Examination in General Clinical Neurophysiology

I. Basic physiology and instrumentation (20%)

- A. Physiology
 - 1. Anatomy of neural generators
 - 2. Mechanisms of EEG and evoked potential generation
 - 3. Pathophysiology of abnormal waveforms
- B. Instrumentation and Recording
 - 1. Basic electricity and electronics
 - 2. Amplifiers
 - 3. Filters
 - 4. Principles of EEG digitalization
- C. Electrical safety
- D. Electrodes and montages
- E. Determination of brain death and ECI

II. Routine EEG (30%)

- A. Normal EEG
 - 1. Maturational changes and normal findings across the age spectrum: Neonatal, pediatric, adult, elderly
 - 2. Normal waking and sleep patterns
 - 3. Normal variants
 - 4. Activation procedures
- B. Abnormal EEG
 - 1. Neonatal and childhood encephalopathies
 - 2. Interictal epileptiform abnormalities
 - 3. Focal background abnormalities
 - 4. EEG correlates of encephalopathy
- C. Drug and treatment effects
- D. Artifacts

III. Epilepsy monitoring (20%)

- A. Seizure localization
- B. Correlation of interictal EEG findings with seizure type / epilepsy syndrome
- C. Correlation of behavioral and EEG changes
- D. Non-epileptic events (functional and physiological)
- E. Planning and interpretation of intracranial monitoring

IV. Critical Care EEG Monitoring (10%)

- A. Periodic and Rhythmic Patterns/ Standardized terminology
- B. Quantitative EEG

C. ICU specific artifacts

V. EP and IOM (15%)

- A. Clinical evoked potentials visual, brainstem auditory and somatosensory
 1. Stimulation and recording techniques2. Presumed generators of major waveforms
 - 3. Criteria for abnormality
 - 4. Clinical correlation of normal/abnormal findings
- B. Intraoperative monitoring
 - 1. Impact of anesthetics, environmental and systemic factors on monitoring 2.SEP/MEP/EMG monitoring for spinal cord surgery
 - 3.BAEP monitoring for brainstem surgery
- VI. Sleep (5%)
 - A. Recognition of sleep stages and arousals
 - B. PSG findings in common sleep disorders
 - C. Interpretation of MSLT

American Board of Clinical Neurophysiology Epilepsy Monitoring Exam Content Outline

The Epilepsy Monitoring Track will contain more case-based items and will incorporate video segments.

- A. Correlation of interictal EEG with seizure type 10%
 - 1. Partial onset
 - 2. Secondarily generalized
 - 3. Primary generalized
 - a. Convulsive
 - b. Nonconvulsive

B. Identification of various patterns of ictal onset, propagation, and resolution along with their localizing significance in scalp recordings - 25%

- 1. Focal onset seizure
- 2. Generalized convulsive seizure
- 3. Generalized nonconvulsive seizure
- 4. Syndromes
 - a. Hypsarrhythmia electrodecremental seizures
 - b Lennox Gastaut syndrome
 - c. Electrical SE during slow sleep
 - d. Landau-Kleffner syndrome
- 5. Recognition of non-ictal events & patterns
 - a. Artifacts
 - b. Nonepileptic paroxysmal patterns
- 6. Technical aspects
 - a. Appropriate recording montages
 - b. Activation techniques
 - c. Other approaches that may assist in event interpretation

C. Recognition of clinical manifestations of various seizure types, and their appropriate classification -20%

- 1. Simple partial
- 2. Complex partial
 - a. Automatisms
 - b. Lateralizing signs
 - c. Localizing signs
- 3. Secondarily generalized
 - a. Lateralizing signs
 - b. Localizing signs
- 4. Primary generalized
 - a. Convulsive
 - b. Absence
- 5. Myoclonic

- 6. Atonic
- D. Identification and localization of neonatal seizures 6%
 - 1. Interictal EEG patterns
 - 2. Ictal EEG patterns
 - a. Focal
 - b. Multifocal
 - 3. Clinical manifestations
- E. Recognition of behavioral features suggestive of non-epileptic events 15%
 - 1. Psychogenic
 - 2. Arrhythmia
 - 3. Parasomnia
 - 4. Other
- F. Planning and Interpretation of Intracranial Monitoring 12%
 - 1. Indications for intracranial monitoring
 - 2. Choice of intracranial electrodes
 - a. Subdural strips
 - b. Grids
 - c. Depth electrodes
 - 3. Interictal epileptiform activity
 - 4. Ictal activity
 - a. Identification of seizure onset
 - b. Localization
- G. Evaluation of patients for epilepsy surgery 12%
 - 1. EEG findings leading to
 - a. Temporal lobectomy
 - b. Corpus callosotomy
 - c. Multiple subpial transection
 - 2. EEG and the intracarotid amobarbital test (Wada)
 - 3. Intraoperative electrocorticography
 - a. Uses
 - b. Limitations

American Board of Clinical Neurophysiology Neurophysiologic Intraoperative Monitoring Exam Content Outline

The NIOM Track will contain more complex multiple-choice questions focusd on all aspects of Neurophysiologic Monitoring. Candidates will have two hours to complete 100 items.

