

Corporate Medical Policy

Intraoperative Neurophysiologic Monitoring

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Description of Procedure or Service

Intraoperative neurophysiologic monitoring (IONM) describes a variety of procedures used to monitor the integrity of neural pathways during high-risk neurosurgical, orthopedic, and vascular surgeries. It involves the detection of electrical signals produced by the nervous system in response to sensory or electrical stimuli to provide information about the functional integrity of neuronal structures.

Background

The principal goal of intraoperative neurophysiologic monitoring (IONM) is the identification of nervous system impairment on the assumption that prompt intervention will prevent permanent deficits. Correctable factors at surgery include circulatory disturbance, excess compression from retraction, bony structures, hematomas, or mechanical stretching. The technology is continuously evolving with refinements in equipment and analytic techniques, including recording, with several patients monitored under the supervision of a physician who is outside the operating room.

The different methodologies of monitoring are described below:

Sensory-evoked Potentials

Sensory-evoked potential describes the responses of the sensory pathways to sensory or electrical stimuli. Intraoperative monitoring of sensory-evoked potentials is used to assess the functional integrity of central nervous system (CNS) pathways during surgeries that put the spinal cord or brain at risk for significant ischemia or traumatic injury. The basic principles of sensory-evoked potential monitoring involve identification of a neurological region at risk, selection and stimulation of a nerve that carries a signal through the at-risk region, and recording and interpretation of the signal at certain standardized points along the pathway. Monitoring of sensory-evoked potentials is commonly used during the following procedures: carotid endarterectomy, brain surgery involving vasculature, surgery with distraction compression or ischemia of the spinal cord and brainstem, and acoustic neuroma surgery. Sensory-evoked potentials can be further categorized by the type of stimulation used:

- Somatosensory-evoked potentials (SSEPs) are cortical responses elicited by peripheral nerve stimulations. Peripheral nerves, such as the median, ulnar, or tibial nerves, are typically stimulated, but in some situations the spinal cord may be stimulated directly. Recording is done either cortically or at the level of the spinal cord above the surgical procedure. Intraoperative monitoring of SSEPs is most commonly used during orthopedic or neurologic surgery to prompt intervention to reduce surgically induced morbidity and/or to monitor the level of anesthesia. One of the most common indications for SSEP monitoring is in patients undergoing

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corrective surgery for scoliosis. In this setting, SSEP monitors the status of the posterior column pathways and thus does not reflect ischemia in the anterior (motor) pathways. Several different techniques are commonly used, including stimulation of a relevant peripheral nerve with monitoring from the scalp, from interspinous ligament needle electrodes, or from catheter electrodes in the epidural space.

- Brainstem auditory-evoked potentials (BAEPs) are generated in response to auditory clicks and can define the functional status of the auditory nerve. Surgical resection of a cerebellopontine angle tumor, such as an acoustic neuroma, places the auditory nerves at risk, and BAEPs have been extensively used to monitor auditory function during these procedures.
- Visual-evoked potentials (VEPs) with light flashes are used to track visual signals from the retina to the occipital cortex. VEP monitoring has been used for surgery on lesions near the optic chiasm. However, VEPs are very difficult to interpret due to their sensitivity to anesthesia, temperature, and blood pressure.

Motor-evoked Potentials

Motor-evoked potentials (MEPs) are recorded from muscles following direct or transcranial electrical stimulation of motor cortex or by pulsed magnetic stimulation provided by a coil placed over the head. Peripheral motor responses (muscle activity) are recorded by electrodes placed on the skin at prescribed points along the motor pathways. Motor evoked potentials, especially when induced by magnetic stimulation, can be affected by anesthesia. The Digitimer electrical cortical stimulator received U.S. Food and Drug Administration (FDA) premarket approval in 2002. Devices for transcranial magnetic stimulation have not yet received approval from the FDA for this use.

Multimodal IONM, in which more than one technique is used, most commonly with SSEPs and MEPs, has also been described.

EMG (Electromyogram) Monitoring and Nerve Conduction Velocity Measurements

Electromyogram monitoring and nerve conduction velocity measurements can be performed in the operating room and may be used to assess the status of the cranial or peripheral nerves, e.g., to identify the extent of nerve damage prior to nerve grafting or during resection of tumors. For procedures with a risk of vocal cord paralysis due to damage to the recurrent laryngeal nerve (i.e., during carotid artery, thyroid, parathyroid, goiter, or anterior cervical spine procedures), monitoring of the vocal cords or vocal cord muscles has been performed. In addition, these techniques may be used during procedures around the nerve roots and around peripheral nerves to assess the presence of excessive traction or other impairment. Surgery in the region of cranial nerves can be monitored by electrically stimulating the proximal (brain) end of the nerve and recording via EMG in the facial or neck muscles. Thus monitoring is done in the direction opposite that of sensory-evoked potentials, but the purpose is similar - to verify that the neural pathway is intact.

