

## **ELECTRONEURODIAGNOSTIC PROGRAM GRADUATE COMPETENCIES FOR PERFORMING EVOKED POTENTIAL STUDIES – ADD-ON EP**

The following graduate competencies for performing evoked potential studies (EP) are recommended as standards for the education of post-secondary students in Electroneurodiagnostic (END) programs with add-on EP. Employers can expect the graduates of CAAHEP-accredited END with add-on EP programs to be competent in the EP areas defined below.

**A. The graduate provides a safe recording environment by:**

1. verifying identity of the patient;
2. cleaning electrodes after each procedure;
3. following universal precautions for infection control;
4. attending to patient needs appropriately;
5. recognizing/responding to life-threatening situations;
6. being certified to perform cardiopulmonary resuscitation;
7. following laboratory protocols for sedation;
8. complying with lab protocols for emergency and disaster situations;
9. maintaining instrument/equipment in good working order; and
10. taking appropriate precautions to ensure electrical safety.

**B. The graduate establishes rapport with the patient and patient's family by:**

1. using personal communication skills to achieve patient relaxation/cooperation;
2. explaining all test procedures including activation procedures;
3. explaining the electrode application method (paste, collodion, etc.);
4. interacting on a level appropriate to patient's age and mental capacity; and
5. maintaining respect and patient confidentiality.

**C. The graduate evaluates the patient to:**

1. determine the patient's mental age, mental state, and comprehension level;
2. accommodate for disabilities and/or special needs;
3. note the patient's overall physical condition; and
4. decide appropriate method of electrode application.

**D. The graduate prepares a patient data sheet that includes:**

1. patient information (name, age, gender, ID number, doctor, etc.);
2. procedure number, recording time, date, and graduates name or initials;
3. significant, relevant medical history and clinical findings specific to the modality studied;
4. patient's mental, behavioral, and consciousness states;
5. all patient medications; and
6. results of other clinical studies relevant to the EP modality being tested, such as audiogram for BAEP, visual field testing for VEP, and nerve conduction studies for SEP.

**E. The graduate follows a method of electrode application that includes:**

1. measuring the patient's head using the International 10/20 system and/or Queen's Square method of electrode placement as appropriate for the evoked potential;
2. cleaning patient's scalp and skin prior to electrode application;
3. using standard disc type electrodes or needle electrodes, as appropriate;
4. using additional electrodes or modified placements as needed or as indicated by lab policy;
5. applying disc electrodes with paste or with collodion and electrolyte; and
6. verifying that electrode impedance's are balanced and below 5000 ohms.

**F. The graduate verifies the integrity of the Evoked Potential instrument by:**

1. calibrating with a square pulse of appropriate amplitude and using parameters that will be used for the recording;
2. recognizing and correcting malfunctions seen with calibration, if possible;
3. having all equipment checked for safety at least twice per year or more frequently as needed or as indicated by department policy; and
4. maintaining individual equipment logs (safety checks, break downs, repairs, and such).

**G. The graduate obtains a standard EP record that includes:**

1. clearly resolved waveforms;
2. at least two replications demonstrating consistency of latency and amplitude measurements;
3. use of appropriate recording and stimulus parameters;
4. additional electrode derivations and other techniques as needed to enhance or clarify the abnormality; and
5. obligate peaks displayed according to recommended standard or department policy.

**H. The graduate identifies and eliminates or reduces artifacts contaminating the waveforms by:**

1. checking the quality of the raw signal regularly or whenever needed;
2. understanding the meaning and significance of artifact rejection;
3. understanding the relationship of signal to noise ratio;
4. recognizing whether the artifact is physiologic or non-physiologic;
5. identifying source of the artifact (poor electrode application, malfunctioning stimulator, or positioning of cables);
6. calculating frequency in Hz of rhythmic artifacts and understanding the effects of aliasing; proper grounding of the patient and equipment; and
7. enhancing signal to noise ratio by increasing the number of sweeps.

**I. When the EP recording is finished, the graduate:**

1. removes electrode paste/glue from patient's scalp, hair and skin;
2. prepares a detailed test data worksheet that includes: montage; time and voltage calibration scales; filter settings; side stimulated; stimulus parameters-type, (polarity, rate, duration, delay, masking, intensity, and visual angle); number of trials averaged; polarity convention; and other modality-specific relevant information such as visual acuity, hearing thresholds, limb length and height;
3. documents sedation used, dosage, and effect (if applicable);
4. marks the obligate peaks and documents their latencies and amplitudes;
5. prepares hard copy of the waveforms; and
6. stores information on electronic media according to department policy.

