

Restore Sensation and Strength to Your Feet - Optimism for Diabetic Neuropathy

INTRODUCTION

If you are a diabetic, then almost certainly one of your doctors has told you about the complications of diabetes. Among the most common complications of diabetes is **neuropathy**. Unfortunately, even with your blood sugar in good control, **neuropathy** may occur. In fact, over time, this will occur in up to 50% of diabetics. Once diabetic neuropathy occurs, it almost always gets worse. Currently, there is no agreement on why it occurs, and there is no medical treatment to prevent it.

While there are several different types of neuropathy that may occur in diabetics, the most common one affects the feet first, and then the hands. Usually, you will begin to notice sensory changes, such as numbness or tingling in your fingers or toes. At first, these symptoms will come and go, but then they will be constant. These unpleasant symptoms may interfere with your going to sleep, or cause you to awaken from sleep. Over a long period of time, these sensory disturbances may cause such a loss of sensibility that you will not feel how tight your shoes are, or know whether the bath water is hot or cold. Changes in muscle strength also occur. In the feet, the weakness may cause you to fall and the arches in your feet to collapse.

Neuropathy is the leading cause of **ulcerations** or holes that occur in the feet. Neuropathy is the leading cause of **infections** in the feet. Neuropathy is the leading cause of the loss of toes and, with advanced cases, **amputation**.

The purpose of this brochure is to provide you with information that is a new source of optimism for patients with diabetes. By having a yearly measurement made of the sensibility in your feet, the earliest stages of neuropathy can be identified and appropriate changes in your diabetes management can be made. In certain circumstances, it may be found that areas are present in your legs that cause compression of your nerves. These sites of pressure on your nerves can be treated with surgery in order to restore sensation to your feet.



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WHY SHOULD NERVES IN THE DIABETIC BE COMPRESSED?

Nerves begin in the spinal cord and extend into the fingers and toes. Along this path, there are anatomic areas of narrowing. These exist in everyone and many are already known to you, such as your “funny bone” at the elbow and the carpal tunnel at the wrist. In the leg, there are similar tight places at the outside of your knee and the inside of your ankle, called the tarsal tunnel. Although some people may have been born with structures that would make the tunnels more narrow and the nerves more likely to become pinched, like a smaller wrist or extra muscles that go through one of these tunnels, the diabetic has two unique reasons to make nerves susceptible to compression.

The first reason that a diabetic’s nerves are susceptible to compression is that the nerves in a diabetic are swollen. Sugar from the blood enters into the nerve to give the nerve energy. This sugar, glucose, is converted into another sugar, called sorbitol. Sorbitol’s chemical formula makes it attract water molecules, and so water is drawn into the nerve, causing the nerves in a diabetic to be swollen. This information has been known since 1978. It is Dr. A. Lee Dellon’s hypothesis that if a nerve swells in a place that is already tight, like those anatomic areas described above, then the nerve becomes pinched, or compressed, causing symptoms. Dr. Dellon is the world’s foremost authority in peripheral nerves, and currently a Professor of Neurosurgery & Plastics at John Hopkins School of Medicine.

The second reason is related to the transport systems within the diabetic nerve. The nerve is filled with a substance that lets important chemical messengers move along the nerve, carrying messages that let the nerve’s central part know what is happening at its other end. If the nerve becomes damaged, by compression, for example, and its cell membranes need to be rebuilt, these building proteins are transported downstream inside the cell along tracks called tubulin. This mechanism, called the slow anterograde component of axoplasmic transport, does not work normally in diabetics. This information has been known since 1979. It is Dr. Dellon’s hypothesis that the decrease in axoplasmic transport means that the nerve cannot repair itself

well, rendering it more likely to remain in trouble from compression, and therefore produce symptoms.

WHAT ARE THE SYMPTOMS OF NERVE COMPRESSION?

If someone were squeezing your neck, choking you, you would be yelling and screaming, struggling to get air into your lungs. If your nerve gets choked, or pinched, it also does not get enough oxygen. The nerve makes you aware of this lack of oxygen by sending you a warning message. You will feel buzzing, tingling or numbness in the areas that are supplied by that nerve.

Therefore, if the median nerve in your wrist becomes compressed in the carpal tunnel, and with the knowledge that the median nerve supplies sensation to your thumb, index, middle and ring fingers, you can predict that compression of the median nerve at the wrist, called **carpal tunnel syndrome**, will cause symptoms in these fingers.

In the foot, the problem similar to carpal tunnel syndrome is called **tarsal tunnel syndrome**. It involves compression of the posterior tibial nerve in the bony tunnel on the inside of the ankle. This nerve supplies the entire bottom of the foot, including the heel. Compression of the posterior tibial nerve can result in numbness or tingling of the heel, the arch, the ball of the foot, and the bottom and tips of the toes. The loss of sensation in the feet can cause a loss of balance, a feeling of unsteadiness, and cause you to fall. Special inserts, called orthotics, may be placed into your shoes to relieve pressure on the tarsal tunnel. Special education for the care of the foot with poor sensation will be required to teach you to minimize the dangers that can come from this impaired sensibility. A cane may be needed.

