

## American Clinical Neurophysiology Society

### Guideline 10: Guidelines for Writing Clinical Evoked Potential Reports

These Guidelines are intended as a general outline for writing reports on clinical evoked potential studies. They do not apply to evoked potentials recorded for research or special purposes, such as monitoring in the operating room and the intensive care unit, long-latency event-related potential testing, or topographic mapping.

The clinical evoked potential report should provide a basic minimum level of information allowing a knowledgeable reader to judge the adequacy and reliability of testing and the accuracy of interpretation. Further numerical data or descriptive information may be added to this basic minimum as desired. Numerical data allow a better evaluation by an informed reader than does a purely descriptive report.

The clinical report should also provide a meaningful guide to the referring physician concerning relevance of the electrophysiologic findings to the clinical problem under investigation.

The format of presentation should follow a logical and orderly sequence. As test reports often travel widely, local idiosyncratic terminology should be avoided for the sake of clarity.

An evoked potential report should generally include: identification, clinical information, technical data, results, description, and interpretation (including impressions and clinical correlation).

#### I. IDENTIFICATION

All reports should contain as a basic minimum: facility name, laboratory name, address, and phone number, test date, test identification number, requesting physician's name, interpreting physician's name, patient name, age, and gender, and patient identifying number if appropriate.

Age is an important variable in all normative studies. Age in infants should be recorded as weeks of conceptional age (CA), as opposed to gestational or chronologic age until age 60 weeks CA. Age in children should be recorded in months until age 36 months. Thereafter, age should be reported in years.

Gender may be a statistically significant variable in some normative studies.

#### II. CLINICAL INFORMATION

1. A concise statement of the clinical question being investigated should be provided in the report, but detailed clinical history and physical examination findings are unnecessary.

2. Physical findings that may affect test results, and that are confirmed by examination in the laboratory, should be recorded. For instance, in VEP testing: visual acuity at the time of testing, with mention made if testing is performed with or without corrective lenses; pupil asymmetry; visual field defects; and inability to fixate or follow stimuli visually. In BAEP testing: auditory threshold as determined by the test stimulus; inability to visualize the tympanic membrane, if attempted; and the results of formal audiometric examination, if available. In SEP testing: a measure of patient height, extremity length, and/or distance from site of stimulus to nerve and

spinal recording site if such measures are used to determine peripheral nerve or central pathway function; and dysmorphic features affecting the extremities, spine, or skull.

3. Patient behavior affecting the reliability of testing should be mentioned in the report. In general, patient restlessness may markedly decrease signal-to-noise ratios. In VEP testing, changes in level of arousal or in degree of cooperation in maintaining fixation may have dramatic effects on responses.

4. The use of sedative or hypnotic drugs during the examination should be specified in the report. Any medication affecting the nervous system used by the patient should also be recorded.

5. Any departure from the usual laboratory protocol of patient examination should be documented in the report.

6. Body temperature should be recorded when testing comatose patients. Peripheral limb temperature should also be noted when SEPs are recorded if peripheral conduction velocity is to be determined.

### III. TECHNICAL DATA

1. Standard laboratory protocol settings for amplifier and averaging parameters need not be reported. Deviations from standard protocols that may materially affect test results (such as changes in filter settings) should be recorded.

2. Recording sites and derivations should be stated, and the evoked response peaks recorded from each site should be indicated.

3. Stimulus parameters affecting test interpretation should be reported. For all modalities of testing this should include **(a)** whether unilateral or simultaneous bilateral stimulation, or both, were employed and **(b)** the stimulus rate.

Specific information for each stimulus modality should be included. For instance, in VEP testing: the pattern check size (in minutes of arc at the subject's eye) and field size (in degrees of arc at the eye); if partial fields are tested, the field location and size and the location of the fixation point relative to the edge of the field; if flash stimuli are used, the type of stimulus (stroboscope, LED, goggles, etc.), whether the eyes are open or closed, if the pupils are dilated pharmacologically or for pathologic reasons, if the patient is light or dark adapted; and if gratings are used, their spatial frequency (in cycles/degree). In BAEP testing: the stimulus intensity and polarity (rarefaction, condensation, or both); the frequency and duration of tone stimuli, if used; the intensity of masking, if used; and the type of transducer, if other than earphones. In SEP testing: the stimulated nerve and site and the stimulus intensity in relation to sensory or motor threshold.

The actual stimulus current or voltage used need not be recorded, but any difficulty obtaining an adequate response, whether sensory or motor, should be described.

4. It is optional whether or not copies of response waveforms are sent with the report, but copies should be made available on request. When copies of waveforms are included, they should be completely labeled, including at least the following information: patient identification, test identification, date, recording and averaging parameters, recording sites, stimulus parameters, response polarity, calibration, and time base, and identification of measured response peaks.

