END-2451: NEONATAL/PEDIATRIC ELECTROENCEPHALOGRAPHY

Cuyahoga Community College

Viewing: END-2451 : Neonatal/Pediatric Electroencephalography

Board of Trustees:
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Academic Term:
Fall 2019

Subject Code
END - Electroneurodiagnostic

Course Number:
2451

Title:
Neonatal/Pediatric Electroencephalography

Catalog Description:
Discussion of neonatal and pediatric electroencephalography. Review the electrographic and clinical findings associated with neonatal and pediatric epilepsy syndromes and seizures. Discussion of long term epilepsy monitoring, pediatric epilepsy surgery and functional cortical mapping. Discussion of automatic seizure detection, artifact rejection and trending software.

Credit Hour(s):
3

Lecture Hour(s):
3

Requisites

Prerequisite and Corequisite
END-1450 Intermediate Electroencephalography (EEG).

Outcomes

Course Outcome(s):
Apply knowledge of neonatal and pediatric electoencephalography to perform monitoring in pediatric epilepsy monitoring units, routine, bedside, ICU EEG testing of pediatric patients of various ages under supervision.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Discuss and describe the American Clinical Neurophysiology Society (ACNS) Guideline 5: Minimum Technical Standards for Pediatric Electroencephalography.
2. Explain the activation procedures used in neonatal and pediatric EEG including the advantages and disadvantages of each.
3. Describe and discuss terminology related to pediatric and neonatal electroencephalography
4. Describe and discuss the approach to visual analysis and interpretation of neonatal electroencephalogram.
5. Describe and discuss the techniques of neonatal electroencephalography recording.
6. Describe and discuss artifacts in the neonatal intensive care unit.
7. Describe and discuss elements of the normal neonatal electroencephalogram.
8. Describe and discuss patterns of uncertain diagnostic significance relative to the neonatal electroencephalogram.
9. Discuss abnormal EEG patterns through a classification of abnormalities, which will be related to all age groups.
10. Describe and discuss the electroencephalographic findings and clinical features of the different seizure types throughout neonatal, infant and adolescent period of life.
11. Describe and discuss imitators of epileptic seizures and their clinical correlations.
12. Describe and Discuss the American Clinical Neurophysiology Society (ACNS) Guideline on Continuous Electroencephalography Monitoring in Neonates.

13. Perform head measurement for placement of electrodes according to the International 10-20 electrode placement and the modified 10-20 system of electrode place for neonatal electroencephalography recordings.
14. Demonstrate the different techniques of applying electrodes using collodion, paste, electrode caps in the neonates and pediatric patients.
15. Describe and discuss how waveforms displays are affected by variations in instrumentation in the neonatal and pediatric patient.
16. Describe and discuss the definition of an epilepsy syndrome.
17. Define the descriptors of EEG activity: wave form, repetition, frequency, amplitude, distribution, phase, timing, persistence, and reactivity.
18. Describe and discuss pediatric epilepsy surgery, electrocorticography and functional cortical mapping.
19. Describe and discuss the utility and functionality of automated seizure detection and trending.
20. Describe and discuss the American Clinical Neurophysiology Society Standardized EEG terminology and categorization for the description of continuous EEG Monitoring in neonates.
21. Describe and discuss the 2017 International League Again Epilepsy (ILAE) Classification of Seizures, and compare and contrast it to the 1981 ILAE Classification scheme.
22. Describe and discuss the ILAE Classification of the Epilepsies: Position paper of the ILAE Commission for Classification and Terminology. Identify the epilepsy syndromes of the neonatal, infancy and adolescent period of life.
23. Describe and discuss the American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology.
24. Discuss and describe pediatric appropriate care by EEG technologists.
25. Identify normal awake and sleep rhythms in an EEG to relate criteria specific to the neonatal and pediatric age groups.
26. Describe and discuss the effects of pain in the human neonate.