EEG (Electroencephalogram) Monitoring

Spontaneous EEG monitoring can also be recorded during surgery and can be subdivided as follows:

- EEG monitoring has been widely used to monitor cerebral ischemia secondary to carotid cross-clamping during a carotid endarterectomy and other procedures that can cause cerebral ischemia. EEG monitoring may identify those patients who would benefit from the use of a vascular shunt during the procedure to restore adequate cerebral perfusion. Conversely, shunts, which have an associated risk of iatrogenic complications, may be avoided in those patients in whom the EEG is normal. Carotid endarterectomy may be

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done with the patient under local anesthesia so that monitoring of cortical function can be directly assessed.

- Electrocorticography (ECoG) is the recording of the EEG directly from a surgically exposed cerebral cortex. ECoG is typically used to define the sensory cortex and map the critical limits of a surgical resection. ECoG recordings have been most frequently used to identify epileptogenic regions for resection. In these applications, ECoG does not constitute monitoring, per se.

Related Policies:

Electrodiagnostic Studies

Navigated Transcranial Magnetic Stimulation (nTMS)

Vestibular Function Testing

******Note: This Medical Policy is complex and technical. For questions concerning the technical language and/or specific clinical indications for its use, please consult your physician.***

Policy

BCBSNC will provide coverage for intraoperative neurophysiologic monitoring when it is determined to be medically necessary because the medical criteria and guidelines noted below are met.

Benefits Application

This medical policy relates only to the services or supplies described herein. Please refer to the Member's Benefit Booklet for availability of benefits. Member's benefits may vary according to benefit design; therefore member benefit language should be reviewed before applying the terms of this medical policy.

When Intraoperative Neurophysiologic Monitoring is covered

Intraoperative monitoring, which may include somatosensory-evoked potentials, motor-evoked potentials using transcranial electrical stimulation, brainstem auditory-evoked potentials, EMG of cranial nerves, EEG, and electrocorticography (ECoG), may be considered medically necessary during spinal, intracranial, plexus, or vascular procedures.

Intraoperative neurophysiologic monitoring of the recurrent laryngeal nerve may be considered medically necessary in patients undergoing:

- high risk thyroid or parathyroid surgery, including:
 - total thyroidectomy
 - repeat thyroid or parathyroid surgery
 - surgery for cancer
 - thyrotoxicosis
 - retrosternal or giant goiter
 - thyroiditis
- anterior cervical spine surgery associated with any of the following increased risk situations:
 - prior anterior cervical surgery, particularly revision anterior cervical discectomy and fusion, revision surgery through a scarred surgical field, reoperation for pseudarthrosis or revision for failed fusion
 - multilevel anterior cervical discectomy and fusion
 - time consuming anterior cervical discectomy and fusion (e.g., tumor)
 - pre-existing recurrent laryngeal nerve pathology, when there is residual function of the recurrent laryngeal nerve.

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When Intraoperative Neurophysiologic Monitoring is not covered

Intraoperative neurophysiologic monitoring of the recurrent laryngeal nerve during anterior cervical spine surgery not meeting the criteria above or during esophageal surgeries is considered **investigational**.

Intraoperative monitoring of visual-evoked potentials is considered **investigational**.

Due to the lack of FDA approval, intraoperative monitoring of motor-evoked potentials using transcranial magnetic stimulation is considered **investigational**.

Intraoperative EMG and nerve conduction velocity monitoring during surgery on the peripheral nerves is considered **not medically necessary**.

Intraoperative neurophysiologic monitoring is considered not medically necessary when performed outside the 2009 American Clinical Neurophysiology Society recommended standards as stated in the Policy Guidelines.

Note: A physician can monitor NO more than three cases simultaneously.

Note: These policy statements refer only to use of these techniques as part of intraoperative monitoring. Other clinical applications of these techniques, such as visual-evoked potentials and EMG, are not considered in this policy.

Policy Guidelines

Constant communication between surgeon, neurophysiologist, and anesthesiologist is required for safe and effective intraoperative neurophysiologic monitoring.