I. Basic NIOM techniques – 20% (Methodology and Principle/Neurophysiologic Anatomic Correlation)

- A. SEP
- B. MEP
- C. BAEP
- D. EEG
- E. ECoG
- F. EMG/NCS
- G. VEP
- H. Others

II. Planning an NIOM procedure – 5%

- A. Customized multimodal technique for monitoring and mapping
 1. Extracting the necessary information from patient history and exam
 - 2. Choosing the appropriate techniques
 - 3. Foreseeing challenging recordings (poor baselines, changes with position)
- B. Discussing the plan with surgical/anesthesia teams

III. Live NIOM monitoring and mapping – 40%

- A. Critical steps of different surgical procedures
- B. Interpretation of monitoring results: expected patterns of neurophysiologic changes and
 - rophysiologic changes and
 - mechanisms of injury
 - C. Management of the neurophysiologic changes
 - D. Interpretation of mapping results
 - E. Communication in the operating room and documentation

IV. Anesthetic effects on neurophysiologic recordings – 15%

- A. SEP
- B. MEP
- C. BAEP
- D. EEG
- E. ECoG
- F. EMG/NCS
- G. VEP

- H. Anesthesia not modality related
- I. Others

V. Operating room procedures – 15% (Equipment/networking issues and technical troubleshooting)

- A. NIOM equipment, hardware and software (e.g., amplifiers, filters, averaging, electrical issues)
- B. Other NIOM equipment (e.g., electrodes, stimulators, cables, connectors)
- C. Networking/Remote access
- D. Anesthesia and OR equipment, sterilization, safety in the operating room.

VI. Ethical and medicolegal issues – 5%

- A. ACNS guidelines
- B. AANEM guidelines
- C. AAN guidelines
- D. Billing rules/CPT coding
- E. Standard of care and other medicolegal issues
- F. Other

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American Board of Clinical Neurophysiology Pediatric EEG Exam Content Outline

I. Pediatric Electroencephalography – 35% (Infant to adolescent)

- A. Age-related normal patterns
 - 1. Wakefulness
 - 2. Drowsiness
 - 3. Sleep
- B. Benign variants and variants of unknown clinical significance
- C. Non-epileptiform abnormalities
- D. Epileptiform abnormalities
 - 1. Interictal
 - 2. Ictal
- E. Medication effects
- F. Activation procedures
 - 1. Hyperventilation
 - 2. Photic stimulation
- G. Artifacts

II. Pediatric Prolonged Monitoring – 35%

- A. Clinical correlation of EEG with behavior/seizure type/epilepsyrelated syndrome
- B. Seizure semiology
- C. Localization and propagation of seizures
- D. EEG in relation to non-epileptic events
- E. Periodic, coma and seizure patterns
- F. Status epilepticus

III. Neonatal EEG – 30%

- A. Basic EEG characteristics of premature and term neonates
- B. Age-related EEG waveforms
- C. Ontogeny of sleep/wake cycling
- D. Non-epileptiform abnormalities
- E. Epileptiform abnormalities
- F. Clinical correlation of EEG with medical condition/epilepsy-related syndrome

American Board of Clinical Neurophysiology Critical Care EEG Monitoring Exam Content Outline

- I. Terminology 15%
 - A. Standardized critical care EEG nomenclature
 - B. Periodic discharges and modifiers
 - C. Rhythmic delta activity and modifiers
 - D. Clinical correlation
- II. Technical aspects of recording 5%
 - A. Electrodes
 - B. Montages
 - C. Troubleshooting
- III. Background patterns 15%
 - A. EEG correlates of different types of encephalopathy
 - B. EEG continuity and reactivity
 - C. Medication effects
- IV. Artifacts 10%
 - A. Physiological
 - B. Non-physiological
- V. Quantitative EEG 25%
 - A. Basic principles of qEEG and trending
 - B. Clinical application
 - a. Identification of seizures
 - b. Identification of ischemia
 - c. Recognition of artifacts
- VI. Indications for long term ICU EEG monitoring 5%
 - A. Seizures
 - B. Cerebrovascular disease
 - C. Coma and altered consciousness
- VII. Seizures and status epilepticus 15%
 - A. Non-convulsive seizures
 - B. Status epilepticus
 - C. Ictal-interictal continuum
- VIII. Hypoxic-ischemic brain injury 10%
 - A. Dynamic EEG changes
 - B. Prognosis