MEDICAL POLICY

MEDICAL POLICY DETAILS	
Medical Policy Title	**EVOKED POTENTIALS**
Policy Number	**2.01.27**
Category	**Technology Assessment**
Effective Date	**12/20/01**
Revised Date	**04/20/06, 03/15/07, 03/20/08**
Archived Date	**12/19/02-04/20/06, 02/19/09**
Edited Date	**02/18/10, 02/17/11, 02/16/12, 02/21/13, 02/20/14, 01/22/15, 01/21/16, 01/19/17, 01/18/18, 03/21/19**
Product Disclaimer	• *If a product excludes coverage for a service, it is not covered, and medical policy criteria do not apply.* • *If a commercial product (including an Essential Plan product) or a Medicaid product covers a specific service, medical policy criteria apply to the benefit.* • *If a Medicare product covers a specific service, and there is no national or local Medicare coverage decision for the service, medical policy criteria apply to the benefit.*

POLICY STATEMENT

Based upon our criteria and review of the peer-reviewed literature:

I. *Auditory-evoked potentials* are **medically appropriate** for the following indications:
   A. To evaluate brainstem function in acquired metabolic disorders;
   B. To assess recovery of brainstem function after a lesion compressing the brainstem has been surgically removed;
   C. To localize the cause of a neurologic deficit seen on exam, not explained by lesions seen on CT or MRI;
   D. To diagnose and monitor demyelinating and degenerative diseases affecting the brain stem (e.g., multiple sclerosis, central pontine myelinolysis, olivopontocerebellar degeneration, and others);
   E. To diagnose lesions in the auditory system;
   F. To evaluate the irreversibility of coma or brain death, along with an EEG; or
   G. For children under age 5, to determine the type and degree of hearing problems or to determine the developed status of nerves.

II. *Visual evoked potentials* are **medically appropriate** for the following indications:
   A. To diagnose and monitor multiple sclerosis;
   B. To localize the cause of a visual field defect, not explained by lesions seen on CT or MRI, metabolic disorders, or infectious diseases; or
   C. To diagnose or evaluate deficits or damage to the visual system of infants, or unresponsive/nonverbal patients.

III. *Somatosensory evoked potentials* are **medically appropriate** for the following indications:
   A. To assess any decline which may be considered emergent to surgery in unconscious spinal cord injury patients who show specific structural damage to the somatosensory system, and who are candidates for emergency spinal cord surgery;
   B. To diagnose and monitor multiple sclerosis;
   C. To evaluate patients with suspected brain death;
   D. To diagnose unexplained myelopathy; or
   E. To localize the cause of a neurologic deficit seen on exam not explained by lesions on CT or MRI.

IV. *Intra-operative neurophysiologic monitoring* is **medically appropriate** during high risk thyroid or parathyroid surgery, spinal, intracranial, or vascular procedures. All other indications for intra-operative neurophysiologic monitoring are **not medically necessary.**

V. *Intra-operative monitoring of visual evoked potentials* is considered **investigational**.

VI. *Visual evoked potential testing* for the diagnosis and evaluation of glaucoma is considered **investigational.**

VII. Due to lack of FDA approval, the use of transcranial magnetic stimulation to elicit motor evoked potentials is considered **investigational**.

Refer to Corporate Medical Policy #11.01.03 regarding Experimental and Investigational Services.

Refer to Corporate Medical Policy #2.01.39 regarding Auditory Processing Disorder (APD) Testing.

POLICY GUIDELINES

The Federal Employee Health Benefit Program (FEHBP/FEP) requires that procedures, devices or laboratory tests approved by the U.S. Food and Drug Administration (FDA) may not be considered investigational and thus these procedures, devices or laboratory tests may be assessed only on the basis of their medical necessity.

