



Practice parameter

Electrodiagnostic studies in ulnar neuropathy at the elbow

Summary statement of the American Association of Electrodiagnostic Medicine, American Academy of Neurology, and American Academy of Physical Medicine and Rehabilitation

Editor's Note: The following is a summary statement of the American Association of Electrodiagnostic Medicine's (AAEM) *Practice Parameter for Electrodiagnostic Studies in Ulnar Neuropathy at the Elbow*. This summary statement of the practice parameter was developed jointly by the Quality Assurance Committee of the AAEM and the Quality Standards Subcommittee of the American Academy of Neurology and was endorsed by the AAN and AAPM&R. It is reproduced here with the permission of the AAEM.

Introduction. Ulnar neuropathy at the elbow (UNE) is a common peripheral mononeuropathy, second only to carpal tunnel syndrome in incidence. The electrodiagnostic evaluation of UNE is frequently complex and challenging to even the most experienced electrodiagnostic medicine consultant. This document defines the standards, guidelines, and options for electrodiagnostic studies of UNE based on a critical review of the literature.

Literature review. A Medline search was conducted for literature in English from 1983 through 1996 under the Medical Subject Headings (MeSH) 1) ulnar nerve, 2) electrodiagnosis, 3) nerve compression syndromes, 4) neural conduction, and 5) elbow. The initial search generated 282 article titles with abstracts. The abstracts were reviewed by two AAEM Quality Assurance Committee members. Of the 282 articles, 56 articles referring to electrodiagnosis and other laboratory studies to evaluate UNE were found and reviewed. The bibliographies of these 56 articles were examined and additional articles identified and reviewed. In total, 398 titles, abstracts, and papers were evaluated for inclusion in the review.

A total of 19 of the 398 articles and abstracts met five or six literature classification criteria; six of these articles were excluded from subsequent analysis for various reasons. For example, some investiga-

tors performed ulnar nerve conduction studies (NCSs) in the course of looking primarily at other phenomena, such as the effects of age on the conduction properties of multiple nerves, the correlation between clinical and electrodiagnostic findings, or the difference between proximal and distal nerve segments; the findings therefore have scant or no applicability to the evaluation of the clinical problem of UNE. Studies of normal control subjects met a maximum of five of five criteria; studies of patients with UNE met a maximum of six of six criteria.

The remaining 13 articles formed the basis for the recommendations of this report. The findings of these and other additional studies are reviewed in the *Literature Review of the Usefulness of Nerve Conduction Studies and Electromyography in the Evaluation of Patients with Ulnar Neuropathy at the Elbow*, developed by the AAEM. This literature review is currently available through the AAEM Executive Office and will be published in a later issue of *Muscle & Nerve*. The conclusions and recommendations are based on a review of Class A evidence from 702 normal control elbows and 564 UNE elbows. The 13 articles reported sensitivities of electrodiagnostic studies ranging from 37% to 86% and specificities of 95% or greater.

Literature classification criteria.

1. Prospective study.
2. Diagnosis of UNE in the patient population based on clinical criteria independent of the electrodiagnostic procedure under evaluation.
3. Electrodiagnostic procedure described in sufficient detail, or reference provided to a published technique, to permit duplication of the procedure; the position of the elbow was stated and the same elbow position used throughout the study.
4. Limb temperature monitored and reported.
5. Reference values for the electrodiagnostic procedure obtained with either a) concomitant studies

Developed by the AAEM Quality Assurance Committee: William W. Campbell, MD, MSHA, Chair; Dorothy J. Carroll, MD; Michael K. Greenberg, MD; David A. Krendel, MD; Rhonda M. Pridgeon, MD; Kadambi P. Sitaram, MBBS; and Faren H. Williams, MD.

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Address correspondence and reprint requests to AAN, 1080 Montreal Ave., St. Paul, MN 55116.

of a reference population or b) previous studies of a reference population in the same laboratory.

6. Criteria for abnormal findings clearly stated, and defined in statistical terms, e.g., range, mean \pm 2 standard deviations (SD), from data derived from the reference population.

Definitions for classification of evidence.

1. Class A evidence: studies that meet all six literature classification criteria, or five criteria in the case of studies only on normal control subjects.
2. Class B evidence: studies that meet four or five literature classification criteria, or less than five criteria in the case of studies only on normal control subjects.
3. Class C evidence: studies that meet three or fewer literature classification criteria.

Definition of practice recommendation strengths. The strength of a recommendation or conclusion is based on the quality and consistency of supporting evidence, as well as the magnitude of benefits, risks, and costs. The following rating system is used:

1. **Practice standards:** generally accepted principles for patient management which reflect a high degree of clinical certainty (Class A evidence).
2. **Practice guidelines:** recommendations for patient management which reflect moderate clinical certainty (Class B evidence).
3. **Practice options/advisories:** other strategies for patient management for which the clinical utility is uncertain (Class C evidence).