For individuals who are undergoing thyroid or parathyroid surgery who are at high risk of injury to the recurrent laryngeal nerve (RLN) who receive IONM, the evidence includes a large randomized controlled trial (RCT) and systematic reviews. Relevant outcomes are morbid events, functional outcomes, and quality of life. The strongest evidence on neurophysiologic monitoring is from an RCT of 1000 patients undergoing thyroid surgery. This RCT found a significant reduction in RLN injury in patients at high risk for injury. High risk in the trial was defined as surgery for cancer, thyrotoxicosis, retrosternal or giant goiter, or thyroiditis. The high-risk category may also include patients with prior thyroid or parathyroid surgery or total thyroidectomy. A low volume of surgeries may also contribute to a higher risk for recurrent laryngeal nerve injury. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who are undergoing anterior cervical spine surgery who are at high risk of injury to the recurrent laryngeal nerve who receive IONM, the evidence includes systematic reviews of case series and cohort studies. Relevant outcomes are morbid events, functional outcomes, and quality of life. The evidence on the use of IONM to reduce RLN injury during cervical spinal surgery includes a 2017 systematic review and a meta-analysis. Of the 10 studies assessed in the systematic review, two compared the risk of nerve injury with use of IONM vs no IONM and found no difference. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who are undergoing esophageal surgery who receive IONM, the evidence includes a nonrandomized comparative study. Relevant outcomes are morbid events, functional outcomes, and quality of life. One nonrandomized comparative study on surgery for esophageal

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cancer was identified. Interpretation of this study is confounded because only those patients who had visual identification of the nerve underwent neurophysiologic monitoring. Current evidence is not sufficiently robust to determine whether neurophysiologic monitoring reduces RLN injury in patients undergoing surgery for esophageal cancer. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who are undergoing surgery proximal to a peripheral nerve who receive IONM, the evidence includes case series and a controlled cohort study. Relevant outcomes are morbid events, functional outcomes, and quality of life. Surgical guidance with peripheral IONM and the predictive ability of monitoring of peripheral nerves has been reported. No prospective comparative studies were identified that assessed whether outcomes are improved with neurophysiologic monitoring. The evidence is insufficient to determine the effects of the technology on health outcomes.

Clinical input and professional society guidelines support the use of intraoperative monitoring during spinal, intracranial, or vascular procedures. There was general agreement that intraoperative monitoring of visual-evoked potentials and motor-evoked potentials (MEPs) using transcranial magnetic stimulation is investigational. It should be noted that there is controversy about the utility of IONM in some surgical procedures. Most of the published literature is from Europe, and, while many articles report the sensitivity and specificity of MEPs for predicting postsurgical neurologic deficits, few articles report intraoperative interventions undertaken in response to information from monitoring.

Clinical input was also supportive of intraoperative monitoring of the recurrent laryngeal nerve during high-risk thyroid or parathyroid surgery, and during anterior cervical spine surgery associated with any of the following increased risk situations:

- prior anterior cervical surgery, particularly revision anterior cervical discectomy and fusion, revision surgery through a scarred surgical field, reoperation for pseudarthrosis, or revision for failed fusion
- multilevel anterior cervical discectomy and fusion
- time-consuming anterior cervical discectomy and fusion (e.g., tumor)
- pre-existing recurrent laryngeal nerve pathology, when there is residual function of the recurrent laryngeal nerve.

2009 American Clinical Neurophysiology Society Practice Standards

In 2009 the American Clinical Neurophysiology Society published recommended standards for intraoperative neurophysiologic monitoring. Guideline 11A includes the following statement.

“The monitoring team should be under the direct supervision of a physician with training and experience in NIOM (Neurophysiologic Intraoperative Monitoring). The monitoring physician should be licensed in the state and privileged to interpret neurophysiologic testing in the hospital in which the surgery is being performed. He/she is responsible for real-time interpretation of NIOM data. The monitoring physician should be present in the operating room or have access to NIOM data in real-time from a remote location and be in communication with the staff in the operating room. There are many methods of remote monitoring however any method used must conform to local and national protected health information guidelines. The monitoring physician must be available to be in the operating room, and the specifics of this availability (i.e., types of surgeries) should be decided by the hospital credentialing committee. In order to devote the needed attention, it is recommended that the monitoring physician interpret no more than three cases concurrently.”

