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Editorial

Neurophysiological monitoring (IONPM)

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Application of Neuro-physiological monitoring (IONPM)

Application of neurophysiological monitoring during surgery (IOM) in intra operative Neurospinal surgery, cases reduces the chances of neuro-spinal surgery complications at all neurological level. Many techniques are available and motor and SSEP (evoked potentials somatosensory) are thought to be essential for better results of IONPM. Spinal cord - evoked potentials (SEP) are observed and recorded over cord where stimulation by electrical means is given on directly over the spinal cord (posterior column) by an epidural stimulation by electrodes. SSEP (somatosensory evoked potentials) provide the functional and anatomical continuity of sensory tracts .starting from peripheral most nerve and posterior column to the sensory cortex.

Motor evoked- potentials (MEPs) consist of spinal cord, nerve and muscle MEPs. MEPs works by examination of the working continuity of down going motor pathways, starting from the motor cerebral cortex to the peripheral muscles. Neuro-spinal surgeons must understand the observing methods and techniques and read monitoring records properly to understand use IONPM for the taking appropriate decisions making while under taking the neuro-spinal surgery for safe spinal-neurosurgery and better surgical Results.

Potentials “Somatosensory evoked” (SSEP)

1970, the SSEPs were first utilized to assess the spinal cord functioning undergoing spinal-surgery for scoliosis treatment. After stimulating terminal nerves, SSEPs are observed both from the spinal, epidural electrode and/or also from the sensory area of the brain [1]. Normally, the posterior peripheral -tibial nerve is used for taking SSEP traces.

Used data are stimulation, 0.2 ms duration; at -3 Hz frequency; with 25 mA intensity. This is given for one minute and averaging gives SSEP result [2]. Amplitude and latency are measured and determined. Latency measures the time and measures distance. Amplitude measures the power and is more variable vis a vis latency. Observing the posterior column intactness by SSEP is the commonest form in neuro-spinal surgery.

Sub-dermal needle are used as electrodes. These are made of Platinum. It is used for stimulation and taking readings. Normally, following is considered.

(a) Almost Half fall in amplitude (b) along with one tenth increase in latency in comparison to baseline values of the patients, indicates danger signal. False negative SSEP monitoring happening during neuro-spinal surgery in 0.063% [3]. Multicenter, very vast, research has concluded the result in reduction of postoperative paraplegia by more than half in modality [4]. Soma to sensory evoked potential are better for spinal cord intactness and functioning while much better information about function of nerve root are provided by use of M E POTENTIAL.

Direct waves MEP

Waves are compound representative of corticospinal tract action potentials started by the direct activation of axons and velocity

(conduction) of nearly 50 m/s [1], thus making it useful for monitoring the motor pathways from the motor cerebral cortex up to level of the spinal-cord where electrodes are placed. This is done by single electrical stimulation through trans cranial route of the intensity by, 80-100 mA, and the total stimulus duration of 0.5-1 ms, using normal frequency of 00.5to 2 Hz .Recording of which done from the epidural and sub-dural place of cord [2]. This is directly generated electrical pulse. And thus called "one stimulation technique" of MEP. This technique thus does not need averaging, but if few averages are taken it improves quality of MEP. This is also good because it provides real-time reading clinically. Warning sign are the decrease in wave amplitude by or more than 50 percent of starting base-line value level. Averaging may also be done when signals are not detectable. This may indicate occuring of or high chances of developing neurological deficits which may include injuries such as complete paraplegia.

Other measurements can be used are Neurogenic MEP

1) Muscular or myogenic MEP
2) Simultaneous electromyography

Spontaneous or simultaneously or free running-done electromyography (EMG) is used to see or observe specific nerve root functioning undergoing neurospinal-cord spinal surgery. Spinal EP and SomatoSensory EP data are not real time. But EMG is truely "real-time" data observed from terminal muscle. Free-running EMG thus may eliminate operative radiculopathy while spinal instrumentation procedure is being done. This also may include pedicle screw putting. Here no stimulation is required. This can be done continuously from particular peripheral muscle or muscle groups supplied by particular nerve roots which are at risk during operation [6-12].

Method of trigger Electro Mayo Graphic for observation of the intactness of lumbar pedicle while doing screwing of pedicles surgery and the correctness screw putting was described by Calancie et al 1922 [13].

