

NEURODIAGNOSTIC TECHNOLOGY PROGRAM GRADUATE COMPETENCIES FOR PERFORMING LONG TERM MONITORING PROCEDURES – ADD-ON LTM

The following graduate competencies for performing Long Term Monitoring Studies (LTM) are recommended as standards for the education of postsecondary students in neurodiagnostic technology (NDT) programs with add-on LTM. Employers can expect the graduates of CAAHEP-accredited NDT with add-on LTM programs to be competent in the areas defined below with appropriate supervision.

I. CORE KNOWLEDGE STATEMENTS

LTM graduates will have the knowledge background to interact with the patient, and obtain a quality, interpretable LTM recording that will yield information about the brain's neuronal activity. The following statements involve knowledge and concepts that are essential in collecting and processing LTM data.

A. Scope of Practice:

1. Successful completion of national board examinations (ABRET) associated with practice administered by the American Board of Registration of Electroencephalographic and Evoked Potential Technologists, Inc. [ABRET];
2. Specific training on procedures unique to LTM; and
3. Additional training on equipment specific for LTM recordings

B. Technical Skills and Other Abilities (these build on ASET's EEG technical competencies):

1. Follows American Clinical Neurophysiology Society (ACNS) and ASET guidelines for head measurement (10/20 or 10/10 international systems);
2. Is proficient in the best electrode application method using paste, collodion or electrode caps as appropriate;
3. Employs methods to ensure electrode security and integrity;
4. Follows policies for infection control;
5. Ensures electrodes and other direct patient contact supplies are cleaned and disinfected as documented in ASET infection control position statement;
6. Follows conscious sedation protocol if indicated;
7. Knows that sedation is ordered by the attending physician and administered by the resident or the staff nurse; then nursing staff monitors the patient closely;
8. Follows patient safety protocols especially those for seizure;
9. Is certified in CPR and knows hospital code for cardiorespiratory arrest;
10. Knows unit's procedures for high patient acuity (severity of patient's condition), i.e., respiratory distress or arrest codes, contagious diseases, death, etc;
11. Recognizes artifacts and minimizes or when possible, eliminates artifact on recordings in all electrically hostile units such as the operating room (OR);
12. Has knowledge of data reformatting and data reduction techniques;
13. Understands computer operations and networking sufficiently to do basic troubleshooting and to report to IT support services;
14. Is able to create custom montages using implanted electrodes or additional non-standard electrodes;
15. Recognizes EEG seizure activity and conducts seizure interview and technical neuroassessment during seizures;
16. Alerts nurse of the occurrence of subclinical and clinical seizure activity;
17. Recognizes and acts appropriately when a patient experiences a respiratory or cardiopulmonary arrest, initiating CPR procedures as needed;
18. Completes and maintains patient documentation for charges, statistics, and medical records; and
19. Demonstrates supportive behaviors necessary for age-specific care

C. Knowledge Statements in LTM

1. **The graduate has knowledge of LTM and the clinically relevant questions to be answered for each individual patient:**
 - a) Medical terminology and accepted abbreviations in LTM;
 - b) Basic electricity and electronic concepts of LTM equipment;

