



Proper Performance and Interpretation of Electrodiagnostic Studies

Introduction

The American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) position with regard to the proper performance of electrodiagnostic (EDX) studies is as follows:

- 1) Physicians performing and interpreting nerve conduction studies (NCSs) and needle electromyography (EMG) should be properly trained in EDX medicine.
- 2) Prior to initiating the EDX studies, physicians should review referral information and perform a pertinent history and physical examination to form a differential diagnosis that determines the appropriate NCS and EMG testing needed for the patient.
- 3) EDX-trained physicians should directly supervise if a technologist or resident/fellow is performing the NCSs and the physician should interpret the NCSs.
- 4) NCS studies should be performed and interpreted with complementary needle EMG on-site and in real time in accordance with the American Medical Associations' Current Procedural Terminology requirements for these procedures.¹

The AANEM believes that EDX studies should fulfill the above criteria in order to provide appropriate care to patients. These elements emphasize principles stated in the AANEM's *Recommended Policy for Electrodiagnostic Medicine*.²

Appropriate Training in Electrodiagnostic Medicine

It is the AANEM's position that in order to perform the steps outlined above and ensure quality patient care, physicians performing EDX studies should receive specific training in the diagnosis and

treatment of neurological, neuromuscular and musculoskeletal disorders in order to properly utilize neurophysiological techniques in the evaluation of these disorders.² The AANEM believes this training should come through completing a residency in neurology and/or physical medicine and rehabilitation and/or fellowships in clinical neurophysiology or neuromuscular medicine. Training in these programs provides detailed education in anatomy, neuromuscular physiology, pathology of muscle and nerve electrophysiology, and clinical aspects of neurological and musculoskeletal conditions. The AANEM's position statement *Who is Qualified to Practice Electrodiagnostic Medicine?* defines the AANEM's educational requirements for an EDX physician.³

Importance of the In-Person Evaluation

To reach a diagnosis based on EDX testing, it is imperative that the physician has obtained a history and examined the patient in-person and designed the NCSs and EMG testing based on the information obtained from the patient. Using a predetermined or standardized battery of NCSs for all patients is inappropriate because it may be possible to obtain the data needed to reach a diagnosis with fewer studies. Alternatively, a pre-determined battery may not include the appropriate NCSs and/or EMG tests to determine the diagnosis. If the EDX studies are not based on the patient's history and physical examination findings, substandard care is being provided. If the NCS results a physician is relying on are interpreted offsite without integrating information from the needle EMG, substandard care is being provided. It is the opinion of the AANEM that relying on NCSs alone to make health care decisions is usually inadequate and inappropriate.



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Direct Supervision of Nerve Conduction Studies

NCSs are one diagnostic test used by an EDX physician to assess the integrity of the peripheral nervous system and diagnose diseases. NCS reports should document the nerves being evaluated, the distance between stimulation and recording sites, the conduction velocities, latencies, and amplitudes of the responses. Waveform images should be recorded, reviewed in real time, and, when feasible, retained as part of the medical record to support quality assurance, accreditation review, and responses to payer inquiries or appeals. Waveform submission is not required to bill for appropriately performed EDX studies.

If a technologist or resident/fellow is performing the NCSs, direct supervision and on-site, real-time review of NCSs waveforms is necessary to ensure a quality study.

Before results can be interpreted as normal or abnormal, it is important that the physician consider factors such as normal variations in innervation, electrical interference, incorrect instrument settings, adjacent nerve co-stimulation, or cold limb temperature. To the extent possible, limbs should be warmed to the laboratory's standard minimum temperatures and the temperature maintained during the NCS. Real time and on-site review of NCS waveforms is also necessary to assess whether further NCSs should be performed, as well as to determine what other diagnostic tests may be necessary.

