Intraoperative Neurophysiologic Monitoring (Sensory-Evoked Potentials, Motor-Evoked Potentials, EEG Monitoring) (70158)

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<tr>
<td>Preauthorization</td>
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Preauthorization is not required.

The following Protocol contains medical necessity criteria that apply for this service. The criteria are also applicable to services provided in the local Medicare Advantage operating area for those members, unless separate Medicare Advantage criteria are indicated. If the criteria are not met, reimbursement will be denied and the patient cannot be billed. Please note that payment for covered services is subject to eligibility and the limitations noted in the patient’s contract at the time the services are rendered.

Description

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. 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.

Summary of Evidence

At the present time, it appears that monitoring of somatosensory-evoked potentials (SSEPs) and motor-evoked potentials (MEPs), particularly for spine surgery and open abdominal aorta aneurysm repairs, has broad acceptance, although the evidence base consists mainly of observational studies. Therefore, intraoperative monitoring, which includes SSEPs, MEPs using transcranial electrical stimulation, brainstem auditory-evoked potentials, electromyography (EMG) of cranial nerves, electroencephalography, and electrocorticography, may be considered medically necessary during spinal, intracranial, or vascular procedures.

More research is required to identify the role and utility of intraoperative visual-evoked potentials; this is considered investigational. Due to the lack of U.S. Food and Drug Administration approval, intraoperative monitoring of MEPs 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, although some clinical input recommended monitoring during surgery around cranial and brachial plexus nerves.

It should be noted that there is ongoing controversy about the utility of IONM in some surgical procedures. Most of the literature is from Europe and the United Kingdom, and, while many papers report the sensitivity and specificity of MEPs for predicting postsurgical neurologic deficits, few papers report intraoperative interventions undertaken in response to information from monitoring. In a 2010 review, Malhotra and Shaffrey noted that although MEP monitoring is considered to be safe, relative contraindications include epilepsy, cortical lesion, skull defect, proconvulstant medication, cardiac pacing, and implantable device.¹

Policy

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 U.S. Food and Drug Administration (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.

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 
Protocol.

Policy Guidelines

Constant communication between surgeon, neurophysiologist, and anesthetist are required for safe and 
effective intraoperative neurophysiologic monitoring.

Intraoperative monitoring is considered a separate service only when a licensed healthcare practitioner, other 
than the operating surgeon, interprets the monitoring. The provision/monitoring of the sensory procedure is 
performed by a healthcare practitioner or technician who is in attendance in the operating room throughout the 
procedure. The intraoperative monitoring performed remotely would be provided in conjunction with the 
healthcare provider who is providing/monitoring the sensory test in the operating room, by the remote 
physician whose attention is directed solely on one patient. Those providing the intraoperative monitoring 
services must have the proper training to do so whether providing real-time review and interpretation on-site 
versus remote.

Background

The principal goal of IONM is the identification of nervous system impairment in the hope that prompt interven-
tion will prevent permanent deficits. Correctable factors at surgery include circulatory disturbance, excess 
compression from retraction, bony structures, or 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 next.

Sensory-Evoked Potentials

Sensory-evoked potential (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 (CNS) 
pathways during operations 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 stimula-
tion 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 SEPs 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. SEPs can be further broken down 
into the following categories according to the type of simulation used:
Intraoperative Neurophysiologic Monitoring (Sensory-Evoked Potentials, Motor-Evoked Potentials, EEG Monitoring)

- 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 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.

- 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.

- 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

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. MEPs, especially when induced by magnetic stimulation, can be affected by anesthesia. The Digitimer electrical cortical stimulator received FDA premarket approval in 2002. Devices for transcranial magnetic stimulation have not yet received approval from FDA for this use.

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

Electromyogram 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 peripheral nerves (e.g., to identify the extent of nerve damage before nerve grafting or during resection of tumors). 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 SEPs, but the purpose is similar—to verify that the neural pathway is intact.

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

Regulatory Status
A number of EEG monitors have been cleared for marketing by FDA through the 510(k) process. FDA product code: GWQ.

Services that are the subject of a clinical trial do not meet our Technology Assessment Protocol criteria and are considered investigational. For explanation of experimental and investigational, please refer to the Technology Assessment Protocol.

It is expected that only appropriate and medically necessary services will be rendered. We reserve the right to conduct prepayment and postpayment reviews to assess the medical appropriateness of the above-referenced procedures. Some of this Protocol may not pertain to the patients you provide care to, as it may relate to products that are not available in your geographic area.

References
We are not responsible for the continuing viability of web site addresses that may be listed in any references below.