Methods of Evaluation:

1. Quizzes
2. Assignments
   a. Analysis of pediatric EEG
   b. Analysis of neonatal EEG
3. Participation
4. Final exam, including pediatric/neonatal EEG analysis

Course Content Outline:

1. The Normal Pediatric EEG Normal and Benign Variants/Artifacts Pediatric / ACNS Guidelines
   a. Terminology
      i. CA, GA
      ii. Pre-Term
      iii. Term
      iv. Infants
      v. Childhood
      vi. Adolescence/adult
      vii. PDR ranges for different ages
      viii. Overall sleep stage breakdown
         1. N1, N2, N3, REM
      ix. Apgar Scores
   b. (b) The Normal EEG see http://www.pediatrics.emory.edu/divisions/neurology/education/pedeeg.html
      i. Infancy: 1 month to 1 year
         1. Awake/drowsy:
            a. HV and Photic
         2. Sleep (chart for sleep architecture vs ages):
      ii. Toddler/early Childhood: 1-3yrs
         1. Awake/Drowsy
         2. Sleep
      iii. 6-12 yrs
         1. Awake/Drowsy
         2. Sleep
      iv. Artifacts: Common pediatric and neonatal artifact
      v. Normal Variants:
         1. Sleep stage identifiers: spindles, v waves, K-Complexes, REM
         2. MU
         3. Lambda
         4. PSWY
         5. Posterior slow wave transients with eye movements

6. Occipital slow transients
7. Slow/fast alpha variants
8. Wicket Spikes
9. Mitten pattern
10. Hypnagogic hypersynchrony
11. RMTD
12. 13/6hz positive spikes
13. SSS or BETS
14. Phantom spike wave bursts

vi. Activation Procedures for Pediatric Patients Overview
1. HV responses: buildup. H-response
2. Photic Stimulation responses:
   a. Photoconvulsive response
   b. H-Response
3. sleep Deprivation and sleep activated epileptiform discharges

vii. ACNS guidelines: "Minimum Technical Standards for Pediatric EEG"(c)

2. Neonatal EEG: Approach to visual Analysis and Interpretation. Techniques of Recording, Artifacts, Elements of the Normal Neonatal EEG. EEG Abnormalities of Premature and Full Term Neonates. (Atlas of Neonatal Electroencephalography
   a. Introduction
   b. Terminology
   c. Approach to visual analysis and interpretation
      i. CA
      ii. Evidence of focal brain dysfunction
      iii. Evidence of diffuse brain dysfunction
      iv. Prognosis
   d. Techniques of Recording
      i. Personnel
      ii. Infant Preparation
      iii. Nursery environment
      iv. Electrode placement
      v. Polygraphic parameters
      vi. Montage selection
      vii. Recording protocols
   e. Artifacts relative to the NICU
      i. Environment
      ii. Recording instrumentation
      iii. Noncerebral Physiologic potentials
         1. Alterations in electrical properties of scalp or skull
         2. Vital signs
         3. Movements
   f. Elements of The Normal neonatal EEG
      i. Continuum of development
         1. Continuity
         2. Bilateral synchrony
      ii. EEG Developmental Landmarks
         1. First review the “neonatal cheat sheets”
         2. Trace Discontinu
         3. Delta Brushs, Beta-Delta Complexes
         4. Monorhythmic occipital delta activity
         5. Temporal Theta and Alpha Bursts
         6. Trace alternant
         7. Frontal Sharp waves (encoches frontales)
         8. Distinguishing between the waking and sleep EEG
         9. Reactivity to Stimulation: table 4.1 in neonatal book says 34 weeks EEG becomes reactive. This is the most important EEG milestone.
         10. Additional special waveforms and Patterns
            a. Bifrontal Delta activity
            b. Temporal Sharp Waves
      iii. Summary of conceptional age-Dependent findings

1. 24-26 weeks CA
2. 27-28 Weeks CA
3. 29-30 weeks CA
4. 31-32 weeks CA
5. 33-34 weeks CA
6. 35-36 weeks CA
7. 37-38 weeks CA

g. Articles for review
   i. **Article:** "Guideline on Continuous EEG Monitoring in Neonates
   ii. **Article:** "Standardized EEG Terminology and Categorization for the Description of Continuous EEG Monitoring in Neonates"

