IONM Abstract – 2021 NASS Annual Meeting

Title:

Utility of Intraoperative Neuromonitoring Alerts Relating to Adverse Outcomes in Spine Surgery: A Study of 289 Patients.

Background Context:

Although rare, one of the most problematic complications during spine surgery is neurologic injury with subsequent deficit. The use of multimodal intraoperative neuromonitoring (MIOM) provides the surgical team with real-time assessment of neurological physiology and function. MIOM is thought to be sensitive and specific for identifying perioperative neurological injury in spinal surgery especially deformity surgery. However, results from recent studies have cast doubt on the effectiveness of certain MIOM techniques in detecting neurological injury in spine surgery patients.

Objective:

The purpose of this study was to improve spine surgery patient safety and outcomes by minimizing the incidence of post-operative new neurological deficits correlated to Intraoperative Neuromonitoring Alerts from two neuromonitoring signals: Motor Evoked Potentials (MEPs) and Somatosensory Evoked Potentials (SSEPs).

Study Design:

A multicenter, multi-surgeon prospective quality improvement initiative that was performed in conjunction with Neuro Alert (NA) Monitoring Services. All data was retrospectively analyzed.

Patient Sample:

A total of 289 patients who (1) received non-deformity lumbar (45%), cervical (45%) or thoracic (10%) surgery between July 2018 and July 2019 and (2) underwent SSEP and MEP monitoring throughout the entire surgery.

Outcome Measures:

This study investigated the incidence of immediate post-operative (≤ 48 hours) new neurological deficits. Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) was calculated for the SSEP and MEP signals.

Methods:

The study was a multicenter, multi-surgeon prospective quality improvement initiative that was performed in conjunction with Neuro Alert (NA) Monitoring Services. All neuromonitoring was carried out in accordance with the guidelines set forth by the American Academy of Neurology and the American Board for Neurophysiological Monitoring Programs. Two commonly used MIOM signals were tracked: Somatosensory Evoked Potentials (SSEPs) and Motor Evoked Potentials (MEPs). Intra-operative data was recorded using a paper data collection tool. SSEP and MEP signal changes were classified as

alerts based on the following best-practices guidelines outlined in the literature: 50% or greater decrease in signal amplitude and/or a 10% or greater increase in signal latency with no signal recovery. Immediate post-operative (≤ 48 hours) new neurological deficit status was assessed for all patients. Neurological deficit information was recorded via paper during a post-operative physical exam that all physicians conducted on the patient within 48 hours after surgery. The Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) for the SSEP and MEP signals were calculated.

Results:

SSEP and MEP neuromonitoring data was analyzed for 289 patients who (1) received non-deformity lumbar (45%), cervical (45%) or thoracic (10%) surgery between July 2018 and July 2019 and (2) underwent SSEP and MEP monitoring throughout the entire surgery. A total of 22 MEP and 16 SSEP alerts were triggered. 90% (20) of MEP alerts occurred during Anterior Cervical Discectomy and Fusion (ACDF) procedures; one MEP alert was triggered during a Posterior Cervical Fusion and one MEP alert was triggered during a Lumbar Laminectomy. 56% (9) of SSEP alerts occurred during Transforaminal Lumbar Interbody Fusion procedures while 25% (4) occurred during ACDFs and 19% (3) occurred during Lumbar Laminectomy surgeries. MEP and SSEP alerts were most frequently triggered during the Decompression surgical step (45% and 25%, respectively).

There were 6 instances (n = 6) of new neurological deficits that occurred within 48 hours post-surgery. These deficits were as follows: foot drop (n = 1), leg weakness (n = 1), arm weakness (n = 2), bilateral paraparesis (n = 1) and unilateral paraparesis (n = 1). The patient who developed unilateral paraparesis was myelopathic. All other patients with new neurological deficits did not have a history of myelopathy. The MEP alert should have been triggered for all 6 patients, however the signal was only alerted in the patient that developed bilateral paraparesis and in one patient that developed arm weakness. In 4/6 patients, MEP alerts were not triggered but a new neurological deficit occurred, resulting in a false negative rate of 67% and a Sensitivity of 33%. In addition, MEPs had a Specificity of 92.4%, PPV of 11% and NPV of 98.5%. The SSEP signal showed 100% Sensitivity and displayed a Specificity, PPV and NPV of 95.2%, 12.5% and 100%, respectively.

Conclusions:

The MEP signal had a low Sensitivity of 33%, which differed greatly from that of the SSEP signal (100%). The Specificity, PPV and NPV were comparable between the SSEPs and MEPs. The PPV was low for both signals. Results indicate that the accuracy of SSEP and MEP alerts in detecting new neurological deficits in spine surgery patients immediately post-surgery is questionable. The effectiveness of these two intraoperative neuromonitoring techniques in identifying neurological injury seems uncertain and needs to be explored further.