Copies of waveforms should display replicated results. Grand averages of individual averages may also be sent if available.

## **IV. RESULTS**

1. Mention should be made of the number of averages replicated and the degree of reproducibility of test results.

2. All numerical values, both directly measured and derived, used in evaluation of the test should be included in the report. Graphic presentation of values may be a useful addition.

3. Latencies should refer to peaks described in Guideline Nine. If nonstandard nomenclature is used for peak identification, the equivalent terminology should be indicated, if possible. It should be noted if onset rather than peak latency of components is measured.

4. If amplitude is reported, the mode of measurement should be specified (from computer “0 volts,” from pre-stimulus baseline, or from preceding or following peak).

5. Normal control population values used in evaluating test results should be included in the report.

The normative data allow the reader to form his own impression of the degree of abnormality present, independently of the interpreter’s opinion. The data also allow some comparison to other generally accepted norms.

It should be noted if normative data have been transformed, and how, before determining tolerance or other limits; whether measured values have been transformed prior to comparison with normative values; and whether age- or gender-specific norms are used.

## **V. DESCRIPTION**

1. Normal response waveforms need not be described. If desired, a simple statement that the waveforms conform to normal configuration is sufficient.

2. Deviations from normal should be described succinctly, with specific reference to the type of abnormality present. Types of abnormality may include alterations of latency, interpeak latency, amplitude, interside latency or amplitude differences, waveform, and topography. However, measures of abnormality that are subjective or controversial, such as waveform or topography, should be described in much greater detail than the more objective numerical or statistical types of abnormality.

## **VI. INTERPRETATION**

1. Impression. **(a)** The impression is a statement of the interpreter’s opinion about the normality or abnormality of the test. The statement should be concise and should not imply clinically significant abnormality unless the findings clearly justify this.

Not all evoked potentials can be characterized as normal or abnormal. It is sometimes more appropriate to report results as unusual or technically inadequate for interpretation. An unusual test may show atypical waveforms and topographic or other characteristics that have no clear clinical correlation. It may best be described as showing a pattern of unknown clinical significance. A technically inadequate test may show highly variable results on replications, with low signal-to-noise ratio, or an inability to record peaks necessary for test interpretation.

Additional testing exceeding that of the standard protocol may sometimes be necessary. This may include (but is not limited to): testing with partial field stimuli to evaluate a VEP “W” waveform response to full-field stimulation, or with different check sizes to distinguish foveal from parafoveal pathology; recording from electrodes in the external auditory canal to evaluate BAEP responses not showing wave I; and recording from multiple sites to determine the separate contributions of N13 and N14 peaks in median nerve SSEP testing.

**(b)** The degree to which test results deviate from normal control values may be graded (such as mildly, moderately, or severely abnormal). This can reflect the degree of certainty that the abnormality is significant and not a false-positive result. Such grading should be based on statistical rather than subjective criteria.

Because of possible lack of correlation between degree of clinical and electrophysiologic abnormality, any reference of the degree of *clinical abnormality* should be made with caution, unless it has been measured during testing (such as visual acuity).

There are no means to determine from a single clinical evoked potential study the likelihood of reversibility or irreversibility of the electrophysiologic alteration and the severity of the underlying pathology, if any.

2. Clinical Correlation. **(a)** Normal findings may need to include an explanation that the test does not exclude disease or that the test does not answer the clinical question being investigated. Referring physicians may not be aware of the limitations of evoked potential testing.

**(b)** It should be made clear when specific clinical problems are not adequately tested for by the laboratory protocol utilized. For instance: a normal VEP to large-check, large-field stimulation does not exclude poor visual acuity from macular or occipital lobe disease; a normal BAEP does not rule out deafness from cortical disease; and a normal SEP does not exclude localized nerve root or anterior spinal cord dysfunction.

**(c)** The clinical correlations of abnormal test results should include a description of the approximate site of dysfunction and the possible neurophysiologic cause of the abnormality. If the actual site of dysfunction cannot be specifically determined from the test, then the overlapping effects of sensory receptor, peripheral nerve, and central sensory pathway abnormalities should be mentioned. Determination of the specific central site of a response abnormality is generally not possible at the current state of understanding of the generation of evoked potential waveforms. Thus, it is more appropriate to designate an approximate region of dysfunction within the neuraxis where possible.

**(d)** The clinical correlation statement should not imply that the test results in themselves are diagnostic of a specific lesion or clinical entity. They may provide support for such a clinically suspected lesion or disease process, but frequently do not exclude other possibilities. It is difficult and potentially misleading to attempt detailed clinical correlations of test results based on limited information summarized on the request form for neurophysiologic evaluation. Frequently, multiple disorders are present in one patient. A test abnormality sought to confirm one disease may, in fact, be produced by a separate, unrelated condition.

**(e)** It is appropriate to state that follow-up testing may clarify uncertain results.