

# **Do Motor Evoked Potentials (MEPs) Improve Neuromonitoring Sensitivity during Lumbar Spine Surgery?** Anthony Sestokas PhD DABNM FASNM; Eric A Tesdahl PhD; W. Bryan Wilent PhD; James S. Harrop MD, FACS; Cheryl Renee Wiggins; Jeffrey Cohen MD, PhD

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#### Introduction

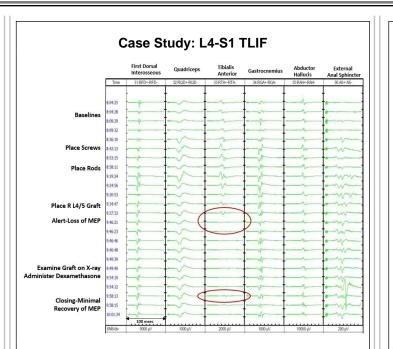
Motor evoked potentials are an important component of multimodality intraoperative neuromonitoring (IONM) for cervical and thoracic spine surgery. However, surgeons utilize this modality less often during procedures in the lumbar region. The present study was undertaken to determine if use of MEPs as part of a multimodality neuromonitoring strategy improves IONM sensitivity to evolving neurologic injury during extradural lumbar spine surgery.

### Methods

We retrospectively reviewed a multi-institutional database of 49,317 consecutive lumbar spine surgeries conducted with IONM between May, 2013 and March, 2017. Neuromonitoring cohorts were based on all combinations of spontaneous electromyography (spEMG), somatosensory evoked potential (SSEP) and/or transcranial electric motor evoked potential (MEP) modalities in the series of cases. True positive (TP) cases were defined as those that had persistent intraoperative neuromonitoring changes and neurologic sequelae (NS), based on neurologic examination in the immediate postoperative period. IONM sensitivity, defined as (number of TP cases)/(number of NS cases)X100% was first calculated for each group, and compared across cohorts using binary logistic regression and post-hoc Tukey HSD tests.

### Results

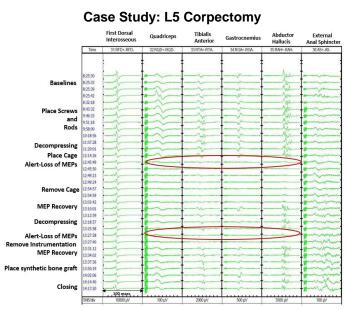
The majority of lumbar spine surgeries (97.7%) in the series were monitored using one of three IONM strategies, which defined the study cohorts: spEMG alone(N=3,516); SSEPs+spEMG (N=35,253); SSEPs+MEPs+spEMG (N=9,428). Neuromonitoring changes prompted alerts in 5,011 of 49,317 (10.2%) cases. The overall incidence of postoperative neurologic sequelae across the series was 0.40%. Sensitivity for detection of neurologic injury was 47.7% for the SSEPs+tceMEPs+spEMG cohort, trending down to 16.7% for the spEMG cohort (p=0.676) and 11.9% for the SSEPs+spEMG cohort (p<0.001). Two case studies illustrating MEP sensitivity to evolving nerve root injury during lumbar spine surgery are shown below.



Persistent loss of MEPs from right tibialis anterior muscle following placement of graft at L4/5. This patient presented postoperatively with right foot drop, which showed partial resolution within several hours of surgery.

### Conclusions

The use of MEPs in concert with SSEP and spEMG monitoring is associated with a four-fold increase in IONM sensitivity for neurologic injury compared to combined SSEP and spEMG monitoring. Introduction of MEPs to a multimodality monitoring strategy may improve detection of evolving neurologic injury and facilitate timely intraoperative intervention to mitigate postoperative complications.



Reversible loss of MEPs during attempted placement of L5 cage. There were no postoperative neurologic sequelae, consistent with intraoperative recovery of MEPs.

## Learning Objectives

Session participants should be able to:

1) Describe the most common IONM strategies for lumbar spine surgery

2) Describe differences in sensitivity for detection of neurologic injury using different combinations of neuromonitoring modalities

3) Describe the incidence of postoperative neurologic deficits in extradural lumbar spine surgery