- c) Basic safety (patient and electrical) issues relating to the patient and the patient's LTM biomedical equipment;
 - d) Basic functional neuroanatomy and neurophysiology relevant to LTM;
 - e) Anatomical correlation of EEG waveforms;
 - f) Pathologic and nonpathologic factors affecting LTM;
 - g) Electrographic correlates of clinical conditions such as generalized tonic-clonic seizures, complex partial seizures, and nonepileptic events;
 - h) Current antiepileptic medications and their effects; and
 - i) Infection control standards (sterile techniques regarding patient and equipment).
- 2. The graduate has a basic understanding of indications for LTM:**
- a) Diagnosis of epilepsy;
 - b) Classification and characterization of seizures;
 - c) Quantification of seizures; and
 - d) Localization of seizures using surface or implanted electrodes.
- 3. The graduate maintains and improves knowledge and skills by:**
- a) Reviewing recordings with clinical neurophysiologist or by alternative criteria (such as reviewing/typing reports) on a regular basis;
 - b) Reading journal articles;
 - c) Attending didactic continuing education courses in clinical neurophysiology;
 - d) Studying textbooks related to the field of LTM and epilepsy monitoring;
 - e) Participating in hospital in-service and department conferences on LTM patients; and
 - f) Participating in quality assurance/improvement activities and reviews.
- 4. The graduate has knowledge of LTM recording options:**
- a) Scalp electrodes without video, continuous trace EEG;
 - b) Scalp electrodes with video;
 - c) Added scalp and/or sphenoidal electrodes without video; and
 - d) Added scalp and/or sphenoidal electrodes with video.
- 5. The graduate has a basic understanding of details of LTM instrumentation:**
- a) Various types of recording and storage media;
 - b) Basic concepts of digital recording, including appropriate sampling rates, aliasing, Nyquist frequency, sampling skew, amplitude resolution, horizontal resolution (analysis time), and digital video specifications;
 - c) Effects of recording parameters (filters, gain/sensitivity) on EEG waveforms;
 - d) Electrode impedance test current, appropriate amperes for electrode type;
 - e) Electrical safety issues of equipment;
 - f) Automatic seizure detection software including understanding of basic algorithms used for detection;
 - g) Parameters used in event detection, how to alter these parameters and their effects;
 - h) Computer operation including organization of file structures and maneuvering around a menu environment;
 - i) Calibration appropriate for analog or digital recording and how to make adjustments when standards are not met;
 - j) Technique of reformatting and the use of a system reference; and
 - k) Audio/video instrumentation, including digital video technology.
- 6. The graduate has knowledge of duties specific to LTM:**
- a) Using electrode application techniques appropriate for extended monitoring and for patients in critical care settings;
 - b) Reviewing events detected by automated spike/seizure detection system;
 - c) Printing EEG from stored computer data;
 - d) Selecting appropriate recording parameters and customizing these parameters based on the case;
 - e) Reviewing, analyzing, and extracting clinical events from recorded data;
 - f) Adjusting video recording system and troubleshooting problems;
 - g) Using safety precautions when caring for patients having seizures;

- h) Assisting in the care and transfer of patients; and
- i) Transporting recording equipment as needed.

7. The graduate has knowledge of various types of electrodes:

- a) Scalp – disk;
- b) Scalp – needle;
- c) Sphenoidal;
- d) Monitoring electrodes (eye movement, EMG, respiratory, etc);
- e) Intracranial electrodes;
- f) Subdural strips, grids, cylinders;
- g) Epidural strips, grids;
- h) Depth electrodes; and
- i) Different electrode metals and their effects on EEG recording.

8. The graduate has other knowledge as detailed in the ABRET Long Term Monitoring Practice Analysis.

II. COMPETENCIES NEEDED IN LTM

The LTM graduate interacts with the patient to obtain a quality, interpretable LTM recording that will yield information about neuronal activity of the brain.

A. The graduate has knowledge of the verification process to check the integrity of LTM equipment by:

- 1. Calibrating system amplifiers; and
- 2. Ensuring audio/video equipment is working properly.

B. The graduate has knowledge of how to acquire information and assists in evaluating the patient and his/her needs prior to the procedure by:

- 1. Reading medical records;
- 2. Interviewing patient;
- 3. Interviewing family/friends;
- 4. Discussing with referring physician;
- 5. Viewing previously recorded data;
- 6. Determining and accommodating the patient's age-specific needs [i.e., mental age, state, comprehension level, disability, and/or other special needs];
- 7. Providing appropriate patient education including expectations and guidelines while in the monitoring unit and explanation of technical procedures, such as limitation of movement, use of event signal devices, continuous audio/video recording, and some loss of privacy;
- 8. Answering questions relating to the LTM monitoring procedure; and
- 9. Answering questions (education/ information) related to subsequent testing procedures, Wada, PET, SPECT, psychological testing, etc.