DESCRIPTION

Evoked potentials (EP) are responses (electrical signals) produced by the nervous system in response to a stimulus. These computerized tests help diagnose nerve disorders, locate the site of nerve damage, and help evaluate the patient's condition after treatment or during surgery. There are several types of evoked potential tests. Each uses mild stimulus to cause the nerves to react and send a message to the brain. Electrodes placed on the skin surface record how the brain and spinal cord respond to stimulus. The responses are analyzed by a computer and printed as a waveform pattern. The wave pattern may reveal certain problems and show where any damage is located along the nerve pathway(s) being tested. Evoked potentials can be further broken down into the following categories according to the type of stimulation used:

I. **Somatosensory-Evoked Potentials**
Somatosensory-evoked potentials (SSEPs) are electrical waves that are generated by the response of sensory neurons to stimulation. Peripheral nerves, such as the median, ulnar or tibial nerve, 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.

II. **Auditory-Evoked Potentials**
A. *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.
B. *Auditory evoked potentials*, also called *auditory brainstem response (ABR),* are an electrophysiologic measure of auditory function that utilizes responses produced by the auditory nerve and brainstem and helps differentiate sensory from neural hearing loss. The response is the waveform averaged over many auditory clicks.

III. **Visual-Evoked Potentials**
Visual-evoked potentials (VEPs) are used to track visual signals from the retina to the occipital cortex. VEP monitoring has been used for surgery on lesions near optic chiasm. However, intraoperatively recorded VEPs are very difficult to interpret due to their sensitivity to anesthesia, temperature, and blood pressure.

IV. **Motor-Evoked Potentials**
Motor evoked potentials (MEPs) are elicited by either electrical or magnetic stimulation of the motor cortex or the spinal cord. Transcranial electrical stimulation involves stimulation of the motor cortex via electrodes on the scalp, or if the brain is exposed by a craniotomy, the motor cortex is stimulated via electrodes placed directly on the brain surface. Magnetic stimulation delivers a pulsed magnetic field over the scalp in the region of the primary motor cortex. Magnetic stimulation is generally regarded as unsuitable for intraoperative monitoring because it is more sensitive to anesthesia.

V. **Intra-Operative Neurophysiologic Monitoring**
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. Different methodologies include, but may not be limited to:

somatosensory-evoked potentials, motor-evoked potentials using transcranial electrical stimulation, brainstem auditory-evoked potentials, electromyography (EMG) of cranial nerves, electroencephalography, and electrocorticography.

RATIONALE

There is sufficient data published in the medical literature to conclude that measurement of evoked potentials and intraoperative monitoring of evoked potentials in appropriate situations improves health outcome. Improved health outcomes have been achieved outside the investigational setting.

Studies have demonstrated a statistically significant association between abnormal visual evoked potentials (VEPs) and an increased risk of developing clinically definite multiple sclerosis (CDMS). In these studies, patients with suspected MS were 2.5 to 9 times as likely to develop CDMS as patients with normal VEPs. VEP sensitivities ranged from 25% to 83%. VEPs improved the ability to predict which MS suspects will develop CDMS by as much as 29%. Measurement of visual evoked responses (VERs) is the primary means of objectively testing vision in infants and young children. VER measurements are useful in infants and young children suspected of having disorders of the visual system, where the child is too young to report differences in color vision or to undergo assessment of visual fields and visual acuity. Lesions affecting the visual pathways can be localized by noting the presence of decreased amplitudes or increased latencies of VERs, and by determining whether VER abnormalities involve one or both eyes.

Several small studies (Pillai et al. 2013, Mousa et al. 2014, Jha et al. 2017, Waisbourd et al. 2017) have investigated the use of VEP technology to differentiate between normal healthy eyes and eyes with early to advanced visual field loss resulting from glaucoma. The authors indicated that VEP signals may discriminate between normal eyes and glaucomatous eyes. However, larger studies are needed to confirm these findings. Additionally, VEP has not been shown to be superior to standard visual field testing in the diagnosis of glaucoma or management of clinical outcomes.

