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INTRAOPERATIVE NEURO-PHYSIOLOGICAL MONITORING IN BRAIN AND SPINE SURGERY

To detect and prevent intraoperative neurological injuries, Neuro-monitoring has established itself as a clinical discipline using neurophysiological methods in surgeries pertaining to the brain and spine/spinal cord. The goal of Intraoperative Neuro-physiological monitoring is to prevent injury to the nervous system during surgeries.

Using this technology, the neurosurgeon can identify anatomically indistinct neural structures by their neuro physiological function. This allows the surgeon to avoid injury to the critical structures in the course of the surgical procedure. In essence, the information gained by the neuro physiological mapping allows the surgeon to operate more safely.

Surgery for brain tumours has become more and more aggressive. However, resection of tumours located in eloquent (critical) areas in the brain requires its identification. Mapping of the sensory motor areas in the brain can be achieved using SSEP (somatosensory evoked potentials) or by using MEP (motor evoked potentials). Using SSEP & MEPs continuous evaluation of the functional integrity of the nervous system is given to the neurosurgeon as a feedback.

SSEP and brainstem auditory evoked potential (BAEP) have been extensively used to assess the functional integrity of the brainstem structures. The human brainstem is a small and highly complex structure containing a variety of critical neural structures. These include the sensory and motor pathways, sensory and motor nuclei, cranial nerve nuclei, cardiovascular and respiratory centers, neural network supporting swallowing, coughing, articulation and the reticular activating system. In such a complex neural structure, even a small lesion can produce severe and life threatening neurological deficits. In these cases, if the tumour doesn't project on the surface, approaching the tumour implies a violation of the anatomical integrity of the brain stem. Therefore functional (ie., physiological) rather than anatomical localisation of the brainstem nuclei and it's pathways should be used to identify safe entry zones for the neuro surgeon to operate. The technique is based on intraoperative electrical stimulation of the motor nuclei of the cranial nerve on the floor of the brainstem using a hand held mono polar stimulating electrode.

SPINE AND SPINAL CORD SURGERY

These surgeries are potentially burdened with serious neurological deficits such as paraparesis/ quadriparesis. As a rule, the closer to the spinal cord the neurosurgeon operates, the higher the risk of injury. Using MEP & SSEP techniques in combination proved highly effective in preventing paraplegia/ quadriplegia. This combined type of monitoring can precisely predict transient post operative motor weakness and clearly distinguish them from the permanent ones.

Intraoperative monitoring during surgery of the lumbosacral nervous system is a demanding task. One of the most widely used applications is in the use of conus-cauda tumours, and the other in the pediatric population who are undergoing surgery for tethered cord with lipomas attached to the filum terminale. Direct stimulation of the nerve roots in the surgical field or direct recording from them after peripheral nerve stimulation has proven helpful. Using mapping techniques, functional neural structures of the lumbosacral region can be correctly identified and thus possibly preserved.

We have been using these intraoperative mapping techniques in the last one year on several of our patients who have undergone major surgeries in the brain and spine/spinal cord. It is also helpful in surgical decompression of fractured bones compressing the cord, and correction of spine deformity like kyphoscoliosis. Therefore with these advancements in mapping technique, surgery in the critical areas of the nervous system has become quite easy for the neurosurgeon to operate at difficult situations.

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