C. The graduate has knowledge of how to prepare a basic data sheet that includes:

- 1. Patient demographic information (name, age, ID number, referring MD, etc);
- 2. Procedure information: number, recording time, date, technologist's initials;
- 3. Significant relevant medical history and clinical findings specific to procedure;
- 4. Seizure or event types, duration, and frequency, first and last event;
- 5. Patient's mental, behavioral, consciousness, and neuroassessment baseline states;
- 6. All patient medications, drug levels if available; and
- 7. Results of studies relevant to LTM (PET, MRI, neuropsychology, SPECT).

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

- 1. Identifying appropriate method of electrode application;
- 2. Checking supplies, number of electrode jackboxes, interconnector cables, and amplifiers for each patient;
- 3. Determining set-up and recording protocols including montage derivations appropriate for the patient;
- 4. Using standard precautions during patient preparation;

5. Using physician-ordered placement of additional electrodes;
6. Ensuring security and integrity of electrodes for an extended period of time;
7. Measuring the patient's head according to the International 10/20 System;
8. Cleaning patient's scalp and skin prior to electrode application;
9. Maintaining sterility of incision and implant site;
10. Discarding or autoclaving electrodes that come in contact with body fluids;
11. Placing appropriate recording reference and ground electrodes in digital recording systems and using spares whenever necessary; and
12. Assessing the patient's potential for skin breakdown and taking steps to minimize such a risk.

E. The graduate has knowledge of how to obtain a baseline recording from all intracranial electrodes used during the LTM procedure:

1. Verifies electrode recording;
2. Uses appropriate recording and stimulus parameters;
3. Is able to reformat recording, adding electrode derivations and montages or other techniques that enhance or clarify the EEG abnormality;
4. Uses sequential montage arrangement going from left to right, central to temporal, anterior to posterior, superior to inferior;
5. Verifies accuracy of input connections;
6. Determines adequacy of scalp site used for recording reference location;
7. Documents and verifies electrode input descriptors, placement and equipment associations (which electrode name from what anatomical area, plugged into which jack input); and
8. Follows all recording standards set by ACNS Guidelines for LTM.

F. The graduate has knowledge of how to identify and eliminate or reduce artifacts contaminating the recording of EEG and video:

1. Checks the quality of the signal;
2. Sets equipment gain factors and amplifier parameters appropriately;
3. Recognizes artifact as physiologic or non-physiologic;
4. Identifies source of artifact and corrects or eliminates;
5. Secures headbox/transmitter system to protect against disconnection during seizures or patient events;
6. Ensures proper grounding of patient and equipment; and
7. Recognizes artifacts related to networking and loss of connectivity.

G. The graduate has knowledge of bedside testing of patients during and after seizures:

1. Performs baseline testing appropriate to patient's age and level of development;
2. Carefully assesses patient's language function by having patient read standardized phrases or name pictures during ictal and postictal states and compares results to baseline testing;
3. Gives patients simple and complex commands during LTM procedures; and
4. Tests memory and cognitive function relative to LTM.

H. The graduate has a basic understanding of how to acquire and review selected data to discuss with clinical neurophysiologist:

1. Reviews complete data from monitoring period by some form of fast review method or reviews data extracted by a computerized automatic event detection system;
2. Extracts portions of electrographic data for interictal (both wake and sleep) and ictal samples;
3. Identifies and accurately describes the chronology of clinical correlates during an event;
4. Selects 2-3 minutes of baseline recording before and after an event;
5. Documents seizure/event, clinical behavior, time, and date;
6. Documents neuroassessment completion and time;
7. Documents LTM review on technical worksheet including:
 - a) Patient identification;
 - b) Recording parameters and system integrity check;
 - c) Electrode placement including additional electrodes, input descriptors;
 - d) Diagram of implanted electrodes;
 - e) Patient room and equipment used;
 - f) Any system malfunction and troubleshooting steps;
 - g) Mapping parameters and findings;