WHAT IS THE RELATIONSHIP BETWEEN NEUROPATHY AND NERVE COMPRESSION?

The most common nerve problem in the diabetic, diabetic neuropathy, is a change in sensation in a stocking and glove distribution. This means that for your hand, the entire hand is affected, both the front and back. These changes can occur up to the elbow and in all of your fingers. For your feet, the entire foot is affected, both the top and bottom, and all of the toes. These changes can be present up to the knee. This pattern of neuropathy is usually the same for both the left and right foot. The problem usually begins in the feet first. In contrast, nerve compression usually is thought of as one nerve in one arm or in one leg, and this suggests that with nerve compression, just part of one arm or of one leg

would have the numbness pattern. This difference in the **pattern of numbness** associated with a nerve compression is one of the main reasons that doctors in the past have not considered that the symptoms of diabetic neuropathy are due to nerve compression.

The symptoms of diabetic neuropathy, of the sensorimotor polyneuropathy type, the most common type that we have been discussing thus far, are numbness and tingling, weakness, and are essentially the same as those of nerve compression.

But what if there are more than one nerve compressed in the leg at the same time?

Knowing that diabetes makes nerves susceptible to nerve compression and knowing that there are many areas of tightness that occur normally in everyone, it is possible that the diabetic could have more than one nerve compressed in each leg. If this were to be true, then multiple sites of nerve compression along the path of the nerves would give a stocking and glove pattern of numbness and tingling.

Another way to think about the relationship of neuropathy and nerve compression is that diabetes creates the neuropathy according to some metabolic process. This neuropathy, then, creates the circumstances that allow nerve compression to occur. It is well-known and accepted that nerve compression can cause the symptoms of numbness, tingling and weakness. It is possible then, to think that the nerve compression are superimposed upon the underlying neuropathy. This means that at some point in time, both neuropathy and nerve compression may exist together, but the symptoms may be due to the sites of compression.

WHAT TYPE OF SURGERY CAN BE DONE?

Surgery that is well-known to restore sensation and strength to people with nerve compression, like carpal tunnel syndrome, and can be done in patients with diabetes. Surgery to decompress the carpal tunnel is among the most common operations done in the United States. You probably know someone who has had this surgery. This type of surgery can be done in the leg and the foot. The surgery opens the tight area through which the nerve passes by dividing a ligament or fibrous band that crosses the nerve. This gives the nerve more room, allows blood to flow better in the nerve and permits the nerve to glide with movements of nearby joints.

HOW DOES THIS TYPE OF SURGERY HELP THE NERVE?

Decompression of a peripheral nerve in a person with diabetes can alter the natural course or history of diabetic neuropathy by removing the tight areas along the length of the nerve that are the symptom-producing regions of friction.

The surgery to decompress the nerve does not change the basic, underlying metabolic (diabetic) neuropathy that made the nerve susceptible to compression in the first place. When the surgical decompression is done early in the course of nerve compression, restoration of blood flow to the nerve will stop the numbness and tingling, and permit strength to recover. When the decompression is done later in the course of nerve compression, and nerve fibers have begun to die, decompression of the nerve will permit the diabetic nerve to regenerate.

Of course, if you wait too long to decompress the nerve, recovery may not be possible. If you already have ulcerations on your feet, or have lost toes, then very little sensation may be recovered because the damage to the nerve has become irreversible.

WHO IS A CANDIDATE FOR THIS TYPE OF SURGERY?

The ideal candidate for surgery to restore sensation and strength is the diabetic who is beginning to experience numbness and tingling in the feet and who may have noticed weakness, loss of balance or loss of control of some of the muscles in the feet. This patient should be examined in order to measure the degree of sensory and motor loss. ***Neurosensory testing can accomplish this purpose for you.***

If the patient is seen sufficiently early in the course of nerve compression, it may be possible to relieve some of the pressure upon the nerve by wearing shoe inserts (orthotics) for the feet. Special instruction is given to the patient in terms of inspecting the foot for early signs of skin breakdown or infection. When the neurosensory testing demonstrates sufficient sensory loss, special shoes may be required to protect the feet. There are some medications that can be given to relieve the discomfort of the neuropathy. And, of course, you must be sure that your blood sugar level is the best that it can be.

Advice and help from your primary care doctor, your endocrinologist and your foot and ankle specialist are essential to prevent worsening of the symptoms of neuropathy.

If the sensory loss progresses to the point where you have numbness and tingling throughout the day and weakness or clumsiness interferes with your daily activities, then you may be a candidate for surgical decompression of your nerve. The ideal candidate does not wait until there is no feeling left or until there is already an ulceration present.

The ideal candidate seeks surgical consultation while there is still time to reverse the damage to the nerves.

HOW DOES THE SURGEON SEE THE NERVES?