3. Epileptic Seizures and their Classification and Imitators of Epileptic Seizure
   a. Epileptic Seizures and their Classification from Epileptic Syndromes and their Treatment
      i. Definitions:
         1. Epilepsy
         2. Epileptic Seizures
         3. Ictal vs interictal
         4. Pharmacoresistant epilepsy stats
         5. Seizure
         6. Refractory/intractable
         7. Idiopathic vs cryptogenic vs symptomatic
         8. Parxysmal
         9. Encephalopathy
         10. Epileptiform
         11. Epileptic or epileptiform encephalopathy
         12. Aura
      ii. Classifications of Epileptic Seizures
      iii. Seizure Classification in the new ILAE Task Force reports
      iv. Generalized seizures
      v. Generalized tonic clonic seizures
      vi. Generalized clonic seizures
      vii. Generalized tonic seizures
      viii. Epileptic Spasms
      ix. Myoclonus
      x. Atonic seizures
      xi. Typical absence seizures
      xii. Atypical absence seizures
      xiii. Focal epileptic seizures
      xiv. Reflex epileptic seizures
   b. Status Epilepticus
      i. Generalized SE
      ii. Focal SE
      iii. Treatment of SE
   c. Imitators of Epileptic Seizures
      i. Syncopal attacks imitating seizures
         1. Neurally mediated syncope
         2. Cardiogenic syncope
         3. Syncopal Attacks provoking epileptic seizures
      ii. Psychogenic NEPEs imitating Epileptic Seizures
         1. Convulsive psychogenic status epilepticus
         2. Non-Epileptic Paroxysmal Movement disorders imitating Epileptic Seizures
         3. Non Epileptic Severe amnesic and confusional attacks imitating Epileptic Seizures
         4. NEPEs occurring during sleep and sleep disorders
         5. Migraine, migralepsy, basilar migraine with EEG occipital paroxysms and diagnostic errors
         6. Cerebrovascular NEPEs imitating epileptic seizures
         7. Cerebrovascular NEPEs imitating epileptic seizures
   d. Seizure First Aid

i. Imitators of epileptic seizures
ii. Seizures: (article: “Semiology: Witness to a Seizure – What to Note and How to Report”)
iii. Basic seizure first aid
iv. The seizure interview
1. Outcomes

e. Articles
i. International League Against Epilepsy Classification of the Epilepsies: Position paper of the ILAE Commission for Classification and Terminology
ii. 2017 International League Again Epilepsy (ILAE) Classification of Seizures

4. Neonatal epileptic seizures and neonatal epileptic seizures. Idiopathic epileptic seizures and syndromes in infancy. Epileptic encephalopathies in infancy and early childhood.
a. Article: “Epileptic and Epileptiform Encephalopathies”
b. Introduction
c. Neonatal seizures
d. Neonatal epilepsy syndromes
e. Main causes of neonatal syndromes
f. Epileptic Encephalopathies in the Neonatal period
g. Early Myoclonic Encephalopathy
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
h. Ohtahara Syndrome
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
i. Idiopathic epileptic seizures and syndromes in Infancy
j. Febrile seizures
k. Epilepsy with febrile seizures plus
l. Benign infantile seizures
m. Myoclonic epilepsy in infancy
n. Epileptic Encephalopathies in Infancy and Early Childhood
o. West Syndrome
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
p. Dravet Syndrome
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
q. xvii) Lennox Gaustaut
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
r. Landau-Kleffner Syndrome
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis
s. Epilepsy with Continuous spikes and waves during slow-wave sleep
i. Introduction
ii. Clinical manifestations
iii. EEG findings
iv. Prognosis

