NATIONAL COMPETENCY SKILL STANDARDS FOR PERFORMING NEONATAL ICU(NICU)/cEEG MONITORING

ICU/cEEG technologists practice in accordance with the facility policy and procedure manual which details every aspect and type of recording.

ASET – The Neurodiagnostic Society presents this document to provide national criteria for evaluating competencies for performing studies associated with continuous EEG monitoring in neonatal Intensive Care Units (NICU/cEEG) with a post-menstrual age (PMA) of less than 48 weeks. The document was revised for consistency in terminology and approved by the ASET Board of Trustees in May of 2021.

In addition to advanced EEG knowledge and technical performance, quality patient care and patient/staff interaction were considered. The technical components include those defined in ASET's published competency criteria documents: *National Competency Skill Standards for Performing an Electroencephalogram* and *National Competency Skill Standards for Long-Term Monitoring in Epilepsy*.

Section I: NICU/cEEG Monitoring Core Knowledge

The ICU/cEEG Technologist has attained the advanced level of technical knowledge, understanding of the maturation of EEG and sleep cycles (including active and quiet) at all stages of development and skills as well as the cognitive ability necessary to interact with the critical care neonatal patient and staff to ensure a high-quality cEEG recording that provides reliable information about the continuous electrophysiology of the brain.

Technical Skills and Other Abilities: The ICU/cEEG technologist:

- Follows American Clinical Neurophysiology Society (ACNS) International 10–20 system, or a reduced or modified array specific for neonate patients.
- Has knowledge of extracerebral channels including electrocardiogram, respiratory channels, eye leads (for electrooculogram) and surface electromyography leads as appropriate to recognize state changes.
- Prepares skin and applies electrodes using paste with knowledge and understanding of skin sensitivity of the neonatal patient population.
- Understands and calculates gestational age and postmenstrual age

(conceptional age).

- Is highly skilled in EEG pattern recognition and in identifying maturation for neonatal patients, as well as identifying state changes seen in critically ill neonatal patients.
- Is familiar with ACNS guideline 16, Standardized EEG Terminology and Categorization for the Description of Continuous EEG Monitoring in Neonates and can provide a technical description to the electroencephalographer, physicians and nursing staff caring for the patient.
- Possesses skills and cognitive abilities in videography.
- Possesses knowledge and skills in EEG data reformatting and artifact reduction techniques.
- Understands computer operations and networking, when applicable, sufficient to do basic troubleshooting/report to information technology support services.
- Is able to work quickly and proficiently under stressful conditions.
- Is knowledgeable of the criteria for medically induced coma.
- Is certified in Basic Life Support (BLS) and follows facility policy and procedures for respiratory or cardiopulmonary crisis.
- Verifies patient status (i.e., whether patient can be moved) with the NICU staff before preparation for EEG testing
- Is able to properly locate fontanel and understands the sensitivity of the neonatal skull anatomy.
- Understands the importance of selecting the proper techniques for securing electrodes against displacement while also taking measures to prevent skin breakdown and burns if the patient is under a warming lamp or with patients with hydrocephalus or on ECMO.
- Provides education for bedside nurse on electrode application and appropriate care during EEG monitoring.
- Follows facility policy and procedures for infection prevention relevant to the patient and equipment.
- Follows facility policy and procedures for safety procedures, patient isolation and sedation.
- Follows HIPAA policy and facility procedures for cybersecurity and safety of electronic records.

The ICU/cEEG technologist comprehends:

- Principles of critical care monitoring and relevant clinical application as reflected in the ACNS Guideline 13: Guideline on Continuous EEG Monitoring in Neonates

- Medical terminology and accepted abbreviations in ICU/cEEG as recommended by ACNS in Guideline 16: Standardized EEG Terminology and Categorization for the Description of Continuous EEG Monitoring in Neonates
- Electronic concepts relative to ICU/cEEG equipment and neonate safety
- Functional neuroanatomy and neurophysiology relevant to critical care neonatal patient monitoring
- Anatomical correlation of EEG waveforms, including interelectrode distance and the effect on the EEG recording
- Electrophysiologic correlates of clinical conditions found in critical care neonate patients such as: convulsive and nonconvulsive seizures, altered levels of consciousness, coma, sedation titration, vasospasm, intraventricular/intracerebral hemorrhage, and hypoxic ischemic encephalopathy
- Therapeutic hypothermia protocol
- The utility of current medications used in critical care; their clinical and electrophysiologic effects
- The clinical value and application of additional neurodiagnostic procedures performed on critical care patients, i.e., evoked potential studies, (EPs), transcranial doppler studies (TCDs), etc.

