

# Electrodiagnostic Testing

Electromyogram and  
Nerve Conduction Study



**North American Spine Society  
Public Education Series**



# What Is Electrodiagnostic Testing?

The term “electrodiagnostic testing” covers a whole spectrum of specialized tests, two of which are the electromyogram and the nerve conduction study. Many problems involving nerves or muscles require electrodiagnostic testing to provide information. Although they are different tests, the electromyogram and the nerve conduction study go hand in hand to give vital information regarding your nerve and muscle function.

## **What is an Electromyogram (EMG)?**

An electromyogram (EMG) is a diagnostic study that has been used by health care providers for over 50 years. An EMG provides information about the function of the muscles and the nerves in your body. An EMG examination is typically ordered by a physician to evaluate for muscle or nerve damage as part of a medical workup.

Using a specialized computer, the examiner actually sees and hears how your muscles and nerves are working. A very small needle is inserted into various muscles in the arm, leg, neck or back, depending on your symptoms. In many cases the examination will include areas away from where you are having symptoms because nerves can be very long.

There is virtually no chance to catch any diseases from having an EMG because only new, sterile needles are used. An EMG is only one part of nerve testing; the other part is called the nerve conduction study.

## **What is a Nerve Conduction Study (NCS)?**

Like an EMG, a NCS is typically ordered by a physician to evaluate for muscle or nerve damage as part of a medical workup. The examiner places small electrodes on your skin over muscles being tested in your arms or legs. The examiner then uses a stimulator to deliver a very small electrical current to your skin near nerves being tested, causing your nerves to fire. The electrical signals produced by nerves and muscles are picked up by the computer, and the information is interpreted by a physician specially trained in electrodiagnostic medicine. The stimulator only produces a very small shock that does not cause damage to your body. Many different motor and sensory nerves are typically evaluated.

## Do I Need an EMG/NCS?



When you go to your health care provider with symptoms including radicular pain (nerve pain radiating from the neck or back), numbness, weakness or tingling in an arm or leg, it is important to find out what is causing your symptoms. There are many possible causes for the above symptoms, and many cases resolve spontaneously on their own. However, if symptoms persist, an EMG/NCS is one way to assess muscle and nerve function and is often used with other tests such as MRI or CT scan that create images of the body.

# What Can EMG/NCS Detect?

The EMG/NCS examines nerves from just outside the spinal cord to the skin. Nerves have long projections called axons that carry electrical signals. Axons are surrounded by supporting cells called schwann cells, which produce myelin. Myelin acts like an insulator for the axons and makes nerve signals travel faster.

In addition, because nerves go into muscles and give signals to muscles causing muscle contraction, the EMG/NCS also tests muscles. Abnormalities with the peripheral nervous system (all nerve tissue outside the brain and spinal cord), including the insulating myelin and muscles, can all be evaluated with EMG/NCS. While EMG/NCS can detect many different problems with nerves or muscles, some of the more common are covered below.

## Cervical or Lumbar Radiculopathy

A radiculopathy is the term used for nerve pain radiating from the neck (cervical) or low back (lumbar). There are many causes for radiculopathy; one is herniated discs. The intervertebral discs are one of the weight bearing structures in the neck and back. These discs can become degenerated and can herniate, pressing on nearby nerves and causing the radiating pain. An EMG/NCS can evaluate the severity of the nerve damage due to disc herniations.

## **Peripheral Neuropathy**

Many common medical conditions like diabetes can cause nerve damage. In such cases, the longest nerves are usually affected first; hence the name peripheral neuropathy. Whether the diabetes is controlled with diet, oral or injectable medications, there is often nerve damage. An EMG/NCS can evaluate the severity and monitor any progression of a peripheral neuropathy.

## **Myopathy**

A myopathy is a disease that is localized to the muscle and muscle supporting structures. Myopathies are hereditary (inherited from a mother or father) or acquired (from infection or underlying medical condition). A patient will usually present with proximal muscle weakness and perhaps myalgias (muscle aches). An EMG/NCS can localize the disease process in such cases and aid diagnosis.




