

Monitoring Techniques Involved in Intraoperative Neurophysiology

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DESCRIPTION

During surgical procedures, Intraoperative Neurophysiological Monitoring (IONM) aids in determining the health of brain structures and awareness. It entails both the location of critical brain structures and the ongoing monitoring of neural tissue. Identification of intraoperative neural insults is the main objective of IONM in order to enable early intervention to prevent or drastically reduce irreparable damage to the neurological structure and avoid a postoperative neurologic deficit. To prevent interference and signal change brought on by anaesthesia, particular anaesthetic protocols are needed when using neurophysiological monitoring during surgical procedures.

There are various forms of intraoperative neurophysiological monitoring (IONM), each of which tracks a particular neural pathway:

- Evoked potentials including Somatosensory Evoked Potential (SSEP)
- Motor Evoked Potential (MEP)
- Brainstem Auditory Evoked Potential (BAEP)
- Visual Evoked Potential (VEP)
- Electro Encephalo Graphy (EEG)
- Electro Myo Graphy (EMG)

Each intraoperative neurophysiological monitoring method keeps track of a particular neural route.

Somatosensory Evoked Potential (SSEP)

The dorsal column-medial lemniscus pathway, which regulates vibration, proprioception, and tactile differentiation, is observed by SSEP. Peripheral sensory nerves are stimulated by stimulation of skin's sensory receptors, and these nerves pass through the nerve root to the ipsilateral dorsal root ganglia at spinal levels. Fasciculi gracilis and cuneatus, which transmit impulse from the lower and upper extremities, respectively, are formed by the projections from these first-order neurons. The earliest synapses are found in the lower medulla, and the medial lemniscus is formed when the impulses cross across at the level of the brainstem. The primary sensory cortex in the parietal lobe receives information from the impulse as it ascends to the

contralateral thalamus. The median and ulnar nerve are monitored in the upper extremities, whilst the posterior tibial and peroneal nerve are examined in the lower extremities.

Motor Evoked Potential (MEP)

Transcranial electrical stimulation stimulates corticospinal projections at various levels, and MEP monitors motor circuits. Motor evoked potentials are produced at many levels of the brain, including the superficial white matter directly below the motor cortex, the deep white matter of the internal capsule, and pyramidal decussation, depending on the degree of stimulation and the location of the electrode. The spinal cord or muscles are where the electrical potential is recorded. The pyramidal tract generates and transmits MEP.

Visual Evoked Potential (VEP)

In response to a light stimulus, the functional integrity of the optic pathways from the retina to the visual cortex of the brain is measured by VEP. The retina transforms visual stimuli into nerve messages. These signals are sent from the retina to the optic nerve, optic chiasma, optic tract, lateral geniculate body, optic radiation, and visual cortex occipital lobe via the optic pathway to the brain.

Brainstem Auditory Evoked Potential (BAEP)

The brainstem's auditory circuits and the auditory nerve are monitored by BAEP. From the cochlear hair cell, the audio signal passes through the vestibulocochlear nerve, superior olivary complex, lateral lemniscus, inferior colliculus, and medial geniculate body on its way to the primary auditory cortex.

Electromyography (EMG)

EMG tracks somatic efferent nerve activity and assesses each nerve's functional health. During operations, EMG keeps track of the spinal, peripheral, and intracranial nerves. When a motor neuron depolarizes, the muscles it innervates develop an electrical potential. Subdermal or intramuscular electrodes are used to track this electrical activity.

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Electroencephalography (EEG)

Pyramidal neuron clusters, whose cell bodies are located in the third and fifth layers of the cerebral cortex, are responsible for producing the electrical activity detected by EEG.