The ICU/cEEG technologist recognizes indications for NICU/cEEG:

- Monitoring the patient's current electrophysiologic status and evolution
- Diagnosis of clinical and subclinical seizures and non-convulsive status epilepticus,
- Traumatic brain injury, intraventricular/intracranial hemorrhage, cerebral ischemia, hemorrhage,
- Hypoxic ischemic encephalopathy
- Observing clinical signs including abnormal eye deviation, cycling and paroxysmal events, such as changes in blood pressure, tachycardia/ bradycardia or oxygen desaturation
- Levels of coma (burst suppression), and importance of vital signs and potential effect on EEG tracing
- Therapeutic hypothermia after cardiopulmonary arrest
- Subarachnoid hemorrhage (SAH), ischemia/vasospasm
- Quantification of seizures
- Localization of EEG abnormalities

The ICU/cEEG technologist is knowledgeable about NICU/cEEG recording and networking options:

- Reduced array or modified scalp electrodes specific for the neonatal patient
- Options for recording, i.e., live EEG data and trending based on neonatal practices
- Use of remote monitoring networking capabilities within the facility, if relevant
- Use of remote monitoring networking capabilities outside the facility, if relevant

The ICU/cEEG technologist understands details of NICU/cEEG instrumentation:

- Types of recording and storage media
- Concepts of digital recording including appropriate sampling rates, aliasing, Nyquist frequency, sampling skew, amplitude resolution and horizontal resolution (analysis time), digital video specifications
- Effects of recording parameters (filters, gain/sensitivity) on EEG waveforms
- Electrical safety issues of equipment

The ICU/cEEG technologist is skilled in overseeing the operation of NICU/cEEG monitoring daily tasks including:

Procedure assessment confirmation

- Correct patient identification (two patient identifiers), room and equipment used
- Skin integrity at electrode sites, daily at minimum
- Electrode attachment security, considering any changes to environment and patient's condition (i.e., addition of a heat lamp, etc.)
- Balanced electrode impedance measurements
- Appropriate recording parameters, importance of assuring good quality video and bedside waveform display, including trending

Documentation

- Electrode placement, including additional electrodes placed, or if using reduced or modified array specific for neonate patients
- Diagram update of skull defects, surgical sites, edema, intracranial pressure, monitor location, etc.
- Any skin breakdown, according to facility policy and procedures

- System malfunction and corrective measures taken
- Medication/dosage changes
- Most recent neuroassessment and clinical changes
- Convulsive or nonconvulsive seizure/event, time and date
- Monitoring (shift) report summarizing number of events, types of events, relevant EEG background changes, precautions necessary, additional procedures ordered and any other relevant information which is available for review by staff caring for the patient
- Baseline ICU monitoring values: Vital signs i.e. temperature, blood pressure, heart rate, SpO2
- cEEG analysis and technical description

cEEG Monitoring

- Follows ACNS guidelines and facility protocols for continuous monitoring in ICU
- Continuously monitors patient's EEG, video and audio in real time OR reviews trends and EEG data periodically if intermittent monitoring
- Reviews patient chart and communicates with NICU staff for updates in patient's critical test results, critical values, treatment plan and medications
- Maintains monitoring log for each patient
- Recognizes and documents critical test results, such as abnormalities in background, seizure patterns, etc. per facility policy
- Alerts appropriate interpreting physician of seizures and critical test results immediately as per facility protocol
- Follows facility protocol for communication and patient safety
- Follows facility protocols for hand-off during shift changes
- Prepares a "monitoring report" [shift report] for review by staff taking care of patient during the course of the cEEG monitoring, summarizing number of events, types of events, special studies needed, precautions necessary, and any other relevant information