Conclusions and recommendations. The following conclusions and recommendations are made for the electrodiagnostic medicine evaluation of patients with suspected UNE. The recommendations are given in greater detail in the literature review developed by the AAEM. *These recommendations are practice guidelines unless otherwise indicated.*

General principles:

1. Ulnar sensory and motor NCSs should be performed with surface stimulation and recording. Limb temperatures should be monitored and maintained in a reference range and should be reported if outside a reference range. Corrections in conduction for temperature, if any, should be indicated in the report, although warming cool limbs and repeating the studies is preferable when possible. *This recommendation is a practice standard.*
2. If ulnar sensory or motor NCSs are abnormal, further NCSs should be carried out to exclude a diffuse process. *This recommendation is a practice standard.*

Elbow position:

3. Ulnar motor NCS reports should specify the elbow position used during the performance of the studies and the reference values employed. The technique used should be the same as that used to determine the reference values. The same elbow position should be employed during both stimulation and measurement. *This recommendation is a practice standard.*
4. The most logical elbow position for ulnar NCSs is moderate flexion; 70° to 90° from horizontal. Moderate flexion provides the greatest correlation between surface skin measurement and true nerve length.
5. Across-elbow distances used in evaluations performed with the elbow in moderate flexion have been in the range of 10 cm; this distance correlates best with published reference values. However, studies performed over this distance may mask a focal abnormality. Normal results over a 10-cm distance may occur despite a significant focal lesion.
6. Stimulation more than 3 cm distal to the medial epicondyle should be avoided as the nerve is usually deep within the flexor carpi ulnaris muscle by this point and there is substantial risk of submaximal stimulation.

Technique:

7. When using *moderate-elbow flexion*, a 10-cm across-elbow distance, and surface stimulation and recording, the following suggest a focal lesion involving the ulnar nerve at the elbow: Multiple internally consistent abnormalities are more convincing than isolated abnormalities, which raise the possibility of artifact or technical mishap. (Note: The following are listed in order of strength of evidence):
 - a. Absolute motor nerve conduction velocity (NCV) from above elbow (AE) to below elbow (BE) of less than 50 m/s.
 - b. An AE-to-BE segment greater than 10 m/s slower than the BE-to-wrist (W) segment. The literature is inadequate to make a recommendation regarding the percent of slowing.
 - c. A decrease in compound muscle action potential (CMAP) negative peak amplitude from BE to AE greater than 20%; this suggests conduction block or temporal dispersion indicative of focal demyelination. This presumes that anomalies of innervation, i.e., Martin-Gruber anastomosis, are not present.
 - d. A significant change in CMAP configuration at the AE site compared to the BE site. This presumes that anomalies of innervation, i.e., Martin-Gruber anastomosis, are not present.
 - e. Nerve action potential (NAP) recording may aid in diagnosis, especially in patients with only sensory symptoms. However, NAP studies have significant pitfalls and limitations. Before rely-

- ing on changes in NAP amplitude or conduction velocity (CV) as a diagnostic criterion for UNE, the examiner should be fully aware of the content and technical details of the applicable literature. Abnormalities of the distal sensory or mixed NAP, especially loss of amplitude, are nonspecific and nonlocalizing features of UNE.
- f. The literature is not adequate to make a recommendation regarding conduction through the AE-to-W or BE-to-W segments.
8. If ulnar motor conduction studies with stimulation at the wrist, above and below the elbow recording from the abductor digiti quinti are inconclusive, the following procedures may be of benefit:
 - a. NCSs recorded from the first dorsal interosseous (FDI) muscle. Because of differential fascicular involvement, fibers to the FDI may show abnormalities not evident when recording from the abductor digiti minimi.
 - b. An inching study, exploring for changes in the CMAP amplitude, area or configuration, or for abnormal changes in latency over precisely measured 1- or 2-cm increments from AE to BE. The most convincing abnormality involves both a change in latency and a change in either amplitude, area, or configuration; however, latency changes in isolation may be significant.
 - c. With severe UNE, distal wallerian degeneration may slow the BE-to-W segment secondarily and make localization difficult. Comparison of the AE to BE segment with the axilla-to-AE segment may be useful under such circumstances, but normative data is scant. *This recommendation is a practice option.*
 - d. NCSs to forearm flexor muscles are not generally useful, but may be employed as a last resort with awareness of the technical limitations and the applicable literature. *This recommendation is a practice option.*
 - e. Depending on the results of NCSs, needle electromyography (EMG) may be indicated. Needle examination should always include the FDI muscle, which is the most frequent muscle to demonstrate abnormalities in UNE, and ulnar innervated forearm flexor muscles. Neither changes limited to the FDI, nor sparing of the forearm muscles, exclude an elbow lesion. If ulnar innervated muscles are abnormal, the examination should be extended to include nonulnar C8/medial cord/lower trunk muscles, to exclude brachial plexopathy, and the cervical paraspinals, to exclude radiculopathy.

Recommendations for future research. It is recommended that:

1. Future evaluations of electrodiagnostic studies in UNE patients be constructed to:
 - a. Meet all six literature classification criteria described in this report.
 - b. Report the specific clinical criteria used for the diagnosis of UNE.
 - c. Include calculation of the sensitivity and specificity of the test results.
 - d. Include sufficient data to permit comparison to the results of previously published studies.
2. An outcome study be performed to assess the harm, benefit, and cost of performing NCSs and needle EMG in patients with symptoms suggestive of UNE. The value of electrodiagnostic studies in predicting treatment outcomes, including surgery, deserve future study.
3. The AAEM reviews this report every 5 years and updates the report as necessary.

Disclaimer

This report is provided as an educational service of the AAEM. It is based on an assessment of the current scientific and clinical information. It is not intended to include all possible methods of care of a particular clinical problem, or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAEM recognizes that specific patient care decisions are the prerogative of the patient and his or her physician and are based on all of the circumstances involved.

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