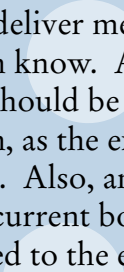
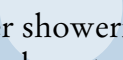
## **Focal Neuropathies**

A focal neuropathy is when a single nerve suffers damage at a specific site along its course. There are an infinite number of possible focal neuropathies in the body, but the most common example is carpal tunnel syndrome. Carpal tunnel syndrome is when the nerve to the hand is squeezed at the wrist causing numbness, tingling and pain. An EMG/NCS evaluates the severity and location of such focal neuropathies.



## How Should I Prepare for an EMG/NCS?

After showering on the day of your examination, do not use any creams, moisturizers or powders on your skin. If you have any bleeding disorders, let the examining physician know prior to testing. If you take blood thinners, even any aspirin or aspirin like medications let the examining physician know. You may be asked to stop blood thinners and aspirin products prior to your examination. If you have a pacemaker or other devices that are implanted in your body to deliver medications, let the examining physician know. Any history of back or neck surgery should be discussed with the examining physician, as the examination may need to be modified. Also, any recent fevers or chills may indicate current bodily infection and should be mentioned to the examining physician.



## What Can I Expect on the Day of the Test?

As mentioned earlier, the electrodiagnostic testing usually includes both electromyogram (EMG) and nerve conduction studies (NCS). The EMG section includes a small sterilized needle being inserted in the muscles to be tested. There is some discomfort with needle insertion, but most tolerate the testing without difficulty. You may notice some bruising after the needle portion of the examination. Icing sore areas can help with discomfort and limit the bruising. Any time the skin is penetrated with a needle, there is a theoretical risk of infection developing.

The NCS portion of the examination includes a small stimulus applied near nerves to make them fire. In most cases a series of shocks are necessary to get the optimal response. Any discomfort is temporary, and the stimulus is not strong enough to cause damage to the body.

## Who Should Not Have This Procedure?

There are a number of factors that indicate you should not have a discogram. If you have an allergy to dye, an active infection or a local infection at the site to be injected, you should discuss it with your health care provider. Psychological factors may be taken into consideration as well.


### Potential Complications

There is a risk of complications associated with discography. The most common is discitis (an infection of the disc space.) On average, this occurs in about one out of 400 patients undergoing discography. Discitis usually results in very intense pain but can be treated with antibiotics. Other complications that have been reported (but are rare) include nerve root injury, urticaria (a vascular reaction on the skin), injection of dye into the dural sac (surrounding the spinal cord), bleeding, nucleus pulposus pulmonary embolism, nausea, headache and increased pain.

You should discuss the risks associated with discography and warning signs of complications with your health care provider before the procedure.

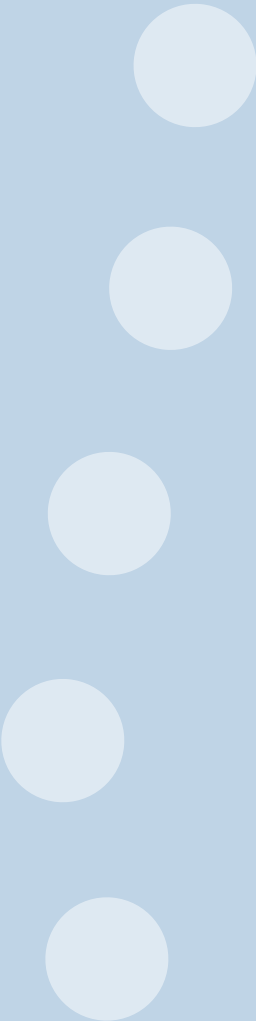
## What Happens After Discography?

The discography results are reviewed and given to your health care provider. Similar to MRI and all other diagnostic tests, discography is not perfect. Due to the intricacies of interpreting the pain responses component of discography, the exact number of times the test is incorrect cannot be clearly determined. It has been reported that patients with severe pain sensitivity may be more likely to provide information that is not helpful in differentiating the disc as a pain generator. Therefore it is important for you doctor to combine the results of the discogram with results from other tests and physical examination to better determine if the disc(s) is causing your pain. This information may be used to determine if surgery may be beneficial. If so, the results are used to determine the best type of surgery for you, and which disc levels may be included in surgery.



## When are the Results Ready?

After EMG/NCS testing, the examining physician must analyse the data and combine all the information into a report. The electrodiagnostic examination report will be added to your medical record and a copy sent to the referring physician. The time for report generation varies from lab to lab, but generally is no more than a few days. Be sure to follow up with your health care provider.





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