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Subject: Evoked Potentials, Intraoperative Neurophysiologic Monitoring, and Quantitative Electroencephalography (QEEG)

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DESCRIPTION:

Evoked Potentials

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 including:

- **Sensory-evoked potential (SEP):** SEP describes the responses of the sensory pathways to sensory or electrical stimuli. Intraoperative monitoring of SEPs is used to assess the functional integrity of central nervous system pathways during surgeries that put the spinal cord or brain at risk for significant ischemia or traumatic injury. The basic principles of SEP monitoring involve identification of a neurologic region at risk, selection and stimulation of a nerve that carries a signal through the at risk region and recording and interpreting the signal at certain standardized points along the pathway. Monitoring of SEPs is commonly used in 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.
- **Somatosensory-evoked potentials (SSEPs):** 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. The 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 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):** 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.
- **Motor-Evoked Potentials (MEPs):** 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.
- **Visual-evoked potentials (VEPs):** 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.
- **Vestibular-Evoked Myogenic Potentials (VEMPs):** VEMP testing (i.e., click evoked neurogenic vestibular potentials) is a neurophysiological assessment technique used to determine the function of the inner ear, specifically the utricle and saccule. VEMP has been investigated in the diagnosis and management of Meniere's disease, vestibular neuritis, otosclerosis, and central nervous system disorders such as multiple sclerosis.

Intraoperative Neurophysiologic Monitoring

Intraoperative neurophysiologic monitoring (IONM) describes a variety of procedures that have been used to monitor the integrity of neural pathways during high-risk neurosurgical, orthopedic, and vascular surgeries. The principal goal of 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 include SEPs, SSEPs, BAEPs, VEPs, MEPs, and:

- **Electromyogram (EMG) Monitoring and Nerve Conduction Velocity Measurements:** EMG 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 (eg, to identify the extent of nerve damage before nerve grafting or during resection of tumors). For procedures with a risk of vocal cord paralysis due to damage to the recurrent laryngeal nerve (ie, during carotid artery, thyroid, parathyroid, goiter, or anterior cervical spine procedures), monitoring of the vocal cords or vocal cord muscles has been performed. These techniques may be used

during procedures proximal to the nerve roots and 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 SEPs, but the purpose is similar to verify that the neural pathway is intact.

- **Electroencephalogram (EEG) Monitoring:** Spontaneous EEG monitoring can be recorded during surgery and can be subdivided:
 - **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 with a normal EEG activity. Carotid endarterectomy may be 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.

Quantitative Electroencephalography (QEEG)

A quantitative electroencephalogram (QEEG), also known as brain mapping, analyzes the electrical activity obtained at as many as 25 sites on the brain and compares the analysis with information from a database of normal and abnormal brain activity. The results of the analysis can be displayed in a graphical form called a brain map. QEEG can provide insight into brain function relevant to certain neurologic conditions.

POSITION STATEMENT:

Evoked Potentials

Somatosensory-evoked potentials (SSEP) **meet the definition of medical necessity** when performed to assist in the diagnosis of certain neuropathologic states in order to provide information for treatment management for **ANY** of the following conditions (this is not an all-inclusive list):

1. Cervical spondylosis with myelopathy
2. Coma
3. Friedreich's ataxia
4. Hereditary and idiopathic peripheral neuropathies
5. Inflammatory and toxic neuropathies
6. Multiple sclerosis
7. Myoclonus
8. Spinal cord trauma
9. Spinal cord tumors

10. Spinal stenosis and other conditions where there is spinal cord compression
11. Syringomyelia.

Visual-evoked potentials **meet the definition of medical necessity** when performed for any of the following conditions:

1. To confirm a diagnosis of multiple sclerosis, evidenced by clinical signs and symptoms (i.e., diplopia, nystagmus, optic neuritis, and occasional papillitis)
2. To assess visual function in an infant or child under age one
3. To rule out hysterical blindness and suspected malingering
4. To evaluate blindness due to optic trauma.

NOTE: Visual-evoked potentials **do not meet the definition of medical necessity** when performed on severely myopic members (corrected visual acuity is less than 20/200).

Auditory-evoked potentials **meet the definition of medical necessity** when performed for the following conditions:

1. Evaluation of hearing loss with disturbed balance, unsteadiness of gait, or other symptoms suggestive of auditory system lesion
2. Evaluation of symptoms suggestive of [Meniere's Disease](#)
3. Intrinsic brainstem lesions (i.e., multiple sclerosis, brainstem infarctions when auditory pathways are involved, brainstem gliomas, or degenerative disorders of the nervous system)
4. Confirmation of brain death when EEG is inconclusive
5. Intraoperative evaluation of the 8th cranial nerve when an acoustic neuroma is being removed
6. Evaluation of dizziness when other causes have been ruled out continuing dizziness after failed treatment for the cause (arrhythmias, ear infection, headache, hypotension)
7. Evaluation of hearing loss in child or neonate since no verbal response is required
8. Assessment of hysterical or factitious hearing loss
9. Evaluation to differentiate sensory (cochlear) from neural (8th cranial nerve) hearing loss
10. Evaluation of "[true vertigo](#)", as revealed by complete history and physical, suggesting vestibular disease.