The clinical utility of BAER over standard auditory testing is due to several of BAER's characteristics: (1) BAER's resistance to alteration by systemic metabolic abnormalities, medications or pronounced changes in the state of consciousness of the patient; and (2) the close association of BAER waveform abnormalities to underlying structural pathology. BAER has been proven effective for differentiating conductive from sensory hearing loss, for detecting tumors and other disease states affecting central auditory pathways (e.g., acoustic neuromas, subclinical lesions in multiple sclerosis), and for noninvasively detecting hearing loss in patients who cannot cooperate with subjective auditory testing (e.g., infants, comatose patients). BAER is the test of choice to assess hearing in infants and young children. It is most useful for following asphyxia, hyperbilirubinemia, intracranial hemorrhage, or meningoencephalitis or for assessing an infant who has trisomy. BAER also is useful in the assessment of multiple sclerosis or other demyelinating conditions, coma, or hysteria. Audiometric analysis using multiple sound frequencies is usually preferred over BAER for testing hearing in cooperative patients who are able to report when sounds are heard.

Intraoperative neurophysiological monitoring has been utilized in attempts to minimize neurological morbidity from operative manipulations. The goal of such monitoring is to identify changes in brain, spinal cord, and peripheral nerve function prior to irreversible damage. Intraoperative monitoring also has been effective in localizing anatomical structures, including peripheral nerves and sensorimotor cortex, which helps guide the surgeon during dissection. SSEP has been the standard of intraoperative monitoring, with excellent ability to assess dorsal column and lateral sensory tract function; it probably also can detect changes in function of anterior motor tracts by stimulating mixed sensorimotor peripheral nerves. However, significant motor deficits have been seen in patients undergoing spinal surgery despite normal SSEPs. MEPs were developed to better monitor the motor neurophysiological pathways.

In patients with pre-operative spinal cord compromise, MEPs may be present when SSEPs are absent or ill-defined. This is because MEPs and SSEPs are conducted in different spinal cord pathways and have different blood supplies. Consequently, being able to perform MEP monitoring makes spinal cord monitoring possible in cases where SSEP signals are unobtainable. In the operating room, transcranial electrical stimulation is preferable to transcranial magnetic stimulation because the electrical stimulus is more reproducible.

For individuals who are undergoing thyroid or parathyroid surgery and 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 derives 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 this 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 might also contribute to a higher risk for RLN injury. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

CODES

- *Eligibility for reimbursement is based upon the benefits set forth in the member's subscriber contract.*
- *CODES MAY NOT BE COVERED UNDER ALL CIRCUMSTANCES. PLEASE READ THE POLICY AND GUIDELINES STATEMENTS CAREFULLY.*
- *Codes may not be all inclusive as the AMA and CMS code updates may occur more frequently than policy updates.*
- *Code Key: Experimental/Investigational = (E/I), Not medically necessary/appropriate = (NMN)*

CPT Codes

Code	Description
92585	Auditory evoked potentials for evoked response audiometry and/or testing of the central nervous system; comprehensive
92586	Auditory evoked potentials for evoked response audiometry and/or testing of the central nervous system; limited
95925-95927, 95938	Somatosensory-evoked potentials (code range)
95928-95929, 95939	Central motor evoked potential study (transcranial motor stimulation) (code range)
95930	Visual-evoked potentials (VEP) checkerboard or flash testing, central nervous system except glaucoma, with interpretation and report
95940	Continuous intraoperative neurophysiology monitoring in the operating room, one to one monitoring requiring personal attendance, each 15 minutes (List separately in addition to code for primary procedure)
95941	Continuous intraoperative neurophysiology monitoring, from outside the operating room (remote or nearby) or for monitoring of more than one case while in the operating room, per hour (List separately in addition to code for primary procedure)
0333T **(E/I)**	Visual evoked potential, screening of visual acuity, automated
0464T **(E/I)**	Visual evoked potential, testing for glaucoma, with interpretation and report