The NIOM record should contain the times of surgical events and procedures. Alerts that were issued to the surgeon or anesthesiologist should be noted. The anesthetics and drugs used should be recorded, and significant changes in dose of these medications should also be noted. Significant changes in physiological parameters, such as blood pressure and temperature, should

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be recorded. If the equipment allows, it may be desirable to maintain this documentation along with the stored waveforms. A final report summarizing the NIOM data should be filed in the patient's chart. Long-term storage of the records should be provided, as required by law.

American Academy of Neurology (AAN) Assessments

The American Academy of Neurology (AAN) published an assessment of IONM in 1990 with an evidence-based guideline update in 2012 by the AAN and the American Clinical Neurophysiology Society. The 1990 assessment indicates that monitoring requires a team approach with a well-trained physician-neurophysiologist to provide or supervise monitoring. EEG monitoring is used during carotid endarterectomy or for other similar situations in which cerebral blood flow is at high risk. Electrocorticography from surgically exposed cortex can help to define the optimal limits of a surgical resection or identify regions of greatest impairment, while sensory cortex SSEPs can help to localize the central fissure and motor cortex. Auditory-evoked potentials, along with cranial nerve monitoring can be used during posterior fossa neurosurgical procedures. Spinal cord SSEPs are frequently used to monitor the spinal cord during orthopedic or neurosurgical procedures around the spinal cord, or cross-clamping of the thoracic aorta. Electromyographic monitoring during procedures near the roots and peripheral nerves can be used to warn of excessive traction or other impairment of motor nerves. At the time of the 1990 assessment, MEPs were considered investigational by many neurophysiologists. The 2012 update, which was endorsed by the American Association of Neuromuscular and Electrodiagnostic Medicine, concluded that the available evidence supports IONM using SSEPs or MEPs when conducted under the supervision of a clinical neurophysiologist experienced with IONM. Evidence was insufficient to evaluate IONM when conducted by technicians alone or by an automated device.

Billing/Coding/Physician Documentation Information

This policy may apply to the following codes. Inclusion of a code in this section does not guarantee that it will be reimbursed. For further information on reimbursement guidelines, please see Administrative Policies on the Blue Cross Blue Shield of North Carolina web site at www.bcbssc.com. They are listed in the Category Search on the Medical Policy search page.

Applicable codes: 51784, 51785, 92585, 95829, 95867, 95868, 95907, 95908, 95909, 95910, 95911, 95912, 95913, 95925, 95926, 95927, 95930, 95940, 95941, 95955, 95961, 95962, G0453

See Policy: Code Bundling Rules Not Addressed in ClaimCheck® or Correct Coding Initiative

BCBSNC may request medical records for determination of medical necessity. When medical records are requested, letters of support and/or explanation are often useful, but are not sufficient documentation unless all specific information needed to make a medical necessity determination is included.

Scientific Background and Reference Sources

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 12/2011

Senior Medical Director – 10/2012

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 12/13/2012

Specialty Matched Consultant Advisory Panel – 5/2013

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American Clinical Neurophysiology Society. Guideline 11A. Recommended Standards for Neurophysiologic Intraoperative Monitoring – Principles. Last reviewed 7/12/2013 at <http://www.acns.org/practice/guidelines>.

Nuwer MR, Emerson RG, Galloway G et al. Evidence-based guideline update: intraoperative spinal monitoring with somatosensory and transcranial electrical motor evoked potentials: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology and the American Clinical Neurophysiology Society. *Neurology* 2012; 78(8):585-9.

American Academy of Neurology. Assessment: intraoperative neurophysiology. Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 1990; 40(11):1644-6.

Senior Medical Director – 7/2013

Quinones-Hinojosa A, Gadkary CA, Gulati M, von Koch CS, Lyon R, Weinstein PR, et al. Neurophysiological monitoring for safe surgical tethered cord syndrome release in adults. *Surg Neurol* 2004;62:127-133; discussion 133-125.

Kothbauer K, Schmid UD, Seiler RW, Eisner W. Intraoperative motor and sensory monitoring of the cauda equina. *Neurosurgery* 1994;34:702-707; discussion 707.

von Koch CS, Quinones-Hinojosa A, Gulati M, Lyon R, Peacock WJ, Yingling CD. Clinical outcome in children undergoing tethered cord release utilizing intraoperative neurophysiological monitoring. *Pediatr Neurosurg* 2002;37:81-86.