Motor-evoked potentials using transcranial electrical stimulation **meet the definition of medical necessity** for evaluation of suspected hysterical or factitious paralysis.

Somatosensory-evoked potentials (SSEP), visual-evoked potentials, auditory-evoked potentials, or motor-evoked potentials using transcranial electrical stimulation **do not meet the definition of medical necessity** for all other indications.

Vestibular-evoked myogenic potential (VEMP) testing is considered **experimental or investigational**. There is a lack of clinical evidence published in the peer-reviewed literature demonstrating that VEMP testing alters patient management or provides added benefit to health outcomes.

Intraoperative Monitoring

Intraoperative neurophysiologic monitoring, which includes somatosensory-evoked potentials (SSEP), motor-evoked potentials (MEP) using transcranial electrical stimulation, brainstem auditory-evoked potentials (BAEP), EMG of cranial nerves, EEG, and electrocorticography (EcoG), **meets the definition of medical necessity** during spinal, intracranial, or vascular procedures.

Intraoperative neurophysiologic monitoring of the recurrent laryngeal nerve **meets the definition of medical necessity** in members undergoing:

1. high risk thyroid or parathyroid surgery, including:
 - a. total thyroidectomy
 - b. repeat thyroid or parathyroid surgery
 - c. surgery for cancer
 - d. thyrotoxicosis
 - e. retrosternal or giant goiter
 - f. thyroiditis.
2. anterior cervical spine surgery associated with any of the following increased risk situations:
 - a. 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
 - b. multilevel anterior cervical discectomy and fusion
 - c. preexisting recurrent laryngeal nerve pathology, when there is residual function of the recurrent laryngeal nerve.

Intraoperative neurophysiologic monitoring of the recurrent laryngeal nerve during anterior cervical spine surgery not meeting the criteria above or during esophageal surgeries is considered **experimental or investigational**. The evidence is insufficient to determine the effects of the technology on health outcomes.

Intraoperative monitoring of visual-evoked potentials is considered **experimental or investigational** for all indications. There is insufficient evidence to permit conclusions on clinical utility or net health outcomes.

Due to the lack of monitors approved by the U.S. Food and Drug Administration (FDA), intraoperative monitoring of motor-evoked potentials using transcranial magnetic stimulation is considered **experimental or investigational** for all indications.

Intraoperative EMG and nerve conduction velocity monitoring during surgery on the peripheral nerves **does not meet the definition of medical necessity**. The evidence is insufficient to determine the effects of the technology on health outcomes.

Quantitative electroencephalography (QEEG)

Quantitative electroencephalography (QEEG) **meets the definition of medical necessity** when performed as an adjunct to traditional EEG for the following conditions:

1. epilepsy, when **ANY** of the following are met:
 - a. the long-term EEG is inconclusive and additional testing for possible epileptic spikes or seizures is needed;
 - b. ambulatory recording is needed to facilitate subsequent visual EEG interpretation; or
 - c. for topographic voltage and dipole analysis in presurgical candidates with intractable epilepsy.
2. cerebral vascular disease, dementia, or encephalopathy:
 - a. when routine EEG outcomes and neurological imaging are inconclusive to confirm diagnostic symptoms.
3. to provide continuous monitoring for the early detection of an acute intracranial complication during cerebrovascular surgery (i.e., intracranial, carotid endarterectomy)
4. to provide monitoring for detecting non-convulsive seizures in high-risk Intensive Care Unit (ICU) members.

Quantitative electroencephalography (QEEG) is considered **experimental or investigational** when performed for other indications such as, but not limited to, the following conditions, as there is insufficient scientific evidence in the peer reviewed medical literature to support its clinical usefulness:

1. anxiety
2. attention deficit disorder
3. attention-deficit hyperactivity disorder
4. autism spectrum disorders
5. depression
6. learning disorders
7. schizophrenia
8. substance abuse.