5. Neonatal Seizures. Benign childhood focal seizures and related epileptic syndromes. Idiopathic generalized epilepsy. Familial (autosomal dominant) focal epilepsies. Symptomatic and cryptogenic focal epilepsies. Reflex seizures and reflex epilepsies.
    a. Idiopathic epileptic seizures and syndromes in infancy
        i. Febrile seizures
            1. Introduction
            2. Simple
            3. Complex
            4. EEG
            5. Clinical manifestations: Seizures
            6. Prognosis
    b. Severe neocortical epileptic syndromes in infancy and childhood
        i. Rasmussen syndrome
            1. Introduction
            2. Clinical manifestations
            3. EET
            4. Prognosis
    c. Benign Childhood focal seizures and Related Epileptic Syndromes
        i. Introduction
        ii. Benign Childhood epilepsy with centrotemporal spikes
            1. Introduction
            2. Clinical manifestations
            3. EEG
            4. Prognosis
        iii. Panayiotopoulos Syndrome
        iv. Introduction
        v. Clinical manifestations
        vi. EEG
        vii. Prognosis
    d. Idiopathic Generalized Epilepsies
        i. Introduction
        ii. Epilepsy with Myoclonic-Astatic seizures (Doose Syndrome)
            1. Introduction
            2. Clinical manifestation
            3. EEG
            4. Prognosis
        iii. Childhood Absence epilepsy
            1. Introduction
            2. Clinical manifestations
            3. EEG
            4. Prognosis
        iv. Juvenile Myoclonic Epilepsy JME
            1. Introduction
            2. Clinical manifestations
            3. EEG
            4. Prognosis
    e. Familial (autosomal dominant) Focal Epilepsies
        i. Introduction
        ii. Autosomal Dominant Nocturnal Frontal Lobe Epilepsy
            1. Introduction
            2. Clinical Manifestations
            3. EEG
            4. Prognosis
    f. Symptomatic and Cryptogenic Focal Epilepsies
        i. Introduction
        ii. Mesial TLE with Hippocampal Sclerosis
            1. Introduction
            2. Clinical Manifestations
            3. EEG
            4. Prognosis

iii. Frontal Lobe Epilepsies
1. Introduction
2. Clinical Manifestations
3. EEG
4. Prognosis

g. Reflex Seizures and Reflex Epilepsies
i. Jeavons Syndrome
1. Introduction
2. Clinical Manifestations
3. EEG
4. Prognosis

ii. Startle Seizures
1. Introduction
2. Clinical Manifestations
3. EEG
4. Prognosis

6. Pediatric Epilepsy Surgery, Electrocorticography, Functional Cortical Mapping.
a. History of Epilepsy Surgery
b. Epilepsy Treatment: response rates to AED therapy
c. General principles of the presurgical evaluation.
d. Seizure freedom rates from different types of epilepsy surgery
e. Phase 1 and Phase 2 epilepsy surgery workup
f. Electrocorticography
i. Intro
ii. The controversial role of intraoperative Ecog in epilepsy
iii. Indications
iv. Methodology
v. Interpretation

g. Functional cortical mapping
i. Intro
ii. Surgical preparation
iii. Sensorimotor mapping
iv. Language mapping
v. Cortical mapping threshold variability
vi. Ecog during functional mapping
vii. Anesthesia considerations
viii. Functional MRI
ix. PET
x. SPECT: interictal and ictal

Resources

Chee, MWL. *WaveGuide, an EEG Atlas.* On CD-ROM. Lippincott-Raven Publishers, 1998.

Cooper, R., Osselton, J. W., Shaw, J.C. *EEG Technology.* 3rd ed. Boston: Butterworth, 1980.

Ebersole, John, Aatif M. Husain (Editor), and Douglas R. Nordi Jr. (Editor). *Current Practices of Clinical Electroencephalography.* 4th ed. Philadelphia, PA: Wolters Kluwer Health, 2014.

Jasper, H. *Report on Committee on Method of Clinical Exam in EEG.* Electroencephalography Clinical Neurophysiology 10:370-375, Raven Press, 1958.

Journal of Clinical Neurophysiology, Vol. 3, Supplement 1. *American Electroencephalographic Society Guidelines in EEG and Evoked Potentials.* Raven Press, 1986.

Spehlmann, R. *EEG Primer.* New York: Elsevier Biomedical Press, 1985.

Tyner, F. S., Knott, J. R., Mayer, W. B. *Fundamentals of EEG Technology, Clinical Correlates.* Raven Press, 1989.

Fenichel, Gerald. *Clinical Pediatric Neurology.* 2nd ed. W. B. Saunders, 1993.

Sheldon, Spire, Levy. *Pediatric Sleep Medicine.* W. B. Saunders Company, 1993.

Stockard-Pope, Werner, Bickford. *Atlas of Neonatal Electroencephalography.* 2nd ed. New York, 1992.

"Neonatal EEG"

"Pediatric EEG"

Resources Other

1. *American Journal of Electroneurodiagnostic Technology (AJET)* by the ASET; 4 issues annually; which reflects most recent changes and updates in the field.

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