathy called motor neuropathy. The nervous system that controls muscles and tendons are called motor nerves. The reason you are able to move your toes up and down is because the muscles and tendons that are connected to the toes contract and extend on orders from the brain. If these motor nerves are cut by traumatic injuries, you will not be able to move your toes. If these nerves are damaged due to chronic high blood sugar levels, you will feel weak, your muscles will become thin, and the shape of your feet will change (Fig 2-2). There are a total of forty-four muscles and tendons within one foot. When motor neuropathy affects the foot, the muscles and tendons become weak, causing an imbalance of all the joints in the foot. Consequently, you would develop hammertoes, bunions, callus, and flat feet (Fig 2-3).

Hammer toes are accompanied by calluses especially on the top of the knuckle of the toes because of irritation of the shoe (Fig 2-4)

Fig 2-4

Fig 2-5

Fatty tissue at the bottom of the foot becomes thinner causing calluses at the sole of the foot. The bunion becomes irritated due to shoe pressure. Motor neuropathy usually occurs with sensory neuropathy, so calluses become less painful. The progress of these neuropathies leads to insensitivity and therefore to deformity of the foot. The irritation of the shoe on the callus and the continuous force that you exert when walking

on the ground, could go unnoticed until a callus forms (Fig 1-1) and later an ulcer forms (fig 1-2) Diabetic foot ulcers are particularly difficult to treat because the surrounding tissues often becomes dead or necrotic (fig 2-5) and the bones become infected.

Therefore, a daily visual inspection of your feet for blisters, or the presence of fluid under the calluses and any discoloration, especially redness around the calluses, has to be your daily task. Inspecting your shoes for foreign objects before wearing them and inspecting your feet after wearing your shoes is important. When the shape of your foot changes, it is important to measure your feet every time you buy a new pair of shoes. If you have an uneven foot (example: one foot is slightly larger than the other), buy the uneven pair of shoes even if they cost more.

The third form of diabetic neuropathy is called autonomic neuropathy, which commonly occurs with the other two forms of neuropathy. The autonomic nervous system controls the muscles of the heart, the arterial muscles, and the glands. In your feet, the sweat glands and arteries are under the control of the autonomic nervous system. The sweat glands in the feet allow them to perspire normally, however when these glands do not work properly due to autonomic neuropathy, you will suffer from dry skin. Severe dry skin causes cracks and fissures. Cracks and fissures, especially around the heel, (Fig 2-6) can be painful, but sensory neuropathy will not allow you to feel it. Cracks and fissures can be a source of bacterial infection like any skin cut and become a portal entry for many skin bacteria.

Fig 2-6

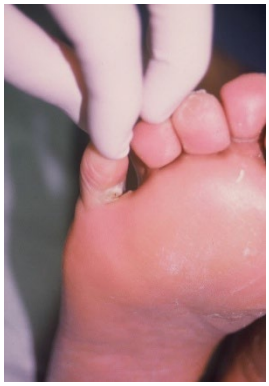

Fig 2-7

Dry skin is also vulnerable to a fungal infection. The body's defense mechanism against infection can be damaged when you have diabetes for a long time. Fungal infection between the toes is particularly dangerous if the infected area is secondarily infected with bacteria (Fig2-7).

Because the area between the toes is not exposed to air, the type of bacteria that does not require oxygen can grow and spread rapidly toward the foot and leg (Fig2-8).

Fig 2-8. Infection started from the area of Fig 2-7 advancing across the bottom of the foot toward the leg

Inspect between the toes daily and keep the area dry. Never apply moisturizer or ointment between your toes as they keep the area too moist and the skin in this area can easily break. As we mentioned earlier, the autonomic nervous system controls the functions of the arteries in the foot, thereby regulating the amount of blood flow to the foot. In autonomic neuropathy, and also when there is a lot of blood flow to the foot, this can become a problem. There is a disease called diabetic neuropathic arthritis or Charcot's diabetic foot (Chapter 7).

Charcot's foot disease is defined as chronic, progressive, and painless destruction of the bones and joints of the foot and ankle. This condition was first described by Dr. Charcot in the last century, who noted changes in the joints of the foot in patients infected with syphilis. In diabetic patients with extensive nervous system damage, the weight bearing bones and joints of the foot can gradually undergo painless destruction creating a totally disfigured foot. When there is too much blood flow to the foot, the minerals that hold the bone hard can be washed away making the bone soft and thus initiating destruction. This destructive process can be initiated by minor foot trauma. The foot may be hot and swollen, but there are no signs of discomfort or pain due to sensory neuropathy. When you continue stepping on the affected foot, the bones and joints begin to break. X-rays of the foot show multiple fractures. In other words, the foot experiences multiple fractures, when you are completely unaware of the pain. When the foot is hot, swollen and red, you should immediately take weight off from the affected foot using crutches and seek podiatric attention as you may have an infection or attack of a Charcot foot process. Charcot foot is discussed later in Chapter 7.

The tingling sensation, burning, sharp pain, throbbing discomfort associated with the initial state of neuropathy, can be meticulously treated by keeping blood sugar levels within normal limits (see Chapter 1). Sometimes, aspirin, ibuprofen, or any other non-steroidal oral anti-inflammatory medication can help reduce inflammation of the nerve tissues, and reduce discomfort.