- h) Medication dosages and when anticonvulsants were tapered off or any other changes; and
- i) Clinical events, times, behavioral correlates, patient assessment;
- 8. Transfers data between local and network drives from acquisition to review station for data review and permanent storage;
- 9. Archives selected portions, such as patient events, for permanent storage;
- 10. Prepares a master tape of video and electrographic data;
- 11. Prints out and labels all events based on laboratory protocol;
- 12. Reviews daily chart notes regarding patient; and
- 13. Interviews patient or relatives daily to determine if events occurred and any unusual clinical behavior to confirm sensitivity of event detection system.

I. When the LTM procedure is completed, the graduate has knowledge of how to:

- 1. Disconnect patient from monitoring equipment, remove scalp electrodes from patient, and clean scalp noting and taking care of any skin breakdown;
- 2. Clean electrodes and patient equipment;
- 3. Replenish and maintain adequacy of supplies for LTM procedure; and
- 4. Store equipment, making it ready for the next procedure.

III. OTHER ASSOCIATED LTM PRACTICE STATEMENTS

A. Bedside or Intraoperative Localization of Language and Sensorimotor Cortex:

- 1. Assists the physician during motor mapping to identify specific areas of motor function;
- 2. Observes the patient carefully and documents movement or sensation during cortical mapping; and
- 3. Prepares the equipment for cortical mapping:
 - a) Accurately connects appropriate cortical inputs for electrical stimulation;
 - b) Sets up and verifies settings of biphasic electrical stimulator;
 - c) Selects and verifies current intensities for mapping;
 - d) Documents intensities used and results of stimulation;
 - e) Notes thresholds for after-discharges;
 - f) Calibrates EEG equipment prior to recording; and
 - g) Selects appropriate timebase, sensitivity and bandpass setting to record after-discharges.

B. Cortical recording in the operating room (ECoG):

- 1. Prepares patient for electrocorticography (ECoG) by explaining recording procedure and applying appropriate reference/ground electrodes;
- 2. Calibrates and sets up EEG recording equipment using appropriate filters and sensitivity settings;
- 3. Selects montages based on electrodes applied to cortex by the neurosurgeon before and during resection;
- 4. Identifies and troubleshoots artifacts encountered during the recording;
- 5. Maintains and ensures completeness of supplies used for ECoG; and
- 6. Documents electrographic findings during the recording, completing paperwork for submission to the clinical neurophysiologist.

C. The Wada Test:

- 1. Prepares equipment and supplies needed for recording in the special procedure;
- 2. Applies electrodes using the International 10/20 System of electrode placement based on ACNS guidelines;
- 3. Runs a 10-minute baseline with appropriate montage and filter settings;
- 4. Makes notations on the recording as to the time of the injection of medicine, behavioral correlates and any other changes observed during the procedure; and
- 5. Completes all paperwork associated with the Wada testing procedure.

D. Home Ambulatory 24-hour EEG:

1. Prepares equipment;
2. Prepares and educates patient on procedure:
 - a) Applies electrodes with collodion technique;
 - b) Explains take-home diary, event button, and computer;
 - c) Wraps head or has patient bring hat, scarf for travel home; and
 - d) Explains safety precautions;
3. Upon patient's return to the laboratory:
 - a) Removes electrodes and cleans scalp;
 - b) Correlates patient diary and verbal 24-hr history with acquired data;
 - c) Identifies events detected and those signaled by patient;
 - d) Identifies artifacts; and
 - e) Prints events and transfers event data for review and interpretation by clinical neurophysiologist.

E. SPECT Scan (Understands radiation safety):

1. Disconnects equipment so patient can have the SPECT procedure; and
2. Reconnects EEG recording equipment after SPECT scan.