Electromyography (EMG) & Nerve Conduction Studies (NCS)

Overview

EMG and NCS are tests that measure the electrical activity of the muscles and nerves of the body, usually to an arm or a leg. The tests can help identify nerve injury or muscle disease such as carpal tunnel syndrome, a pinched spinal nerve, peripheral neuropathy, myositis, or ALS. The presence or absence of injury can be helpful in determining further treatment.

Why do I need an EMG or NCS test?

While an MRI or X-ray of the spine can provide clues about its structure, EMG and NCS tests provide data about how the muscles and nerves **function**. The tests add valuable information to what your doctor already knows from your history, physical exam, and imaging scans.

For example, during the physical exam the doctor looks for clues as to the underlying spinal problem (loss of muscle or "atrophy," loss of reflexes, weakness, and/or areas of numbness). This *structural* exam is expanded by imaging tests that look inside the body at the skeleton, muscles and nerves (X-rays, MRIs, and/or CT myelograms).

A good analogy is shopping for a used car. You first look at the car's structure: Is there any body damage or leaking oil? No matter how good it looks, you do not make an offer to buy without driving the car to test its *function:* How does it steer or brake? How does the engine sound?

In a similar manner, X-ray, MRI or CT myelogram all take a look at spinal structure — the bones, discs and nerves. X-rays tell us about bony alignment (scoliosis) or bony spurs (arthritis). MRI scans show us details about disc herniation, or narrowing (stenosis) of the nerve canals.

An MRI may show nerve entrapment, but it has limitations. It only shows narrowing when the MRI was taken, at one point in time. It cannot tell if the nerve was more severely pinched three weeks ago or how tightly the nerve is being pinched right now. The nerve *could* have been damaged with swelling, but now the swelling is less.

So, like the car buyer who looks beyond appearance and requests a test-drive, your doctor will look beyond the structure on a CT/MRI scan and test function before making a decision regarding treatment.

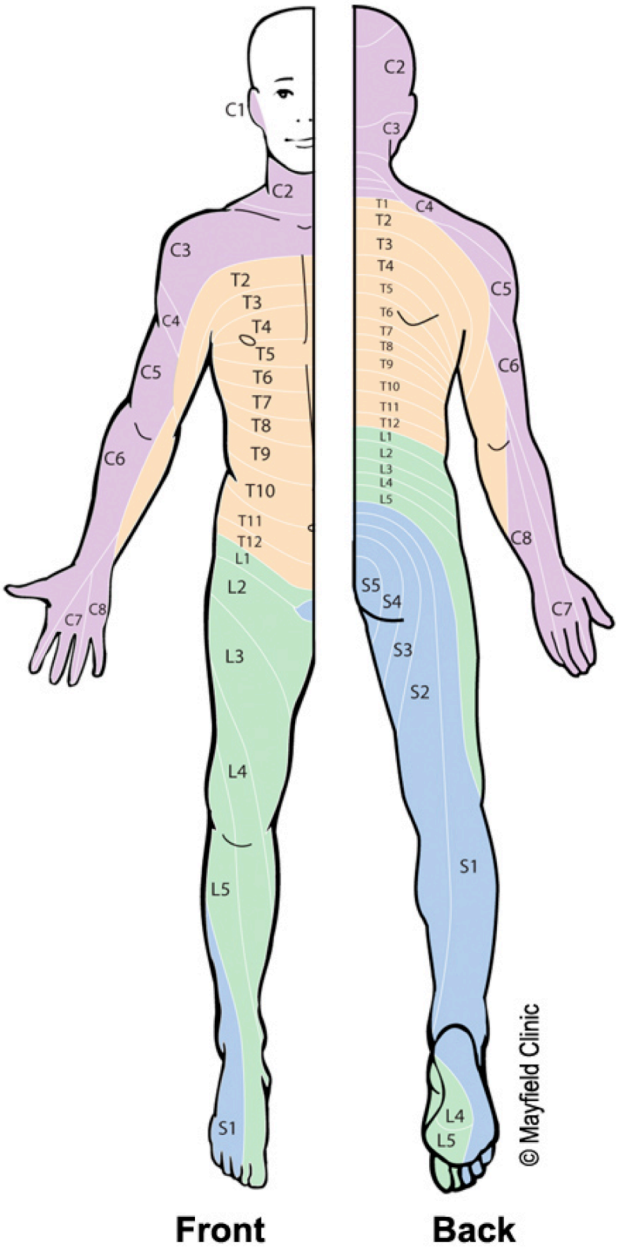

Figure 1. Each spinal nerve is responsible for sensory and motor control of specific areas of the body — creating a dermatome map. When nerve roots are compressed, the electrical impulses to the muscle served by that nerve begin to slow.

evaluates how well the nerves from the spine transmit information to and from the arms, legs, and paraspinal muscles (Fig. 1).

An EMG or NCS may be ordered if you have pain, tingling, numbness, or unexplained weakness in the arms or legs. The test can confirm normal function or estimate the degree of nerve damage.

Who performs the test?

A doctor who specializes in Physical Medicine and Rehabilitation (PM&R) or neurology performs the test in the office.

How should I prepare for the test?

You can eat normally the day of the test. Take your prescribed medications unless otherwise instructed. Do not use any lotions or powders on the area to be tested. Dress in loose clothes that permit access to the area to be tested or that are easily removed. Testing typically takes 30 to 60 minutes.

What happens during an NCS?

An NCS evaluates the two major nerve groups:

- Sensory nerves (that detect pain, touch, pressure)
- Motor nerves (that move the muscles)

The doctor places sensors on the skin. A small electric pulse, similar to a static shock after walking on a carpet, is applied to activate the nerve. Your muscle may twitch. The speed, size, and consistency of the nerve's response is recorded and analyzed. NCS shocks are mild and do not cause any damage.

Figure 2. NCS of the leg.

What happens during an EMG?

An EMG evaluates the electrical activity a muscle produces at rest and when it contracts, similar to an EKG of the heart muscle. The doctor places a single, small, Teflon-coated wire pin into selected muscles to be studied. The tip of the pin acts like an antenna, picking up electrical activity from the muscle that can be heard and seen on a screen. You will be asked to tighten (contract) the muscle. Electrical activity is recorded and can be heard as popping and clicking sounds when the muscle is contracting.

Figure 3. EMG of the arm.

What are the side effects or risks?

EMG and NCS tests have few side effects. Occasionally, the pin exam can cause a small bruise. This is more common in patients on blood thinners (Coumadin, Plavix) or anti-inflammatory drugs (ibuprofen, aspirin). Infection at the pin sites is rare, given the skin's natural defenses and the small pin size. You may feel some soreness for a day or two following the test. There are no activity restrictions, and you can drive home afterwards. The tests are safe and can be performed in people with pacemakers or defibrillators.

How do I get the test results?

The test results are analyzed, and a report is sent to the doctor who ordered the test. A negative test means results are normal; a positive test result will reveal some degree of nerve damage (neuropathy).

Sources

If you have questions, please contact the doctor who ordered your test.

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