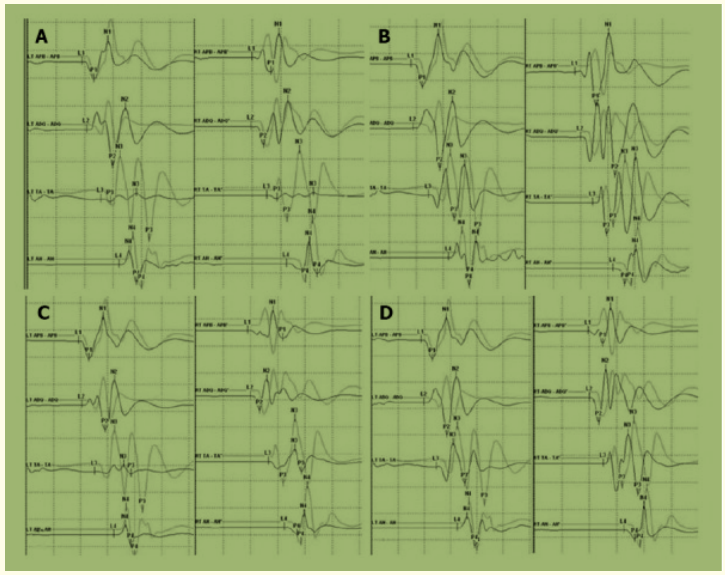
There may be reduction in electrical threshold leading to immediate visualization of CMAPs of the muscles under consideration by the nerve root which are irritated or damaged, by that muscle group due to stimulation using the screw [14].

Spinal cord EP or SCEP technique described in Japan in1970s. Electrical triggering done on the posterior spinal cord by epidural electrodes during procedure [15] and SCEP are recorded at the spinal cord. The Spinal Cord Evoked Potential matches to total of nervous actions that originating from the all up going and down coming tracts and neural tissues at the site of recording. The potentials so recorded are quite vigorous. They in reality shows all actions of the neural tracts of the spinal cord, including posterior columns and cortico-spinal tracts along with others [16]. Therefore practically, Spinal cord Evoked Potential may not provide accurate inputs regarding motor activities. It's so because of presence of sensory-related potentials as well. These large amplitude sensory potentials, masks motor potentials. We have used utilizing neurophysiological monitoring, for lumbosacral discetomy and decompression for canal stenos is and destabilization by immediate fixation using MRI compatible titanium pedicle rods and screw and also cervical spinal surgery for disc and intra and extra spinal neurospinal surgery using-somato sensory evoked potential and MEP, which helped immensely in preventing damage. Under IONPM using somato sensory evoked potential and MEP. This helped immensely in detecting closeness of neural structures and thus alerting the neurospinal surgeon and preventing damage to neural structure. By preventing intraoperative neural structure damage, it helps patients and decrease their mortality and morbidity. Therefore it help the neurospinal surgeon during surgery so he is more confidently and objectively able to avert damage. Therefore it's the recommendation of the author that during neuro-spinal surgeries and spinal fixation the Methodologies should be utilized if available. Therefore it is preferable to use this preventive measure in extra spinal cord and intra spinal cord neurospinal surgeries to neural structure and decreasing the chances of mortality and morbidity for patients and confidence and reliable method for neuro-spinal surgeons [17].

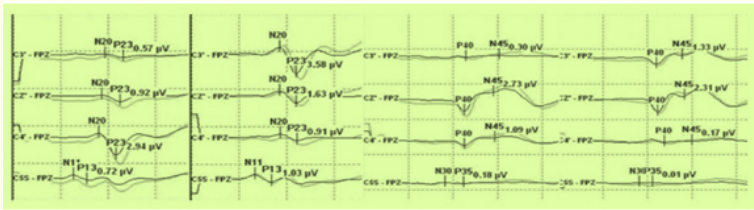
Neurophysiological intra operative graph have been shown as graph 1 and 2.
Graph 1 Recording of Neurophysiological monitoring (intra operative).

Representative case demonstrating clinical usefulness of intraoperative neuromonitoring in spinal surgery. A: MEP after applying rod to the screw heads using derotation maneuver and cantilever maneuver. The amplitude of MEP (black line) at both lower more than

50% compared with the baseline amplitude (green line); B: The amplitude of MEP recovered after correction release by removal of the rods and set screws; C: The amplitude of MEP re-deteriorated extremities decreased after reassembly of the implants; D: The amplitude of MEP recovered finally after raising MAP and administration of dexamethasone. APB: Abductor pollicisbrevis; ADQ: Abductor digitiquinti; TA: Tibialis anterior; AH: Abductor halluces; MEP: Motor evoked potential; MAP: Mean arterial pressure.



Graph 2: SSEP showing no change in comparison to base line.



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