HCPCS Codes

Code	Description
G0453	Continuous intraoperative neurophysiology monitoring, from outside the operating room (remote or nearby) per patient (attention directed exclusively to one patient) each 15 minutes (List separately in addition to code for primary procedure)

ICD10 Codes

Code	Description
C71.6	Malignant neoplasm of cerebellum
C79.31	Secondary malignant neoplasm of brain
D33.0-D33.2	Benign neoplasm of brain (code range)
D33.3	Benign neoplasm of cranial nerves
D43.0-D43.2	Neoplasm of uncertain behavior of brain (code range)
D43.4	Neoplasm of uncertain behavior of spinal cord
D49.6	Neoplasm of unspecified behavior of brain
H40.001-H40.9 (E/I)	Glaucoma (code range)
H53.411-H53.419	Scotoma involving central area (code range)
H53.421-H53.429	Scotoma of blind spot area (code range)
H53.431-H53.439	Sector or arcuate defects (code range)
H53.451-H53.459	Other localized visual field defect (code range)
H53.481-H53.489	Generalized contraction of visual field (code range)
H53.461-H53.469	Homonymous bilateral field defects (code range)
H53.47	Heteronymous bilateral field defects ~~(code range)~~
I63.031-I63.039	Cerebral infarction due to thrombosis of carotid artery (code range)
I63.131-I63.139	Cerebral infarction due to embolism of carotid artery (code range)
I63.231-I63.239	Cerebral infarction due to unspecified occlusion or stenosis of carotid arteries (code range)
I65.21-I65.29	Occlusion and stenosis of carotid artery (code range)
I71.00-I71.03	Dissection of aorta (code range)
M40.00-M40.05	Postural kyphosis (code range)
M40.202-M40.209	Unspecified kyphosis (code range)
M40.292-M40.299	Other kyphosis (code range)
M40.30-M40.37	Flatback syndrome (code range)
M40.40-M40.57	Lordosis (code range)
M41.00-M41.27	Idiopathic scoliosis (code range)
M41.30-M41.35	Thoracogenic scoliosis (code range)
M41.80-M41.~~9~~87	Other forms of scoliosis (code range)
M41.9	Scoliosis, unspecified
M43.6	Torticollis
M48.00-M48.08	Spinal stenosis (code range)

Code	Description
M50.10-M50.13	Cervical disc disorder with radiculopathy (code range)
M50.20-M50.23	Other cervical displacement (code range)
M53.0	Cervicocranial syndrome
M53.1	Cervicobrachial syndrome
M53.80-M53.88	Other specified dorsopathies (code range)
M54.11	Radiculopathy, occipito-atlanto-axial region
M54.13	Radiculopathy, cervicothoracic region
M54.81	Occipital neuralgia
M96.3	Postlaminectomy kyphosis
M96.4	Postsurgical lordosis
M99.20-M99.29	Subluxation stenosis of neural canal (code range)
M99.30-M99.39	Osseous stenosis of neural canal (code range)
M99.40-M99.49	Connective tissue stenosis of neural canal (code range)
M99.50-M99.59	Intervertebral disc stenosis of neural canal (code range)
M99.60-M99.69	Osseous and subluxation stenosis of intervertebral foramina (code range)
M99.70-M99.79	Connective tissue and disc stenosis of intervertebral foramina (code range)

REFERENCES

Amarasekera DC, et al. Steady-state pattern electroretinogram and short-duration transient visual evoked potentials in glaucomatous and healthy eyes. Clin Exp Ophthalmol 2018 Jan;46(1):54-61.

*BlueCross BlueShield Association. Intra-operative neurophysiologic monitoring (sensory-evoked potentials, motor evoked potentials, EEG monitoring). Medical Policy Reference Manual Policy # 7.01.58. 2018 April 12.

Chawla J. Clinical applications of somatosensory evoked potentials. Updated 11/08/18. [https://emedicine.medscape.com/article/1139393-overview] accessed 12/12/18.

