Peripheral Nerve Problems
How they develop and ways to treat them

How Nerves Work

Nerve cells (neurons) have long, slender branches called nerve fibers. These fibers allow the nerve cells to receive sensory information from the skin, other organs, and muscles. The nerve cells then send electrical signals out along other nerve fibers to the spinal cord, which carries this information to the brain. The brain responds by sending electrical signals down the spinal cord and out along nerves to the muscles, which makes them move.

All of these nerve pathways are constantly sending and receiving information. Your ability to do everyday activities depends on how well this complex system is working.

Peripheral Nerve Injury

Peripheral nerves are nerves that are outside the brain and spinal cord. When peripheral nerves are damaged from injury or disease, many different types of problems can occur. Information from your skin or other organs travels both to the brain and out to the muscles along the same peripheral nerve. If a peripheral nerve is damaged, your ability to feel sensation may be limited. You also may have muscle weakness and pain.

The location of your damaged peripheral nerve and the type of injury will affect the symptoms you have and how to treat them. Your nerve may be able to recover on its own. But, if the damage is too severe, surgery may be needed to restore function.

Most peripheral nerve injuries affect 1 of these areas:

- The neck and upper extremity (arm and hand)
- The buttocks and lower extremity (leg and foot)
Peripheral Nerve Problems

A peripheral nerve and its connections to the spinal cord and end organs (the nerve’s stopping point)

Neck and Upper Extremity Injuries

Brachial Plexus

The *brachial plexus* is a group of nerve fibers that begins in the neck, at the *lower cervical* and *upper thoracic* sections of the spinal cord. From there, they travel into the chest, up through the neck, into the armpit, and out to the arm and hand.

The nerves in the brachial plexus have different functions:

- The *radial nerve* straightens your arm at the elbow, extends your hand at the wrist, and straightens your fingers.
- The *median nerve* flexes your hand at the wrist and moves your fingers.
- The *ulnar nerve* also moves your fingers, and it controls most of the small muscles in your hand that you use for doing small movements, such as typing.
Lumbo-sacral Plexus

The lumbo-sacral plexus is made up of 2 groups of nerve fibers that begin in the lower back:

- The nerves in the lumbar plexus travel from the spinal cord into the abdomen, groin, thighs, knees, and calves.
- The nerves in the sacral plexus travel from the spinal cord into the pelvis, buttocks, genitals, thighs, calves, and feet.

Shortly after leaving the lumbo-sacral plexus, the nerve fibers divide into several distinct nerves. The largest nerve in the leg is the sciatic nerve. It runs through your buttocks and down the back of your legs. The upper part of the sciatic nerve flexes your leg at the knee.

At about knee level, the sciatic nerve divides into 2 nerves:

- The tibial nerve pushes the foot down and turns it in.
- The common peroneal nerve lifts the foot up and turns it out.

Another important nerve in the lumbo-sacral plexus is the femoral nerve. It crosses the groin area on its way into the front of your thigh. The femoral nerve works to extend your leg at the knee.

We will carefully test your muscle strength and how well your nerves are sending sensory information. These tests will tell us the location of your peripheral nerve injury and how severe the damage is.

Recovering from Peripheral Nerve Injury

Your ability to recover from peripheral nerve injury will depend on how severe the injury is.

- A mild injury only causes damage to the cells that insulate (protect) the nerve fibers. These are called basal lamina cells. With mild injuries, full function usually returns very quickly, taking several weeks at the most.
• In a **moderate injury**, the nerve fiber (*axon*) is damaged and cannot transmit steady electrical signals. The cellular structure around the nerve is not injured. In moderate injuries, the nerve fibers slowly *regenerate* (grow back) and regain their ability to send electrical signals.

Nerve fibers regenerate at about 1 inch a month. Full recovery of nerve function depends on the location of the injury and the length of the nerve fibers. Recovery from a moderate nerve injury usually takes several months, and your damaged nerve will probably never regain full function.

In a **severe injury**, the entire peripheral nerve is either completely cut or is so damaged that the nerve cannot regenerate. In severe nerve injuries, the loss of function is usually permanent.

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**Evaluating Your Peripheral Nerve Injury**

Evaluating your nerve injury is a step-by-step process:

• First, a *neurologist* (a doctor who studies nerves) will evaluate your injury using an electrical test called an *electromyogram* (EMG) and *nerve conduction studies*. These tests show where your nerve injury is located and how severe it is. They can also show whether or not your nerves are regaining their ability to function.

You may have these tests done more than once. The results will tell your doctor if your nerves are regenerating on their own.
A neurosurgeon (a doctor who specializes in treating peripheral nerve injuries and diseases through surgery) will then examine you, review your electrical tests, and decide if more tests need to be done.