Vigorous blood sugar control can reverse the initial damage done to the nerves. Once you experience the signs of diabetic foot neuropathy, you need special attention to your feet. The shoes and socks you wear can be the source of future problems (Chapter 10). Socks are preferred to be 100% cotton and not reinforced. Shoes should be well cushioned with enough room to accommodate any bone deformities you may have, such as hammertoes, bunions, and calluses. Shoe inserts are also essential to prevent blisters and calluses (Chapter 10). If you already have calluses on your feet, they should be examined periodically by a podiatrist, not by yourself. Removing calluses will periodically prevent the build-up of thick dead skin that causes undue pressure on underlying bones. "Cutting your calluses yourself" and doing it in the bathtub is particularly dangerous. If you accidentally cut yourself with a rusty razor blade, this can cause a devastating foot infection. The podiatrist is the only medical specialist who has been specifically trained to diagnose and treat any foot and ankle problem, specially diabetic foot disease that requires special knowledge and skills.

TEST YOURSELF

(T F) True or false

1. T F Neuropathy means damaged nerve systems caused by chronically elevated blood sugar level.

2. T F Blood sugar, when elevated, will attack the nerves in your body causing nerve damage.

3. T F If you feel burning, sharp knife-like pain, shooting sensation in feet, you may have sensory neuropathy

4. T F Neuropathy always leads to a numb foot.

5. T F If you lose the sensation of pain, you will not have pain when you step on a piece of glass.

6. T F If you have motor neuropathy, you would eventually become paralyzed and walking becomes impossible.

7. T F If you have neuropathy, corns and calluses can easily ulcerate,so that the bones underneath can become infected.

8. T F Autonomic neuropathy causes dry skin.

9. T F Severe dryness causes skin cracks around the heel. You should apply antiseptic medicine like alcohol or peroxide daily to prevent infection.

10. T F Always apply antiseptic ointment between the toes because the bacterial count is high in the areas between the toes.

11. T F Although your foot is swollen and hot, as long as there is no pain, it is not a problem.

12. T F once your feet are affected by neuropathy there is no way to reverse this condition.

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1. (T) 2. (T) 3. (T) 4. (F) 5. (T) 6. (F) 7. (T) 8. (T) 9. (F) 10. (F) 11. (F) 12. (F)

Chapter 14

When Chemotherapy Worsens Diabetic Neuropathy: Protecting Your Feet During Cancer Treatment

Some cancer drug can cause dryness, thickness, cracking, or blistering of the skin on the palms of the hands and the soles of the feet. The toenails become discolored, thickened and brittle. The toenails become ingrown and painful. They easily become infected and sometimes cancer treatment has to be stopped because of active infection. Just like people with diabetes, infections of the foot could lead to foot ulcers and the need for an amputation.

A class of chemotherapy drug which suppresses certain cell-to-cell signals to stop the growth of tumors. For example, Multikinase inhibitors can cause many skin changes. Common side effects of chemotherapy include rash, skin discoloration, dry skin, and hand-foot syndrome. Hand-foot syndrome, also known as palmar-plantar erythron dysesthesia or PPE, is caused by exposure to chemotherapy drugs and could cause the blistering as well as a red and peeling rash that looks like sunburn. PPE affects the parts of the body where blood tends to pool, such as the hands and feet. The drug may be more likely to leak out of the small blood vessels during chemotherapy.

Within a week or two after starting chemotherapy, you may feel stinging or tin- gling in your hands and feet. Over a few days, you may develop redness of the palms and soles. Sometimes the reaction stops there, and it can be painful and interfere with daily activities, sometimes it progresses to blisters or accumulation of fluid under the nail plates which can be very painful. Eventually toenails become discolored, thickened and brittle which resemble fungal infection of he toenails. If blisters or painful toenails form, the main treatment is proper wound care. You of course should contact your physician. What you have to do is inspecting the affected areas daily, washing them with a mild soap and water, wearing protective socks and shoes, keeping open sores

covered with proper dressings. Of course, the first thing you should do is discuss any symptoms you're having with your doctor, who may refer you to a podiatrists or wound care specialist for treatment. I personally use prednisone or topical steroid which can help with the condition. Dry skin is another common side effect of chemotherapy. This ranges from mild to severe, and though it may not cause skin ulceration. You should ask your physician how you can prevent this and other complications that could endanger your feet. Proper foot care is the key. You should wash your feet with a gentle cleanser. Bar soaps generally have fewer irritants, such as preservatives and fragrances, added to them than liquid soaps. Do not use harsh chemicals on your skin, such as alcohol, iodine, peroxide if your skin is intact. Gentle cleansers will kill bacteria living on the skin, so you do not need to use an antibacterial soap if your skin is still intact. Avoid harsh soaps. After cleansing, dry your skin thoroughly. Use a towel or a cool hair dryer, and don't forget to dry the skin between the toes; this is the most common place for fungal or bacterial growth. Next, apply a moisturizer. Plain petroleum jelly (such as Vaseline) is a great option and it is inexpensive and gentle for your skin. For thick skin on your feet, use a keratolytic moisturizer, which helps exfoliate the skin using lactic acid or urea. Amlactin, Keralac, Eucerin work this way. Prevention is always best when it comes to keeping your feet intact during chemotherapy. If your skin of the foot starts to break down, consult your doctor and get care immediately to avoid complications.