Chawla J. Motor evoked potentials. Updated 11/08/18. [https://emedicine.medscape.com/article/1139085-overview#a1] accessed 12/12/18.

Chen XW and Zhao YX. Comparison of isolated-check visual evoked potential and standard automated perimetry in early glaucoma and high-risk ocular hypertension. Int J Ophthalmol 2017 Apr 18;10(4):599-604.

Cruccu G, et al. Recommendations for the clinical use of somatosensory-evoked potentials. Clin Neurophysiol 2008 Aug;119(8):1705-19.

Dong CC, et al. Intraoperative facial motor evoked potential monitoring with transcranial electrical stimulation during skull base surgery. Clin Neurophysiol 2005;116:588-96.

Frei FJ, et al. Intraoperative monitoring of motor-evoked potentials in children undergoing spinal surgery. Spine 2007 Apr 15;32(8):911-7.

Evans AB. Clinical utility of evoked potentials. Updated 3/14/17. [http://www.emedicine.com/neuro/topic69.htm] accessed 12/12/18.

Glasker S, et al. Monitoring motor function during resection of tumours in the lower brain stem and fourth ventricle. Childs Nerv Syst 2006 Oct;22(10):1288-95.

*Grosneth GS and Ashman EJ. Practice parameter: the usefulness of evoked potentials in identifying clinically silent lesions in patients with suspected multiple sclerosis, report of the American Academy of Neurology. Neuro 2000 May;54:1720-5.

Horiuchi K, et al. Intraoperative monitoring of blood flow insufficiency during surgery of middle cerebral artery aneurysms. J Neurosurg 2005 Sep;103(2):275-83.

Jacobs MJ, et al. The value of motor evoked potentials in reducing paraplegia during thoracoabdominal aneurysm repair. J Vasc Surg 2006 Feb;43(2):239-46.

Jha MK, et al. Visual evoked potentials in primary open angle glaucoma. J Neurodegener Dis 2017;2017:9540609. Epub 2017 Jul 20.

Julkunen P, et al. Navigated TMS combined with EEG in mild cognitive impairment and Alzheimer's disease: a pilot study. J Neurosci Methods 2008 Jul 30;172(2):270-6.

Jung P, et al. Multimodal evoked potentials measure and predict disability progression in early relapsing-remitting multiple sclerosis. Mult Scler 2008 May;14(4):553-6.

Kim YJ, et al. Use of multifocal visual evoked potential tests in the objective evaluation of the visual field in pediatric epilepsy surgery. J Neurosurg 2006 Mar;104(3 Suppl):160-5.

Lases EC, et al. Clinical prospective study of biochemical markers and evoked potentials for identifying adverse neurological outcome after thoracic and thoracoabdominal aortic aneurysm surgery. Br J Anaesth 2005 Nov;95(5):651-61.

Legatt AD. General principles of somatosensory evoked potentials. Updated 12/08/14. [http://www.emedicine.com/neuro/topic640.htm] accessed 12/12/18.

Leocani L, et al. Multimodal evoked potentials to assess the evolution of multiple sclerosis: a longitudinal study. J Neurol Neurosurg Psychiatry 2006 Sep;77(9):1030-5.

Liem L. Intraoperative neurophysiological monitoring. [http://www.emedicine.com/neuro/topic102.htm] Updated 3/17/16, accessed 12/12/18.

Lo YL, et al. Intra-operative monitoring in scoliosis surgery with multi-pulse cortical stimuli and desflurene anesthesia. Spinal Cord 2004;41:342-5.

Lo YL, et al. Transcranial magnetic stimulation screening for cord compression in cervical spondylosis. J Neurol Sci 2006 May 15;244(1-2):17-21.

*McDonald DB, et al. Monitoring scoliosis surgery with combined multiple pulse transcranial electric motor and cortical somatosensory-evoked potentials from the lower and upper extremities. Spine 2003 Jan;28(2):194-203.