After reviewing all test and evaluation results, your neurosurgeon will recommend a treatment plan. The tests may show that:
- Your peripheral nerve is healing and you do not need surgery.
- Your peripheral nerve problem requires surgery.
- It is unclear whether or not your nerve is healing, and you will need to be re-evaluated at a later date.

Deciding About Surgery
Timing is important when deciding if and when to do surgery to repair your nerve. Damaged nerves need time to regenerate, and most times your doctor will want to watch your progress to see if the nerve can recover on its own. But, if surgery is needed, it should be done fairly soon after the injury occurs for the surgery to have the best effect. Another reason to have surgery soon after nerve damage occurs is that when nerves in an area of your body do not work for a long time, your muscles will atrophy (break down) and joints will degenerate (weaken).

Your doctor will consider both the need to watch your progress and the need to do surgery as soon as possible. Electrical studies will help determine the best timing of your surgery. Your doctor will talk with you about your treatment and surgery options.

Open Wounds
If your injury is a sharp, open wound and you lost all nerve function right away, your nerve can probably be repaired with surgery. In this kind of wound, the nerve is cleanly cut and there is very little damage to the rest of the nerve or the area around it. The surgeon is then able to suture (sew) the nerve ends back together.

Closed Wounds
Most peripheral nerve injuries result from closed wounds, and the nerve damage occurred when the area was hit or stretched. In this kind of wound, how much damage has been done to the nerve and the area around the nerve may not be clear. Your doctor will need to watch your progress over time before making a decision about surgery.

Treatment of a closed wound nerve injury can occur in 1 of 2 ways:

1. **If the amount of nerve injury is not known**, your doctor cannot predict whether or not the nerve will recover on its own. Over the next 3 to 4 months, your doctor will do a series of clinical and electrodiagnostic studies to find out if your damaged nerve is starting to regenerate. If the tests do not show healing, your doctor will likely recommend surgery.
2. **If the nerve has been cut**, your doctor still may not be able to tell the full extent of the injury. For the next several weeks, your doctor will monitor your injury to see if a scar starts to form. If it does, your surgeon can remove the scar tissue and repair the damaged part of your nerve. If there is only a small gap between the two cut ends of the nerve, your surgeon can suture the two ends together. If the gap is large, your surgeon will need to use nerve grafts to repair the nerve.

The nerve graft acts as a bridge between the two nerve ends, and it helps the nerve fibers reconnect as they regenerate. The graft will probably be taken from your **sural nerve**, a sensory nerve in your lower leg. The sural nerve is used because it is easy for your surgeon to get to. And, after it is removed and you have recovered from surgery, your only side effect will be a mild loss of sensation along the outer side of your lower leg.

**Surgery Risks**

All surgery involves some risks, but major complications from surgery are rare. Your doctor will recommend surgery to repair your damaged nerve if the expected benefits are greater than the risks.

Some risks of surgery include:

- Problems with the incision, such as poor healing or infection
- Side effects of general anesthesia, which your anesthesiologist will discuss with you
- Damage to vital body structures that are either directly involved in your injury or disease or are located in the same area:
  - Healthy nerves may be damaged, causing more sensory changes, muscle weakness, or pain.
  - Major blood vessels, which often are in the same area as nerves, may be damaged. This may cause a loss of blood that requires a blood transfusion. Even though all blood used for transfusions is carefully tested, there is still a small risk that it may carry a contagious disease. Damage to a blood vessel may also cause swelling or loss of your arm, hand, leg, or foot.
- Pain at the incision site. You will receive pain medicine for this.

Your neurosurgeon will talk with you about any other risks that will be involved in your specific surgery.
After Surgery

You will stay in the hospital 1 to 5 days after surgery, depending on the extent of your surgery and how quickly you recover. Your activity will be limited only by your own level of comfort, unless your doctor tells you otherwise. At most, you will not need to restrict your activities for more than a few days.

Your doctor and nurses will closely monitor your level of activity and encourage you to move. Activity after surgery will help ease stiff joints, lessen the formation of scar tissue that could interfere with your nerve function, and lessen muscle atrophy. You should begin to move around as soon as possible after surgery. It is especially important to move the part of your body where your surgery was done.

You may be referred to a physical therapist (PT), who will teach you exercises to help your body heal and strengthen. It will be up to you to do these exercises as often as prescribed. Seeing the PT is only a start. You will become your own 24-hour physical therapist during your recovery.

Follow-up

Your neurosurgeon will follow your progress for many years after your surgery. This long follow-up period is needed because it takes a long time for your nerve fibers to regenerate and reconnect, and for your body to adjust to how the new nerves work. Try to be patient with your healing and keep a positive attitude.

Peripheral Nerve Clinic

Your doctors, nurses, and the rest of the staff at the Peripheral Nerve Clinic are here to help. Please feel free to ask any questions you may have about your peripheral nerve problem, its treatment, and your care.

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Your questions are important. Call your doctor or health care provider if you have questions or concerns. UWMC clinic staff are also available to help.