**J. The graduate understands:**

1. recommended criteria for assessing evoked potential abnormalities and maturation of EP components; basic electricity and electronics concepts;
2. basic functional neuroanatomy and neurophysiology;
3. anatomy of EP systems and generators of EP components;
4. medical terminology and accepted abbreviations;
5. EP correlates of certain clinical conditions such as neurologic, orthopedic, neurosurgical, and audiologic disorders;
6. pathologic and non-pathologic factors affecting EPs;
7. the technical aspects, electrical hazards, & recording techniques unique to hostile environments (ICU,OR, radiology suites);
8. EP normative data; and
9. other knowledge as detailed in the ABRET Evoked Potential Technology Practice Analysis.

**K. The graduate applies the principles and concepts of EP instrumentation to the recording by understanding:**

1. signal averaging and noise reduction;
2. analog to digital conversion including amplitude resolution, sampling rate, analysis time, sampling interval (dwell time), and Nyquist frequency;
3. the function of differential amplifiers including input impedance, common mode rejection, polarity convention, and gain;
4. effects of stimulus & recording parameters on EP waveforms;
5. electrode impedance and its importance; and
6. electrical safety.

**L. The graduate maintains and improves knowledge and skills by:**

1. reviewing EP records with clinical neurophysiologist on a regular basis;
2. reading journal articles and studying text books related to the field;
3. attending continuing education courses in clinical neurophysiology; and
4. participating in quality assurance/improvement reviews.

**M. The graduate records a technically adequate Brainstem Auditory Evoked Potential by:**

1. obtaining relevant audiologic, neurologic, and/or neurosurgical history, hearing loss, ear infections, dizziness, tinnitus, etc.;
2. assessing the patient's ear canals;
3. establishing hearing thresholds;
4. correlating elevations in thresholds with any existing hearing loss or conditions of ear structures;
5. noting the results of prior hearing evaluations;
6. using a montage derivation of vertex to ipsilateral and vertex to contralateral ears;
7. choosing the appropriate timebase, number of stimuli, sensitivity and bandpass settings;
8. choosing the appropriate click polarity, rate and intensity;
9. expressing click intensity measures in equivalent units of dBSL, dBHL or dBSPL;
10. adequate resolution of obligate waves I, III, and V;
11. using techniques to enhance wave I resolution such as an ear to ear montage derivation or using an ear canal electrode or increasing stimulus intensity;
12. measuring and calculating the absolute latencies, amplitudes and interpeak intervals of obligate peaks;
13. masking of opposite ear and understanding its use and effects; and
14. performing a latency intensity series for auditory assessment in infants & other patients whenever indicated.

**N. The graduate obtains a technically adequate Somatosensory Evoked Potential (SEP) by:**

1. obtaining relevant neurologic, orthopedic, and/or neurosurgical history or any other relevant pathway specific information such as the presence of peripheral neuropathy;
2. selecting appropriate timebase, sensitivity and bandpass settings;
3. applying the appropriate stimulating electrodes: active cathode over the nerve and anode placed distally
4. properly grounding the patient to reduce stimulus artifact;
5. selecting current of sufficient intensity and duration to elicit a motor twitch from the appropriate areas of stimulation;
6. using a montage that records responses from multiple levels of the pathway such as peripheral nerve, spinal cord, subcortical, and cortical responses;
7. adequately resolving of the obligate components of Erbs Point, N13, P14, N18, and N20 of the median nerve SEP;
8. adequately resolving of the obligate components of popliteal fossa, lumbar, N34, and P37 of the posterior tibial nerve SEP;
9. marking waveforms & calculating the absolute latencies, amplitudes and interpeak intervals of the obligate components;
10. calculating peripheral nerve conduction velocity; and
11. using additional techniques that clarify the abnormalities seen.

**O. The graduate obtains a technically adequate Visual Evoked Potential by:**

1. obtaining relevant ophthalmologic and neurologic history;
2. using a montage that records responses from both hemispheres;
3. assessing the patient's visual acuity;
4. selecting an adequate check size and positioning the patient at a distance from the pattern stimulator appropriate for the desired visual angle;
5. close monitoring of the patient's attention during the test;
6. performing the study with the same parameters and conditions used for normative studies including ambient light, pattern luminance and contrast;
7. adequately resolving peaks N75, P100, N145 ;
8. adequately resolving a "W" shaped waveform
9. measuring and calculating the absolute latency, amplitude, amplitude ratios and intraocular latency difference of P100;
10. using flash stimuli in selected patients when use of pattern reversal stimulus is not possible;
11. understanding the limitations of use of flash stimuli; and
12. using hemifield testing when indicated to clarify asymmetries or other abnormalities.