Misra UK, et al. The role of sensory and motor evoked potentials in the prognosis of Pott's paraplegia. Clin Neurophysiol 2004 Oct;115 (10):2267-73.

Mousa MF, et al. Evaluation of hemifield sector analysis protocol in multifocal visual evoked potential objective perimetry for the diagnosis and early detection of glaucomatous field defects. Korean J Ophthalmol 2014 Feb;28(1):49-65.

Neuloh G, et al. Motor evoked potential monitoring with supratentorial surgery. Neurosurg 2004 May;54 (5):1061-70.

Neuloh G, et al. Motor tract monitoring during insular glioma surgery. J Neurosurg 2007 Apr;106(4):582-92.

Paradiso G, et al. Multimodality intraoperative neurophysiologic monitoring findings during surgery for adult tethered cord syndrome: analysis of a series of 44 patients with long-term follow-up. Spine 2006 Aug 15;31(18):2095-102.

Pillai C, et al. Sensitivity and specificity of short-duration transient visual evoked potentials (SD-tVEP) in discriminating normal from glaucomatous eyes. Invest Ophthalmol Vis Sci 2013 Apr 23;54(4):2847-52.

Piron L, et al. Clinical correlation between motor evoked potentials and gait recovery in poststroke patients. Arch Phys Med Rehabil 2005 Sep;86(9):1874-8.

*Rothstein TL. The role of evoked potentials in anoxic-ischemic coma and severe brain trauma. J Clin Neurophysiol 2000 Sep;17(5):486-97.

Schmidt GN, et al. Identification of sensory blockade by somatosensory and pain-induced evoked potentials. Anesthesiol 2007 Apr;106(4):707-14.

Schwartz DM, et al. Neurophysiological detection of impending spinal cord injury during scoliosis surgery. J Bone Joint Surg Am 2007 Nov;89(11):2440-9.

*Sherman DA. Coma prognosis in children: part II: clinical application. J Clin Neurophysiol 2000 Sep;17(5):467-72.

Shields CB, et al. Objective assessment of cervical spinal cord injury levels by transcranial magnetic motor-evoked potentials. Surg Neurol 2006 Nov;66(5):475-83.

*Thompson AJ, et al. Diagnostic criteria for primary progressive multiple sclerosis: a position paper. Ann Neurol 2000;47:831-5.

Waisbourd M, et al. Short-duration transient visual evoked potentials and color reflectivity discretization analysis in glaucoma patients and suspects. Int J Ophthalmol 2017 Feb 18;10(2):254-261.

Weinzierl MR, et al. Combined motor and somatosensory evoked potentials for intraoperative monitoring: intra-and postoperative data in a series of 69 operations. Neurosurg Rev 2007 Apr;30(2):109-16.

*Key Article

KEY WORDS

ABR, BAEPs, Evoked potentials, MEPS, SEEPs, VEPS.

CMS COVERAGE FOR MEDICARE PRODUCT MEMBERS

There is currently a National Coverage Determination (NCD) for Evoked Response Tests. Please refer to the following NCD website for Medicare Members: http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=200&ncdver=1&CoverageSelection=Both&ArticleType=All&PolicyType=Final&s=New+York+-+Upstate&CptHcpcsCode=36514&bc=gAAAABAAAAAA&

There is currently a Local Coverage Determination (LCD) for Visual Electrophysiology Testing. Please refer to the following LCD website for Medicare Members: https://www.cms.gov/medicare-coverage-database/details/lcd-details.aspx?LCDId=36831&ver=25&SearchType=Advanced&CoverageSelection=Both&NCSelection=NCA%7cCAL%7cNCD%7cMEDCAC%7cTA%7cMCD&ArticleType=SAD%7cEd&PolicyType=Both&s=41&KeyWord=evoked+potentials&KeyWordLookUp=Doc&KeyWordSearchType=Exact&kq=true&bc=IAAAACAAAAAA&