Analysis of the Needle Electrode Examination Electromyography

A Forensic Perspective

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You may be asked if EMG is the "gold standard" for radiculopathy. This concept is important to understand because the 4th edition of *AMA Guides* lists this clinical study as an impairment rating category differentiator for objective and important electrodiagnostic evidence. Because this concept is confusing for the chiropractic medical examiner, an overview of electrodiagnostic medicine is in order.

The problem regards sensitivity with insufficient specificity. I recommend you perform a Medline search (http://www.igm.nlm.nih.gov). It is my experience that most of the extremity pain that we evaluate is chronic, usually musculoskeletal in origin, and is analyzed on clinical grounds. The proper forensic approach is the time-honored one: history-physical examination-confirmation by laboratory tests. For example, the diagnosis of carpal tunnel syndrome (CTS) is made on clinical grounds. The electrical tests may be abnormal in someone who doesn’t have (CTS). Clearly, electrodiagnostic testing is not the "gold standard" here, nor should it be for radiculopathy. Most responsible EMG’ers will agree that these tests are an extension of clinical examination. Any reliance solely on electrodiagnostic testing is dangerous.

The nerve root, like the brain and spinal cord, is insensitive to pain. A neurosurgeon named Lindahl demonstrated this about 25 years ago. It becomes sensitized to compression by any or all of 10 or more substances found in sterile inflammation (substance "P," hydrogen ions, etc.). The EMG will pick up evidence of neuromuscular irritability in this case. Otherwise, the best evidence on EMG comes from axonal injuries. Both show fibrillations, positive sharp waves, and sometimes repetitive discharges. Could these occur with a normal MRI? (A Medline search may help with this also.) This is possible with a stretch injury of the nerve root if there is a sterile inflammation in the vicinity. I believe I have seen this in my clinical practice; others may have, too.

More troublesome is the fact that EMG is fairly subjective. One can produce false-positive results by making it look something like an irritative process. In addition, there are sampling errors. My own practice is to obtain an MRI when clinically indicated, with a view to epidural blocks, surgery or the like, and
perform an EMG, if further confirmation is needed. It has even been suggested in the literature that examining only the paraspinal muscles for the changes mentioned above is sufficient to confirm that the suspected nerve root compression is recent, ongoing, or recovering.

The EMG is helpful all right, but not the gold standard. A careful clinical examination by an experienced forensic chiropractic medical examiner is the gold standard. Gallstones are always abnormal, and they’re taken out. We’re not dealing with gallstones. The EMG is only as good as the "EMG’er," and his or her skills are properly clinical.

The term "electrodiagnostic medicine" is indefinite in the sense that it encompasses numerous electrophysiologic procedures. These are the cornerstone procedures of nerve conduction studies (NCS) that study motor, sensory, or mixed nerves, and needle electrode examination (NEE) electromyography (EMG) that can evaluate any muscle accessible to a needle. Additionally, there are the special studies: H-responses, F-waves, repetitive stimulation studies, blink reflex, and single-fiber EMG. The term also encompasses somatosensory, motor and other evoked potential. However, in the majority of electrodiagnostic medicine laboratories, the scope is more limited, consisting of the two basic studies and possibly some special studies.

Nerve conduction studies and needle electrode examination electromyography are two distinct and complementary techniques; each plays a central role in the evaluation of patients with neuromuscular disorders. Before nerve conduction studies existed, the term "electromyography" simply referred to the needle electrode portion of the examination. However, after nerve conduction studies were introduced, the letters "EMG" were often used as an umbrella term for both nerve conduction studies and needle electrode examination electromyography. Most of the special studies are variations of the nerve conduction studies and have relatively limited application. The two special studies that are most pertinent to radiculopathies are H-responses (sometimes termed the H-reflex) and F-waves.

In forensic practice, electrodiagnostic studies serve as an extension of the clinical exam. A neurologic examination performed beforehand helps identify clinical abnormalities and establish a differential diagnosis. Each study should be individualized based on the neurological examination and differential diagnosis, and modified as the study progresses and further information is gained.

Nerve conduction studies and needle electrode examination are most often used to diagnose disorders of the peripheral nervous system. These include disorders affecting the primary motor cells (i.e., motor neurons or anterior horn cells), primary sensory nerve cells (i.e., dorsal root ganglia), nerve roots, plexuses, peripheral
nerves, neuromuscular junctions, and muscles.

The goals of every study are to:

- establish the presence of a lesion;
- provide further information regarding the underlying nerve pathophysiology in the case of nerve disorders;
- assess the severity and temporal course of the disorder, and determine the location within the limitations of the test.

Occasionally, the test will be so specific that it meets the gold standard for the *AMA Guides* differentiator. However, in most cases the exact etiology is not determined based on the electrodiagnostic studies.

Harry Truman was right when he said, "Command is lonely." When you’re the forensic examiner, the buck stops with you. The essence of your forensic algorithm is the willingness to make the type of tough, unambiguous choices that will have an impact on the examinee. I have reviewed too many examinee medical documents when medical examiners flinched from this responsibility.

References

- *Aids to the Examination of the Peripheral Nervous System*. W.B. Saunders. 1996.

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