

END-2422: INTERMEDIATE INTRAOPERATIVE MONITORING

Cuyahoga Community College

Viewing: END-2422 : Intermediate Intraoperative Monitoring

Board of Trustees:

March 2026

Academic Term:

Fall 2026

Subject Code

END - Electroneurodiagnostic

Course Number:

2422

Title:

Intermediate Intraoperative Monitoring

Catalog Description:

Intermediate discussion of principles of intraoperative monitoring of the nervous system structure and function integrity during surgical procedures. Emphasis on various types of surgery, decision making on the modality, signal improvement, in-depth discussion of variables and co-morbidities, surgical outcomes.

Credit Hour(s):

2

Lecture Hour(s):

1

Lab Hour(s):

2

Requisites

Prerequisite and Corequisite

END-2402 Intraoperative Monitoring for Electroneurodiagnostic Technologists; or departmental approval.

Outcomes

Course Outcome(s):

Apply advanced concepts of intraoperative monitoring in setting up somatosensory evoked potentials (SSEP) monitoring.

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. Review advanced science and instrumentation of intraoperative monitoring.
2. Relate advanced intraoperative concepts of anatomy and physiology of the nervous system and its structures.
3. Obtain clearly resolved waveforms.
4. Obtain two replications demonstrating consistency of latency and amplitude measurements.
5. Demonstrate use of additional electrode derivation, alternate electrode placement and other techniques as needed to enhance or clarify abnormality.
6. Demonstrate the appropriate recording and stimulus parameters.
7. Demonstrate display of obligate peaks displayed according to recommended standards.
8. Establish acceptable baselines.
9. Correlate the pathology, surgical procedure, appropriate monitoring procedures and their execution, and potential risks as reflected on monitoring for various types of surgery where SSEP would be utilized.
10. Associate preoperative and intraoperative factors for multiple variables.

Course Outcome(s):

Apply advanced concepts of intraoperative monitoring in setting up motor evoked potentials (MEP), Electromyography (EMG), brainstem auditory evoked potential (BAEP), and electroencephalogram (EEG) monitoring.

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. Review advanced science and instrumentation of intraoperative monitoring.
2. Relate advanced intraoperative concepts of anatomy and physiology of the nervous system and its structures.
3. Obtain patient history to establish indication and contraindication for specific modality.
4. Demonstrate the appropriate recording and stimulus parameters.
5. Use montages appropriate for obtaining responses for specific modality.
6. Establish acceptable baselines.
7. Correlate the pathology, surgical procedure, appropriate monitoring procedures and their execution, and potential risks as reflected on monitoring for various types of surgery where MEP, EMG, BAER or EEG would be utilized.
8. Associate preoperative and intraoperative factors for multiple variables.

Course Outcome(s):

Verify the integrity of the evoked potential instrumentation.

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. Accurately assess the integrity and proper instrumentation set-up.
2. Select proper montage and indicate electrode derivations for assigned surgical procedures.
3. Demonstrate the practice of proper electrical safety and equipment/patient grounding.

Course Outcome(s):

Demonstrate the ability to distinguish changes on intraoperative waveforms as compared to pre-established baselines.

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. Demonstrate a comparison of EP responses based to pre-established baselines.
2. Explain criteria for a significant change.
3. Relate advanced concepts of effects of homeostasis, pharmacology, and pathology on the structures of the nervous system.
4. Demonstrate identification of locations of abnormality and/or change based on EP responses and knowledge of neural pathways.
5. Identify source of a significant change.
6. Distinguish a significant change from artifact.

Methods of Evaluation:

1. Quizzes
2. Exams
3. Comprehensive final
4. Case study
5. Worksheets

Course Content Outline:

1. Advanced science and instrumentation of intraoperative monitoring
 - a. Effect of improper use of filters on correct interpretation of recordings
 - b. Improving signal averaging
 - c. Advanced stimulus techniques
2. Advanced intraoperative concepts of anatomy and physiology of the nervous system and its structures
 - a. Brain
 - b. Brain stem
 - c. Cranial nerves
 - d. Vertebral column
 - e. Spinal cord
 - f. Peripheral nerves
3. Advanced concepts of effects of homeostasis, pharmacology, and pathology on the following structures of the nervous system
 - a. Brain
 - b. Brain stem
 - c. Cranial nerves
 - d. Vertebral column
 - e. Spinal cord
 - f. Peripheral nerves
4. Advanced recording concepts, preoperative, and intraoperative factors for:
 - a. Electrode sites
 - b. Stimulation sites
 - c. Stimulation troubleshooting
 - d. Equipment settings
5. Vertebral column surgery (cervical, thoracic, lumbosacral)
 - a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (signal-to-noise ratio (SNR) discussion, stimulus adjustment)
6. Spinal cord surgery (tumor, tethered cord)
 - a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (SNR discussion, stimulus adjustment)
7. Peripheral nerve surgery
 - a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (SNR discussion, stimulus adjustment)
8. Cerebellopontine angle surgery (tumor, microvascular decompression)

