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Total Intravenous Anaesthesia for Intra-Operative Neurophysiological Monitoring

Dr Siddharth.M[1*], Dr Shylaja.D[2], Dr Gunasekaran[3].

[1*]Third Year Postgraduate, Department of Anaesthesiology, Saveetha Medical College and Hospital

[2]Third Year Postgraduate, Department of Anaesthesiology, Saveetha Medical College and Hospital

[3]Professor Department ofAnaesthesiology, Saveetha Medical College and Hospital

*Corresponding Author: Dr Siddharth.M Email id.siddhu7293@gmail.com

Abstract

Intra-operative neurophysiological monitoring is a well-established, safe and sensitive tool for detecting intra-operative injuries during neurosurgeries. Motor evoked potentials (MEP) and somatosensory evoked potentials (SSEP) are monitored throughout the procedure and any significant change from baseline is noted as this may indicate a compromise of the monitored pathway. Anaesthesia especially inhaled agents and muscle relaxants are confounders for motor evoked potential (MEP) monitoring as they have deleterious effects on the amplitude of the waveform signal. Total intravenous anaesthesia with no intraoperative muscle relaxants following intubation has been suggested as the preferred anaesthetic technique for these surgeries.T.I.V.A is an effective means of providing anesthesia for patients requiring intra-operative neurophysiological monitoring.

Keywords: Neuroanaesthesia, Intra-Operative Neurophysiological Monitoring, Total Intravenous Anaesthesia (T.I.V.A).

Introduction

Though relatively new, intraoperative neurophysiological monitoring (IONM) has become standard of care for many neurosurgical procedures. The use of IONM has substantially decreased the rate of paralysis after neuro and orthopedic surgery, and has been validated in intracranial surgeries, cervical spine surgeries, and thoracic & lumbar laminectomy. Anaesthesia especially inhaled agents and muscle relaxants are confounders for motor evoked potential (MEP) monitoring as they have deleterious effects on the amplitude of the waveform signal. All the intravenous anaesthetic agents cause a dose- dependent decreased amplitude and increased latency of the evoked potential. This effect is less marked than those seen with volatile agents. Therefore, to preserve neuronal function during IONM, a combination of intravenous agents is often employed. Because of the preservation of evoked potential, even with the use of high-dose opioids, total intravenous anaesthesia (TIVA) is favoured.

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Case Details:

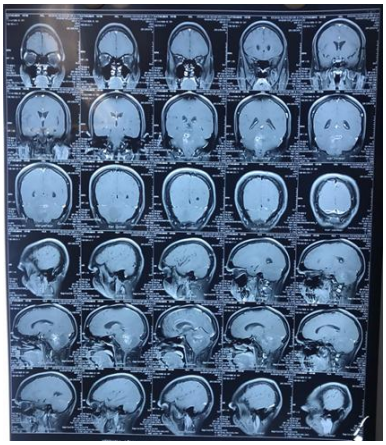
A 20-year-old male patient came with history of headache for the past 6months, blurring of vision for past 3 months and deviation of angle of mouth for past 3months (Fig.1). After obtaining relevant clinical history, clinical examination and imaging studies; a diagnosis of brain stem astrocytoma was made and patient was planned for craniotomy and excision of tumour. (Fig.2)

Routine pre-operative investigation including complete blood count, random blood glucose, renal function test, liver function test, serum electrolytes, urine examination, coagulation profile, chest X ray, electrocardiography, serology, blood grouping & typing and echocardiography were done and found to be within normal limits. Clinical examination including airway examination was within normal limits.

Ophthalmology, otorhinolaryngology, pulmonology and cardiology opinions were obtained.Adequate packed red blood cells were reserved for surgery. High risk consent was obtained. ICU bed with ventilator was kept on standby.

Fig.1. Pre-operative examination of patient showing deviation of Angle of mouth

Fig.2. MRI of the Patient Showing A Space Occupying Lesion in the Brain Stem.