Surgery is done in a “bloodless field”. This is achieved by placing a tourniquet about your thigh once you are asleep. Once inflated, this prevents any bleeding during the surgery. The surgeon wears “loupes”, small microsurgical operating glasses, that magnify about 3-times in order to see the nerves and delicate tissues. The nerves are located in specific places in relation to the muscle and ligaments which helps in their identification.

HOW LONG DOES THE SURGERY TAKE?

From the time you enter the operating room until the time you enter the recovery room is about two hours. You will stay in the recovery room for another hour. These times will vary for the individual patients.

DO I HAVE TO BE PUT TO SLEEP?

Most often, it is easier for you to have a general anesthetic in which you are truly put to sleep. With surgery in your legs, it is possible to have spinal anesthesia which just puts your legs to sleep. With a spinal anesthesia, you are usually made sleepy but do all your own breathing. This is also known as “twilight medicine”.

Sometimes, if there are medical reasons why it may be too risky for you to have a general anesthetic, the surgery can be done with a local anesthetic. With this, you are made sleepy with medication given to you through your vein by an “I.V.” The best method for you will be determined in consultation with your own doctor, the anesthesiologist and, of course, we will try to accommodate any wishes you may have.

IS THE SURGERY PAINFUL?

No surgery is pain free but this surgery is not usually very painful. Partly, this is because you already have lost some of your sensation and partly because the surgery does not go into the joints. The surgery usually involves just cutting the skin and some ligaments and this usually is not too painful.

A long-acting local anesthetic will be put into your incisions so that when you awake not only will there be very little pain but, in fact, you will not feel your foot at all.

When the local anesthetic wears off, in about four hours, you will begin to feel your foot. If this becomes painful for you, you will be given pain medications. You may need to take this medication for a few weeks after surgery.

If the surgery has been to your tarsal tunnel, on the inside of your ankle, you may have some increased pain as you begin to walk again.

When the nerves that have been “asleep” awakened, you may experience hot or cold or shooting pains in your toes. This is a good sign as it shows recovery, but it may still be uncomfortable for you. There is medication that can help these feelings, too.

DO I HAVE TO BE HOSPITALIZED?

No. Most patients can have the surgery safely as an outpatient. There may be medical reasons why it will be best and safer for you to stay one night in the hospital, such as to receive intravenous antibiotics, or to receive proper care for your heart or kidneys.

WHAT SHOULD I BRING FOR MY CONSULTATION WITH YOU?

You should have a **letter of referral** sent by your doctor. That letter should state how long you have had diabetes and what your **current medications** are, including your dose schedule for insulin. You do not need to bring x-rays with you.

If you have had a nerve conduction test (EMG or NCV), you should bring a copy of the electrodiagnostic test with you, however, it is not necessary to have this test before your consultation.

WHEN WILL I HAVE NEUROSENSORY AND MOTOR TESTING?

Neurosensory testing with the Pressure-Specified Sensory Device (PSSD) is the best way we have to measure the degree of function in your fingers and toes. This testing is done with a computer and **does not hurt because there are no needles and no electric shocks**. This is different from the electrodiagnostic studies you may already have had. Diabetics should have neurosensory testing every year. It must be done on the day of your office visit **if you ask the receptionist to schedule the testing at the time of your office visit**. Otherwise, you can come back and have it done on another day. The testing takes less than one hour.

You will have the testing done after surgery, too. Usually, it is done at about six to twelve weeks after surgery to document that neural regeneration is occurring. This will also document that the operated leg/foot is improving and help us determine if you should proceed to have surgery upon your opposite leg.

WHAT ARE THE RISKS OF THIS SURGERY?

The biggest risk of the surgery is the risk of anesthesia, which can include death. Although very rare, severe complications are possible. This is why your past medical history is so important to us in selecting the safest anesthesia for your surgery and in selecting the appropriate type of medical facility in which you should have your surgery.

With any surgery, there is always the risk of bleeding, infection, scar formation, the unpredictable nature of the healing process and failure of the procedure to achieve its desired goal.

Unique to the surgery you will have the possibility of a painful scar, possible worsening of your symptoms as the diabetic nerve regenerates, and delayed wound healing.

WHAT ARE THE CHANCES OF SUCCESS?

Over the past twenty years, the results of this type of surgery have been carefully evaluated. Several separate studies have been done, and reported. These studies reach the same conclusion:

Overall, about 80% of those diabetic patients who have had a nerve decompressed have had decreased pain and improved sensory and motor function. Balance is improved.

None of these patients had ulcerations or amputated toes at the time of their surgery. The presence of ulcerations or previous toe amputation does not mean you are past the point where you can be helped. Only a consultation can determine this.

A postoperative patient survey has shown that over the period of time that this surgery has been done, none of the patients had been admitted to the hospital for treatment of foot infection or ulceration. No patient has had an amputation. No one has fallen or broken a hip.

While these results in no way guarantee that **you** will achieve an excellent outcome, they are suggestive of what can be achieved by this approach.