CHAPTER 48

THE USE OF ELECTROMYOGRAPHIC AND NERVE CONDUCTION STUDIES

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Electromyographic (EMG) and Nerve Conduction Studies (NCV) are tests requested with some degree of frequency. Typically these studies are performed by a neurologist. Unfortunately, the individual performing the test may at times fail to provide any meaningful information in the eyes of the clinician. To some degree, the lack of seemingly pertinent data may be due to a lack of suitable communication between the physician requesting the study and the neurologist.

The ability of the referring physician to recognize the need for the study is as important as the request itself. It has been shown that with a specific differential diagnosis and thorough history and physical, the results of the study will be far more valuable. EMG and NCV studies can be frustrating to both the referring physician and the neurologist. If the neurologist has a through knowledge of the suspected differential diagnosis, he has a better chance of discovering the diagnosis in question.

UNDERSTANDING EMG AND NCV

An understanding of EMG and NCV tests is helpful in deriving the maximum benefit from the study requested. Often a diagnosis is supported with the use of the EMG and NCV, but without prior clinical correlation the studies may be inconclusive. This leads to the frustration experienced by many physicians following the EMG or NCV study.

COMMON USES FOR EMG AND NCV

In podiatric practice, patients with a cavus type foot may be referred for neurological studies. The correlation between cavus foot deformities and a neurological deficiency such as Charcot-Marie-Tooth disease is widely described in the literature. However, patients with suspected compartment syndromes, drop feet, tarsal tunnel and specific nerve entrapments are also candidates for these studies. In each case, the neurologist will benefit from the referring physician's specific physical and historical findings prior to the studies. These studies are also of benefit in the monitoring of reinnervation process following blunt trauma, or laceration and repair of nerves.

PHYSIOLOGY OF EMG AND NCV

The EMG and NCV studies are based on the ability of the neurologist to isolate the nerve in question and then stimulate its depolarization. This depolarization is dependent on the sodium-potassium pump which causes the transfer of a signal proximally to the brain and distally to the muscle creating the action and reaction phenomenon. If the nerve innervation to the muscles in question is difficult to isolate, a recruitment of surrounding muscles may interfere with test results. In cases of a proximal nerve lesion, the depth of the tissue may prohibit the localization of the lesion, revealing only that a lesion exists. In some cases the goal of the study may include the stimulation of all muscles in a given compartment, therefore testing the recruitment phenomenon.

INTERPRETATION OF COMMON TERMS

When viewing the results of the EMG/NCV studies, the physician should not rely completely upon the impression given by the neurologist. Terms often seen are defined as follows:

AMPLITUDE: The recorded response of the stimulated nerve from the baseline.
DURATION: The amount of time which transpired during the nerve response. This is directly related to the amplitude.
LATENCY: The latency is the time which occurs between the delivery of the stimulus and the response that occurs. The latency can be measured both proximally and distally.
NERVE CONDUCTION VELOCITY: This is the rate of the conduction that is measured in the nerve,

calculated from the latency and the distance between the test points.

COMPOUND MUSCLE ACTION POTENTIAL: The electric potential which is noted following the stimulation of a muscle. The stimulation takes place between the end plate of the muscle and the tendon.

SENSORY NERVE ACTION POTENTIAL: The electrical potential recorded from the stimulation of a single sensory or mixed nerve.

F RESPONSE: The conduction along the entire length of the nerve from the distal-most point to the anterior horn cells, and back to the original point. A measure of efferent nerves only.

H REFLEX: One of the only true measurements of both the efferent and the afferent nerve responses. The H reflex is seen only in the tibial nerve in the lower extremity.

DISCUSSION

The results obtained from an EMG or NCV exam are influenced by three factors; the patient, the neurologist, and the environment. The EMG and NCV examination can be painful. However, the data from this exam is based on the patient's voluntary contraction and relaxation of the muscle groups in question. Without the full cooperation of the patient, the results may be questionable. Results will also vary according to the individual's anatomical variations.

The environment (room temperature) can also affect the results. A cold limb may produce false or inconclusive findings. The technical aspect of the EMG and NCV exam rests with the neurologist. It is his or her expertise with the anatomy, coupled with a good differential diagnosis. The referring physician must remember that the symptoms seen distally may be a manifestation of a proximal lesion in the brain or the spinal cord.

CONCLUSION

The interpretation of EMG and NCV studies can be both rewarding and frustrating. If a specific differential diagnosis can be provided for the neurologist, a more specific exam may be completed. The referring physician must remember that with a progressive disorder early symptoms may not show on the EMG or NCV exam. Conversely, a subclinical neuropathy may be discovered on testing. The EMG and NCV exams are a useful tool in aiding the diagnosis of neurological disorders, but are best used as an aid in the diagnosis due to the variables in the patient, environment, and the neurologist.