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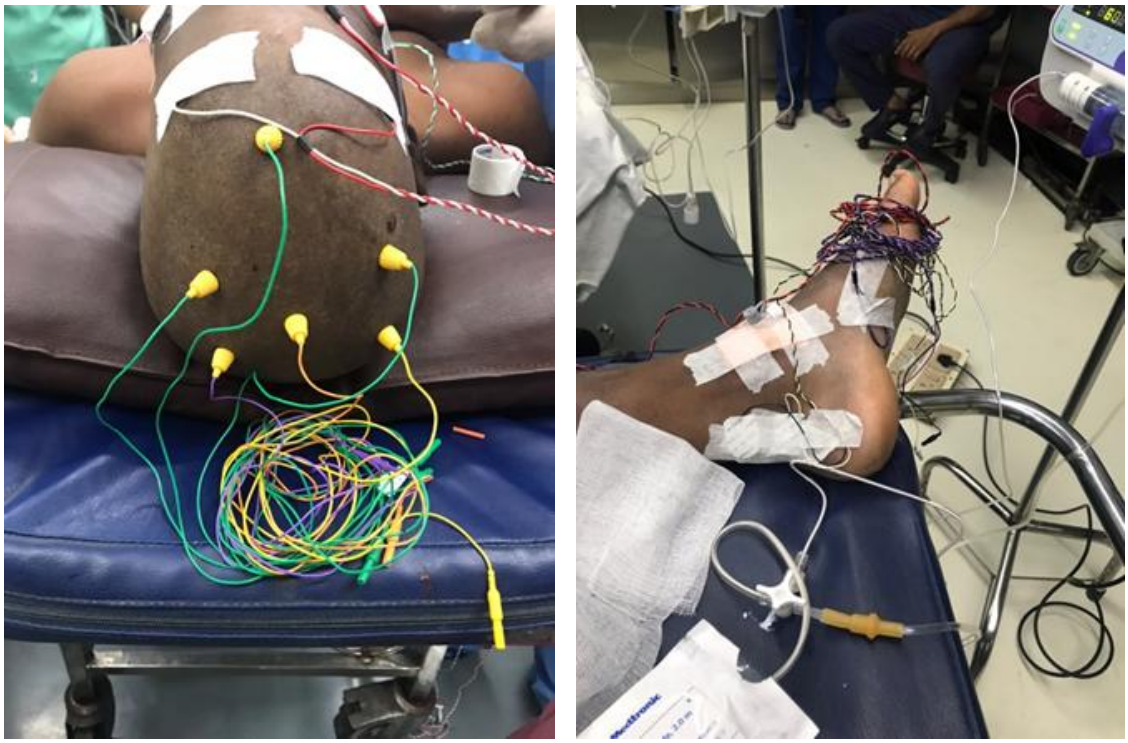
Patient was shifted to operation theatre and ASA standard monitors were attached. Two 16G venflon were secured; one in right hand and one in left leg. Patient was premedicated using 0.2mg glycopyrolate I.V, 1mg midazolam I.V and 100mcg of fentanly I.V. Patient was induced using 100mg of propofol. After confirming ventilation via bag and mask, 25mg of atracurium was given I.V. Bag and mask ventilation was done for three minutes with 100% oxygen and patient was intubated using 8.0 size armoured endotracheal tube. Five-point ausculation done and the endotracheal tube was fixed at 21 centimeters. Proper endotracheal tube position confirmed using end tidal carbon dioxide monitor.

Fig.3 & 4. Electrodes attached for neurophysiological monitoring.



Following confirmation of proper endotracheal tube position, patient was put on mechanical ventilation using 1 litre of oxygen and 1 litre of air (Fig.5). Intraoperative anaesthesia was maintained with target-controlled infusion of propofol using TCI pump (target plasma level of 5-6 mcg/ ml), dexmedetomidine IV infusion at the rate of 0.5mcg/kg/hr and intermittent bolus of I.V fentanyl. Neurophysiological monitors were attached and patient was positioned in prone position for surgery as the tumour was to be approached using a sub-occipital incision (Fig. 3 & 4). 45 minutes following induction of anaesthesia and 30 minutes after starting of IV infusion propofol and dexmedetomidine, no further muscle relaxant was used. Baseline neurophysiological monitoring values were obtained at 60 minutes post induction and incision was made at 80 minutes post induction. Motor evoked potential, somatosensory evoked potential and train of four (TOF) were monitored at regular intervals during the surgery. (Fig.6 & 7).

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Fig.5. Anaesthesia workstation monitor displaying no use of nitrous oxide and volatile inhalational agent.

Following surgery patient was mechanically ventilated and shifted to ICU. Patient was slowly weaned off from the ventilator and extubated in the ICU.

Discussion

Motor evoked potentials are recorded from muscles following direct stimulation of the exposed motor cortex. Somatosensory Evoked potentials are electric activity of the brain that results from stimulation applied over the body.

Train of four (TOF): Four supramaximal stimulus are given every 0.5 second. Each stimulus in the train causes the muscle to contract and "fade" in the response provides the basis for evaluation. Dividing the amplitude of the fourth response by the amplitude of the first response provides the TOF ratio.T.I.V. A reduces the hindrance for Motor Evoked Potentials (MEP) and Somatosensory Evoked Potentials (SSEP) caused by the use of inhalational agents and muscle relaxants.

Fig.6. Train of four (TOF) monitoring

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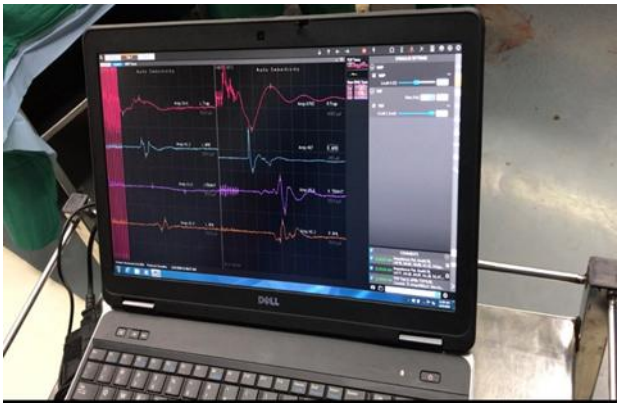
Fig.7. Motor Evoked Potential (MEP) andSomato Sensory Evoked Potential (SSEP) monitoring.



Conclusion

T.I.V.A is an effective means of providing anesthesia for patients requiring intra-operative neurophysiological monitoring. Although the choice and management of anesthesia is important to the success of intra-operative monitoring, the critical component of team work underlies the entire process. In fact, the entire operative team needs to remain focused on their interdependence in creating the most effective outcome for the patient.The interdependence of the surgeon and anaesthesiologist is well known , and the interdependence of the surgeon with the monitoring team is logical.

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Authors' Contributions

All authors were actively involved in the management of the case and in the process of publication.

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Nil**.**

Conflicts of Interest

There are no conflicts of interest.

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