Data Review/analysis

- Follows ACNS guidelines for cEEG monitoring in neonates (Guideline 13) and facility protocols for cEEG and video data review
- Reviews and reports data following the ACNS standardized EEG terminology and categorization for the description of continuous EEG monitoring in

neonates (Guideline 16)

- Reviews patient's chart notes daily or/and at shift change
- Intermittent data review: provides periodic trending analysis, and reviews/or EEG and video data review periodically- at minimum every 12 hours or per facility protocols and procedures
- Continuous real time EEG and video review- reviews, clips and annotates EEG data in real time as per facility policy and procedures
- Selects cEEG data for physician review, interpretation and clinical correlation according to department data editing policy
- Identifies and accurately describes the chronology of clinical correlates during an event
- Selects 2 to 3 minutes of baseline recording before and after an event
- Follows facility protocols for EEG annotation, clipping and archiving of data
- Transfers data between local and network drives from acquisition to review station for data review and permanent storage
- Provides preliminary technical report to electroencephalographer at minimum every 12 hours or per facility protocol
- Completes preliminary, daily and final cEEG reports

Communication

- Immediately alerts interpreting physician of the occurrence of nonconvulsive and/or convulsive seizure activity or critical pattern change noticed during continuous monitoring or per facility policy and procedures
- Responds to event button alerts, annotates the record and ensures communication of events to interpreting physician
- Periodic update to attending physicians and NICU nursing staff per facility policy and procedures
- Periodic data analysis update to the electroencephalographer regarding cEEG and patient clinical condition, at least every 12 hours if no urgent notification is warranted, or per facility policy and procedures
- Obtains updates from patient, family and/or nursing staff regarding changes in patient's level of consciousness and clinical behavior per facility policy and procedures

RECOMMENDATIONS:

- Successful completion of national board examinations (ABRET) in electroencephalography (R. EEG T.) and certification in long term monitoring (CLTM)

- Knowledge of procedures unique to critical care monitoring in neonates
- Specific training on equipment for critical care EEG recording
- Advanced knowledge of neonatal maturation of the EEG and sleep cycles
- Specific training in networks, remote access to recording equipment and review station

The ICU/cEEG technologist maintains and improves knowledge and skills by:

- Reviewing cEEG monitoring recordings with the electroencephalographer
- Reading journal articles
- Attending webinars
- Attending didactic continuing education courses in clinical neurophysiology and electroencephalography
- Studying textbooks related to the specialty of ICU/cEEG monitoring in neonates
- Participating in ICU "rounds," in-services and department conferences on ICU/cEEG monitoring in neonates
- Completing online courses
- Participating in quality assurance/improvement activities and reviews
- Achieving LTM certification and meeting recertification requirements

SECTION II- NICU/CEEG MONITORING PROCEDURE

The ICU/cEEG technologist ensures the integrity of cEEG equipment and supplies:

- Electrodes and other supplies and equipment that have direct patient contact are cleaned and disinfected according to facility infection prevention policy and procedures
- Digital calibration of EEG and all ancillary recording instruments according to ACNS guidelines, per facility policy and procedures
- Equipment safety evaluation according to facility policy and procedures
- Audio/video equipment are functioning properly
- Ensures event button is functioning properly
- Maintains individual logs on equipment malfunctions, per facility policy and procedure
- Confirms adequate storage space on recording instruments, servers, or other data storage devices to record a minimum of 24 hours of continuous data
- Confirms computer connectivity

The ICU/cEEG technologist acquires information and evaluates the patient prior to the procedure by:

- Reviewing patient's medical records
- Interviewing NICU staff and/or family as appropriate
- Communicating with physicians and nursing staff caring for the patient
- Collaborating with the electroencephalographer
- Viewing previously recorded neurodiagnostic data
- Determining and accommodating the patient's age-specific needs
- Determining and accommodating the patient's needs specific to level of alertness and physical limitations
- Providing appropriate family/staff education regarding the procedure and expectations of the monitoring process

The ICU/cEEG technologist prepares an initial patient data sheet that includes:

- Patient demographic information (name, conceptional and gestational age, head circumference, medical ID number, referring MD, etc.)
- Procedure information: number, recording time, date, technologist's initials
- Significant relevant medical history and clinical findings specific to procedure
- Patient's neuroassessment baseline state and level of consciousness
- All patient medications
- Baseline NICU monitoring values: ICP, blood pressure, heart rate, ventilation
- Results of studies relevant to cEEG (MRI, CT, SPECT, angiogram, other neurodiagnostic studies)

The ICU/cEEG technologist ensures a method of electrode application that includes:

- Follows American Clinical Neurophysiology Society (ACNS) International 10–20 system, or a reduced or modified array specific for neonate patients.
- Has knowledge of extracerebral channels including electrocardiogram, respiratory channels, eye leads (for electrooculogram) and surface electromyography leads as appropriate to recognize state changes.
- Know how to select alternate electrode sites, as needed, to avoid scalp IVs, head wounds, halos, etc.
- Following facility policy and procedures regarding infection prevention during

patient preparation that includes maintaining sterility of head wounds, incisions and intracranial monitor areas

- Selecting appropriate method of electrode application
- Using disposable products when possible (i.e., using MRI/CT scan safe electrodes when possible)
- Assessing the risk for skin breakdown daily (at minimum) at the electrode application site and using (and documenting) appropriate electrode application technique for patients at risk (edema, cardiac patients, hypoperfusion) according to facility policy and procedures
- Placement of appropriate recording reference and ground electrodes in digital recording systems
- Securing headbox/transmitter system to ensure patient safety and protect against disconnection during patient movement

The ICU/cEEG technologist obtains a baseline cEEG recording from all electrodes used during the cEEG procedure and:

- Verifies electrode recording integrity
- Assesses adequacy of scalp site used for recording reference location
- Determines set-up and recording protocol including reduced and modified electrodes and montage derivations appropriate for the neonatal population
- Uses recording and stimulus parameters appropriate for cEEG, and test for reactivity as appropriate
- Is able to reformat data, adding electrode derivations and montages or other techniques that enhance or clarify the EEG abnormality
- Uses sequential montages according to facility policy and procedures or ACNS guidelines
- Displays most appropriate montage and/or trending on bedside monitor for staff reference, i.e., anterior/posterior chain

The ICU/cEEG technologist communicates with NICU staff regarding:

- Type of electrodes used and related precautions (i.e., MRI-, CT-compatible or not)
- The importance of keeping the patient on video/camera
- How to move patient without jeopardizing electrode security
- How to check head wrap for tightness and to loosen as needed

- Disconnecting electrodes appropriately, i.e., to transport patient for imaging studies
- Documenting events and comments into the computer
- Type of networking connections used and how to correct loss of connectivity
- Who to contact regarding equipment issues
- Who to contact regarding clinical issues
- How to troubleshoot electrodes if necessary

The ICU/cEEG technologist identifies and eliminates or reduces artifacts contaminating the recording of cEEG and video by:

- Analyzing the quality of the recording
- Recognizing artifact as physiologic or non-physiologic
- Ensuring proper grounding of patient and equipment
- Correcting, eliminating or monitoring artifact as appropriate
- Documenting artifacts that cannot be avoided, i.e., patting patient, patient suckling, oscillating vents, etc.
- Performing established protocol to confirm stimulus induced electrographic changes
- Optimizing equipment amplifier parameters
- Articulating artifact-producing instrument or device adequately for bio-med to troubleshoot if needed

The ICU/cEEG technologist ensures the following after completion of the cEEG procedure:

- Disconnection of patient from monitoring equipment and removal of electrodes
- Documentation of any skin breakdown per facility policy and procedures
- Proper disposal of disposable electrodes and procedure products
- Proper cleaning/disinfecting/sterilizing of reusable application products per facility policy and procedures
- Proper cleaning/disinfecting of cEEG equipment per facility policy and procedures
- Restocking cEEG supplies per facility policy and procedures
- Relocation of equipment to assigned storage area

- Completes and maintains patient documentation for charges, statistics and medical records

* Critical test results – any values/interpretations where delays in reporting may result in serious adverse outcomes for patients. MA Coalition for Prevention of Medical Errors; www.macoalition.org/document/CTRPractices.pdf

-- Approved by ASET Board of Trustees May 6, 2021