BILLING/CODING INFORMATION:

CPT Coding:

0333T	Visual evoked potential, screening of visual acuity, automated, with report
0464T	Visual evoked potential, testing for glaucoma, with interpretation and report (Noncovered)

92517	Vestibular evoked myogenic potential (VEMP) testing, with interpretation and report; cervical (cVEMP) (Investigational)
92518	Vestibular evoked myogenic potential (VEMP) testing, with interpretation and report; ocular (oVEMP) (Investigational)
92519	Vestibular evoked myogenic potential (VEMP) testing, with interpretation and report; cervical (cVEMP) and ocular (oVEMP) (Investigational)
92650	Auditory evoked potentials; screening of auditory potential with broadband stimuli, automated analysis
92651	Auditory evoked potentials; for hearing status determination, broadband stimuli, with interpretation and report
92652	Auditory evoked potentials; for threshold estimation at multiple frequencies, with interpretation and report
92653	Auditory evoked potentials; neurodiagnostic, with interpretation and report
95836	Electrocorticogram from an implanted brain neurostimulator pulse generator/transmitter, including recording, with interpretation and written report, up to 30 days
95925	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in upper limbs
95926	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in lower limbs
95927	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in the trunk or head
95928	Central motor evoked potential study (transcranial motor stimulation); upper limbs
95929	Central motor evoked potential study (transcranial motor stimulation); lower limbs
95930	Visual evoked potential (VEP) checkerboard or flash testing, central nervous system except glaucoma, with interpretation and report
95938	Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system; in upper and lower limbs
95939	Central motor evoked potential study (transcranial motor stimulation); in upper and lower limbs
95940	Continuous intraoperative neurophysiology monitoring in the operating room, one on 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)

95955	Electroencephalogram (EEG) during non-intracranial surgery (e.g. carotid surgery)
95957	Digital analysis of electroencephalogram (EEG) (e.g. for epileptic spike analysis)
95961	Functional cortical and subcortical mapping by stimulation and/or recording of electrodes on brain surface, or of depth electrodes, to provoke seizures or identify vital brain structures; initial hour of attendance by a physician or other qualified health care professional
95962	Functional cortical and subcortical mapping by stimulation and/or recording of electrodes on brain surface, or of depth electrodes, to provoke seizures or identify vital brain structures; each additional hour of attendance by a physician or other qualified health care professional (List separately in addition to code for primary procedure)
S8040	Topographic brain mapping

HCPCS Coding:

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 in addition to primary procedure)
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ICD-10 Diagnosis Codes That Support Medical Necessity for somatosensory-evoked potentials (95925, 95926, 95927, and 95938):

C70.0 – C72.59	Malignant neoplasm of brain, spinal cord, cranial nerves, or other parts of central nervous system
C79.31 - C79.49	Secondary malignant neoplasm of brain and cerebral meninges; and other parts of nervous system
D33.0 – D33.4	Benign neoplasm of brain and other parts of the central nervous system
D43.0 – D43.8	Neoplasm of uncertain behavior of brain and central nervous system
D49.6	Neoplasm of unspecified behavior of brain
G11.1 – G11.9	Hereditary ataxia
G25.3	Myoclonus
G35	Multiple sclerosis
G95.0	Syringomyelia; syringobulbia
G95.20, G95.29, G95.9	Spinal cord compression
I63.031, I63.032, I63.033, I63.039	Cerebral infarction due to thrombosis of carotid artery
I63.131, I63.132, I63.133, I63.139	Cerebral infarction due to embolism of carotid artery
I63.231, I63.232, I63.233, I63.239	Cerebral infarction due to unspecified occlusion or stenosis of carotid arteries
I65.21 – I65.29	Carotid stenosis or occlusion

I71.00 – I71.9	Aortic aneurysm dissection
M47.011 – M47.029	Anterior spinal and vertebral artery compression syndromes
M48.01 – M48.07	Spinal stenosis
M50.00 – M50.03	Cervical disc disorder with myelopathy
M99.20 – M99.22	Subluxation stenosis of neural canal
M99.30 – M99.32	Osseous stenosis of neural canal
M99.40 – M99.42	Connective tissue stenosis of neural canal
M99.50 – M99.52	Intervertebral disc stenosis of neural canal
M99.60 – M99.62	Osseous and subluxation stenosis of intervertebral foramina
M99.70 – M99.72	Connective tissue and disc stenosis of intervertebral foramina
R40.20 – R40.2364	Coma
S14.0xxA – S14.0xxS	Concussion and edema of cervical spinal cord
S14.101A – S14.159S	Other and unspecified injuries of cervical spinal cord
S24.0xxA – S24.0xxS	Concussion and edema of thoracic spinal cord
S24.101A – S24.159S	Other and unspecified injuries of thoracic spinal cord
S34.01xA – S34.139S S34.3xxA – S34.3xxS	Injury of lumbar and sacral spinal cord and nerves at abdomen, lower back and pelvis level

ICD-10 Diagnosis Codes That Support Medical Necessity for motor evoked potentials (MEPs) (95928, 95929, and 95939):

F44.4	Conversion disorder with motor symptom or deficit (hysterical paralysis)
F68.10 – F68.13	Factitious disorder

ICD-10 Diagnosis Codes That Support Medical Necessity for quantitative electroencephalography (QEEG) (95957, 95961, 95962, and S8040):

F01.50 – F01.C4	Vascular dementia
F03.90 – F03.C4	Unspecified dementia
G40.101 – G40.919	Epilepsy and recurrent seizures
G93.40 – G93.49	Other and unspecified encephalopathy
I67.0 – I67.9	Other cerebrovascular diseases

REIMBURSEMENT INFORMATION:

Refer to section entitled [POSITION STATEMENT](#).