- a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (SNR discussion, stimulus adjustment)
9. Vascular surgery (thoracic aneurysm, cerebral aneurysm, carotid endarterectomy)
- a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (SNR discussion, stimulus adjustment)
10. Brain surgery (mapping)
- a. Pathology
 - b. Surgical procedure
 - c. Appropriate monitoring methods
 - d. Surgical outcomes-reflection on monitoring
 - e. Advanced review of cases
 - i. Setup
 - ii. Waveform review
 - iii. Change vs. artifact
 - iv. Advanced discussion of settings (time base, sensitivity, filters)
 - v. Improving recording (SNR discussion, stimulus adjustment)

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/> Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	Review of modalities-part 1
Week 2	Review of modalities-part 2
Week 3	Review of modalities-part 3
Week 4	Surgery and IOM
Week 5	Vertebral Column surgery
Week 6	Vertebral Column surgery
Week 7	Spinal Cord surgery

Week 8	Peripheral Nerve surgery
Week 9	Vascular surgery-Carotid endarterectomy
Week 10	Vascular surgery-Thoracoabdominal aneurysm
Week 11	Craniotomy-Overview
Week 12	Craniotomy-Brain surgery
Week 13	Craniotomy-Brain surgery-cranial nerve monitoring
Week 14	Craniotomy-Brain surgery
Week 15	Case studies
Week 16	Final exam

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Readings may be selected from the following:

- Zouridakis, G. Papanicolaou, A. *A concise guide to Intraoperative Monitoring*, Boca Raton: CRC Press.
- Russell, G. Rodichok, L. *Primer of Intraoperative Neurophysiologic Monitoring*, Boston: Butterworth-Heinemann.
- Simon MD, M. *Intraoperative Neurophysiology*, New York: Demos Medical Publishing.
- Husain MD, A. *A Practical Approach to Neurophysiologic Intraoperative Monitoring*, New York: Demos Medical Publishing. Møller, A. *Intraoperative Neurophysiological Monitoring*, New York: Springer.
- Jahangiri, F. *Surgical Neurophysiology*, Unknown.
- Loftus, C., Biller, J, Baron, E. *Intraoperative neuromonitoring*, New York: McGraw-Hill Education.
- *American Journal of Electroneurodiagnostic Technology (AJET)* by the ASET; 4 issues annually; which reflects most recent changes and updates in the field.

Resources for the Instructor

Deletis, V., Shils, J., Sala, F., Seidel, K. . (2020) *Neurophysiology in Neurosurgery: A Modern Approach*, San Diego, CA: Academic Press.

Husain MD, A. (2014) *A Practical Approach to Neurophysiologic Intraoperative Monitoring*, New York: Demos Medical Publishing.

Jahangiri, F. (2012) *Surgical Neurophysiology*, Unknown.

Jahangiri, Faisal. (2021) *Mapping of the Brain*, Columbia, SC: Global Innervation LLC.

Loftus, C., Biller, J, Baron, E. (2014) *Intraoperative Neuromonitoring*, New York: McGraw-Hill Education.

Møller, A. (2011) *Intraoperative Neurophysiological Monitoring*, New York: Springer.

Russell, G. Rodichok, L. (1995) *Primer of Intraoperative Neurophysiologic Monitoring*, Boston: Butterworth-Heinemann.

Simon MD, M. (2018) *Intraoperative Neurophysiology*, New York: Demos Medical Publishing.

Zouridakis, G. Papanicolaou, A. (2001) *A concise guide to Intraoperative Monitoring*, Boca Raton: CRC Press.

Husain, Atif M. (2018) *Illustrated Manual of Clinical Evoked Potentials*, New York: Springer Publishing Company Demos Medical Medical Publishing.

American Clinical Neurophysiology Society. "Guidelines in Evoked Potentials, Guidelines in EEG, Evoked Potential and Polysomnography"

Additional Resources for the Instructor

1. www.aset.org
2. www.asnm.org
3. *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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