Importance of Performing Nerve Conduction Studies and Needle Electromyography Together

The AANEM is concerned that there continues to be a significant portion of EDX tests done by some provider groups which include only an NCS without an accompanying needle EMG. According to CMS' national provider database, there were eight physician specialties in 2023 who billed only a NCS more than 10% of the time. The same data set also revealed that advanced practice providers (APPs) billed Medicare for only an NCS 25-43% of the time.⁴

When NCSs are performed without needle EMG, valuable data that may be essential in establishing an accurate diagnosis is usually missing. In fact, EMG can often provide an alternative etiology or coexisting disorder in the case of a suspected disorder.

For example, in suspected carpal tunnel syndrome (CTS), alternative etiologies including cervical radiculopathy, brachial plexopathy, proximal median neuropathy or underlying peripheral neuropathy can be detected by EMG in cases where the clinical evaluation or NCS initially suggests CTS only. Missing an alternative etiology could lead to incorrect or unnecessary surgical procedures. For this reason, performing a needle EMG in suspected CTS is usually needed.

In radiculopathy, patients may have normal NCSs.⁵ While reports have indicated that some radiculopathies can be determined by F wave results if even a few of the large, myelinated motor fibers are intact, the F-wave results can be normal.⁴

Alternative diagnoses such as mononeuropathy or plexopathy often produce NCS abnormalities. Therefore, the AANEM's *Recommended Policy* states that a minimal evaluation for radiculopathy should include one motor and one sensory NCS *and needle EMG* of the involved limb.²

Additionally, patients with myopathy, plexopathy, or motor neuron disorders may have more widespread abnormalities that are only detectable



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by needle EMG. These disorders are likely to be misdiagnosed or missed completely if the needle EMG is not performed with a NCS.

It is AANEM's position that one attending physician perform or supervise all of the components of the EDX testing (i.e., review of referral information, history taking, physical examination, supervision and/or performance of the EDX test and data interpretation) for a given patient and that in the vast majority of cases all testing should occur on the same date of service. Performance of NCS alone by a provider who is not fully trained or properly supervised with subsequent referral to a trained EDX physician for assistance in diagnosing the patient will usually result in the NCS being repeated prior to performing needle EMG to ensure a quality study. Duplication of testing is not cost effective or an efficient use of limited health care resources.

Summary

The AANEM strongly recommends that EDX procedures be performed by physicians with medical education in neuromuscular disorders and special training in EDX testing. The same physician should perform a focused history and physical in order to properly design the EDX study as well as directly supervise (if not perform) and interpret the NCSs including those performed by a NCS technologist.² Because needle EMG studies offer information needed for an accurate diagnosis, except in unique situations, it is the AANEM's position that NCSs and needle EMGs should be performed together in the same setting.² It is the opinion of the AANEM that utilizing only NCSs provides incomplete diagnostic information, potentially leading to inadequate or inappropriate treatment (including inappropriate surgery) and increased health care costs.

Disclaimer

This position statement is provided as an educational service of the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) and is provided for informational

purposes only. Specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on the individual facts and circumstances involved in each case. This position statement is not intended to be used as a basis for reimbursement decisions.

Approved: September 2005.

Reviewed and updated by the Professional Practice Committee and approved by the AANEM Board June 2014, January 2020, August 2025, and July 2026.

References

1. American Association of Neuromuscular & Electrodiagnostic Medicine. [Definition of Real Time Onsite.](#)
2. American Association of Neuromuscular & Electrodiagnostic Medicine. [Recommended Policy for Electrodiagnostic Medicine.](#)
3. American Association of Neuromuscular & Electrodiagnostic Medicine. [Who is Qualified to Practice Electrodiagnostic Medicine?](#)
4. Centers for Medicare & Medicaid Services. Available at <https://data.cms.gov/provider-summary-by-type-of-service/medicare-physician-other-practitioners>. May 2025 Accessed.
5. Werner RA, Cavender GD: Evaluating radiculopathy: How useful is electrodiagnostic testing? *Phys Med Rehabil: State of the Art Review* 1999;13(2):251-261.