PROGRAM EXCEPTIONS:

Federal Employee Program (FEP): Follow FEP guidelines.

State Account Organization (SAO): Follow SAO guidelines.

Medicare Advantage Products:

The following were reviewed on the last guideline reviewed date: National Coverage Determination (NCD) for Evoked Response Tests (160.10), National Coverage Determination (NCD) for Electroencephalographic Monitoring During Surgical Procedures Involving the Cerebral Vasculature

(160.8), and Billing Medicare for Remote Intraoperative Neurophysiology Monitoring [HCPCS Code G0453] (Updated September 2020); located at cms.gov.

The following Local Coverage Determination (LCD) was reviewed on the last guideline reviewed date: Somatosensory Testing (L33958) located at fcso.com.

DEFINITIONS:

True vertigo: a feeling of impulsion, rotation, oscillopsia with associated signs of nausea, vomiting, tinnitus, and deafness, staggering with relief by sitting or lying still.

RELATED GUIDELINES:

[Autonomic Nervous System Testing, 01-95805-20](#)

[Nerve Conduction Studies; F-Wave Studies; H- Reflex Studies, 01-95805-02](#)

[Preventive Services, 01-99385-03](#)

OTHER:

None applicable.

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COMMITTEE APPROVAL:

This Medical Coverage Guideline (MCG) was approved by the Florida Blue Medical Policy and Coverage Committee on 06/24/21.

GUIDELINE UPDATE INFORMATION:

11/28/00	Medical Coverage Guideline developed.
05/15/01	Reformatted and revised.

01/01/02	HCPCS coding changes.
05/15/03	Reviewed; removed reimbursement limitations; added statement regarding tests billed in the office setting.
01/01/05	Annual HCPCS update; consisting of addition of 95928 and 95929.
04/15/05	Scheduled review; no changes in coverage statement; no longer scheduled for routine review (NLR).
04/15/06	Revision consisting of the addition of clarification for ICD-9 diagnosis application.
09/15/07	Review, coverage statements maintained, guideline reformatted, references updated.
09/15/09	Revision consisting of adding fifth digit specificity for ICD-9 diagnosis code 433.1.
10/01/10	4 th Quarter HCPCS coding update: ICD-9 diagnosis code 724.02 revised, ICD-9 code 724.03 added for 95925, 95926, and 95927.
01/01/11	Revision; related ICD-10 codes added.
01/01/12	Annual HCPCS coding update: added 95938 and 95939.
09/15/12	Revision to Position Statement to include information regarding quantitative electroencephalography; add relevant coding; update references.
01/01/13	Annual CPT/HCPCS coding update; added 95940 and 95941 and G0453; revised 95961 and 95962; deleted 95920.
07/01/13	3 rd Quarter CPT coding update: added 0333T; Program Exceptions section updated.
10/15/13	Revision to add position statement for vestibular evoked myogenic potentials (VEMP); references updated.
07/15/15	Revision to the Billing/Coding section.
10/01/15	Revision; ICD9 and ICD10 coding sections updated.
11/01/15	Revision: ICD-9 Codes deleted.
09/15/16	Revision; Guideline title, description, position statements, billing/coding, and references updated.
10/01/16	ICD-10 coding update; codes I63.033, I63.133, & I63.233 added.
01/01/17	Annual CPT/HCPCS update. Added 0464T; revised 0333T.
07/15/17	Revision; Intraoperative monitoring position statements and references updated.
01/01/18	Annual CPT/HCPCS update. Revised code 95930.
01/01/19	Annual CPT/HCPCS coding update. Added code 95836.
06/15/19	Review; Position statements maintained; description section and references updated.
01/01/21	Annual CPT/HCPCS update. Codes 92517-92519,92650-92653 added; codes 92585 & 92586 deleted.
07/15/21	Review; Position statements maintained and references updated.
10/01/22	Annual ICD-10 coding update. Codes F015.11-F01.C4 and F03.911-F03.C4 added; code range I71 updated; codes F01.51, F03.91 and I71.01 deleted.