Husain AM, Emerson RG, Nuwer MN. Emerging subspecialties in neurology: Neurophysiologic intraoperative monitoring. *Neurology*; April 2011. 76:e73-e75

Nuwer MR, Cohen BH, Shepard KM. Practice patterns in intraoperative neurophysiologic monitoring. *Neurology* 2013; 80:1156-1160

Emerson RG, Husain AM. Blurring of local and remote practice models threatens IOM's future. *Neurology* 2013; 80:1076-1077

Senior Medical Director – 2/2014

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 5/22/2014

Specialty Matched Consultant Advisory Panel – 5/2014

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 5/21/2015

Specialty Matched Consultant Advisory Panel – 5/2015

Specialty Matched Consultant Advisory Panel – 5/2016

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 5/8/2017

Specialty Matched Consultant Advisory Panel – 5/2017

BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 4/12/2018

Specialty Matched Consultant Advisory Panel – 5/2018

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BCBSA Medical Policy Reference Manual [Electronic Version]. 7.01.58, 4/8/2019

Specialty Matched Consultant Advisory Panel – 5/2019

Policy Implementation/Update Information

- 1/15/13 New Evidence Based Guideline developed. “Intraoperative monitoring, which includes somatosensory-evoked potentials, motor-evoked potentials using transcranial electrical stimulation, brainstem auditory-evoked potentials, EMG of cranial nerves, EEG, and electrocorticography (ECoG), may be appropriate during spinal, intracranial, or vascular procedures. Intraoperative monitoring of visual-evoked potentials is not recommended. Due to the lack of FDA approval, intraoperative monitoring of motor-evoked potentials using transcranial magnetic stimulation is not recommended. Intraoperative EMG and nerve conduction velocity monitoring during surgery on the peripheral nerves is not recommended.” Senior Medical Director review 10/14/12. (btw)
- 2/12/13 Reference added. (btw)
- 7/1/13 Specialty Matched Consultant Advisory Panel review 5/15/2013. No changes to guideline. (btw)
- 2/11/14 Evidence based guideline converted to corporate medical policy. Added Related Policy: Electrodiagnostic Studies to the Description section. “Intraoperative monitoring, which includes somatosensory-evoked potentials, motor-evoked potentials using transcranial electrical stimulation, brainstem auditory-evoked potentials, EMG of cranial nerves, EEG, and electrocorticography (ECoG), may be considered medically necessary during spinal, intracranial, or vascular procedures.” “Intraoperative monitoring of visual-evoked potentials is considered **investigational**.” “Due to the lack of FDA approval, intraoperative monitoring of motor-evoked potentials using transcranial magnetic stimulation is considered **investigational**. Intraoperative EMG and nerve conduction velocity monitoring during surgery on the peripheral nerves is considered **not medically necessary**.” “Intraoperative neurophysiology monitoring is considered **not medically necessary** when performed outside the 2009 American Clinical Neurophysiology Society recommended standards as stated in the Policy Guidelines.” “**Note:** A physician can monitor NO more than three cases simultaneously.” Policy Guidelines updated. Added the following codes to the Billing/Coding section; 51784, 51785, 95961, 95962, and 95829. Referenced Code Bundling Rules Not Addressed in ClaimCheck® or Correct Coding Initiative in the Billing/Coding section. References added. Senior Medical Director review 2/4/2014. Notification given 2/11/2014. Policy effective 4/15/2014. (btw)
- 7/29/14 Reference added. No change to policy statement. (lpr)
- 11/11/14 Specialty Matched Consultant Advisory Panel review 5/27/2014. No change to Policy statement. (sk)
- 7/28/15 Reference added. Specialty Matched Consultant Advisory Panel review 5/26/2015. (sk)
- 7/1/16 Specialty Matched Consultant Advisory Panel review 5/25/2016. (sk)
- 6/30/17 Reference added. Policy Guidelines updated. High risk thyroid and anterior cervical spine surgeries added as new medically necessary indications. (Sensory-evoked potentials, motor-evoked potentials, EEG monitoring removed from policy title. Specialty Matched Consultant Advisory Panel review 5/31/2017. (sk)

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8/24/18 Reference added. Policy Guidelines updated. Specialty Matched Consultant Advisory Panel review 5/23/2018. (sk)

5/28/19 Reference added. Specialty Matched Consultant Advisory Panel review 5/15/2019. (sk)

Medical policy is not an authorization, certification, explanation of benefits or a contract. Benefits and eligibility are determined before medical guidelines and payment guidelines are applied. Benefits are determined by the group contract and subscriber certificate that is in effect at the time services are rendered. This document is solely provided for informational purposes only and is based on research of current medical literature and review of common medical practices in the treatment and diagnosis of disease. Medical practices and knowledge are constantly changing and BCBSNC reserves the right to review and revise its medical policies periodically.