EVIDENCE SEARCH RESULTS

Question/subject of request:	I work with the spinal surgeons during spinal surgery. We perform intraoperative neurophysiology during scoliosis surgery which means we monitor the function of the spinal cord in real time to avoid neurological injury which could result in paralysis or even death. In the past the surgeons place an indwelling epidural catheter at the end of the procedure and administer local anaesthetic bolus and then infusion of levobupivacaine. However, we have observed that this may affect the neurophysiology signals and so have collected data from 10 patients who had this pain relief administered to see if the signals dropped. This is a service evaluation, so I wanted to know if there is any literature out there on the effect of epidurals on motor evoked potentials.
Date requested:	28th January 2025
Date completed:	12th March 2025
Compiled by:	Laetitia Delaleuf

CITING THIS SEARCH

If you reference this search in any paper, publication or presentation, please let us know.

The citation format is:

- Delaleuf, L., (2025). *Evidence summary: effect of epidurals on motor evoked potentials* Taunton, UK: Somerset Foundation Trust Knowledge and Library Services.

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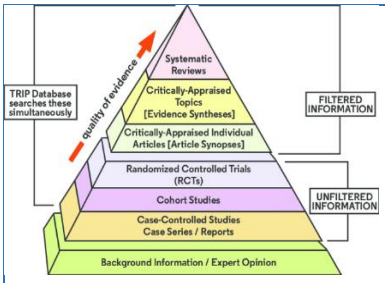

The results are presented according to the hierarchy of evidence which is used to rank the relative strength of results obtained from scientific research.

The design of the study and the endpoints measured affect the strength of the evidence.

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Contents (click to jump to each section):

Summary of search results:

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I haven't found any evidence on epidural with levobupivacaine and the effects on Motor Evoked Potentials (MEP) for spine surgeries. However, there is a case report of ropivacaine (Souvatzis, X., Askitopoulou, H. and Katonis, P., 2009) and the effect on MEP but mainly Somatosensory Evoked Potentials (SSEP) on spinal surgery (57-year-old man). The conclusion was that there is a latency increase and amplitude reduction. This is also noted. in the review done by Barnoub, M., Tetzlaff J.E. and Schubert, A. (2003): "neuraxial administration of local anaesthetics at higher concentrations is not suitable to supplement general anaesthesia in scoliosis surgery if SSEPs are to be monitored". Furutani, K. et al. (2021) also advise using a low dose of local anaesthetic.

Reysner, M. et al. (2024) concluded that erector spinae plane block (ESPB) provides better analgesia. However, there are concerns raised on the compatibility with MEP in the case of lumbar spine surgery (Acharya, P. et al. 2022)

Lidocaine has also been tested in a clinical trial and can be administered without affecting the monitoring of MEP during spinal surgeries (Urban, M. K. et al. 2017).

To complement this, I have also added articles on:

- Intraoperative neurophysiological monitoring: Nunes, R. et al. 2018; Avila E.K. et al. 2013, Deletis, V. and Sala, F. 2008 and 2004
- Effects of anaesthetics agents on motor evoked potential Horiuchi, T. et al. 2007; Lotto, M. L. Banoub, M. and Schubert, A. 2004; Deletis, V.; Rodi, Z.; Amassian, V. E. 2001
- Erector spinae plane block (ESPB): Domagalska, M. et al. 2024
- Dexmedetomidine: Rozet, I. et al. 2015
- Motor evoked potential (broader information): Doyal, A., Schoenherr, J.W. and Flynn, D.N. 2023
- Use of bolus of rocuronium for intraoperative neurophysiologic monitoring of neuro intervention: Ko, M. et al. 2018
- Motor-evoked potential suppression or loss: Lo, Y. L. et al. 2018, Denda, S. et al. 2006

In the section Older articles, you will find articles published mainly in the 90s on SSEP and the effect of epidurals. These articles are still referred to as landmarked studies.

The Knowledge & Library Service have a growing archive of completed evidence summaries on inSPIRE – the organisation's knowledge, research and evidence repository. You can browse the evidence summaries here.

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SYSTEMATIC REVIEW AND REVIEWS

The Influence of Anesthesia on Neuromonitoring During Scoliosis Surgery: A Systematic Review

Authors: Reysner, Malgorzata;Reysner, Tomasz;Janusz, Piotr;Kowalski, Grzegorz;Geisler-Wojciechowska, Alicja;Grochowicka, Monika;Pyszczorska, Monika;Mularski, Aleksander and Wieczorowska-Tobis, Katarzyna
Publication Date: Dec 17 ,2024
Journal: NeuroSci 5(4), pp. 693–712

Abstract: BACKGROUND: Intraoperative neuromonitoring (IONM) is crucial for the safety of scoliosis surgery, providing real-time feedback on the spinal cord and nerve function, primarily through motor-evoked potentials (MEPs). The choice of anesthesia plays a crucial role in influencing the quality and reliability of these neuromonitoring signals. This systematic review evaluates how different anesthetic techniques-total intravenous anesthesia (TIVA), volatile anesthetics, and regional anesthesia approaches such as Erector Spinae Plane Block (ESPB), spinal, and epidural anesthesia-affect IONM during scoliosis surgery. METHODS: A systematic review was conducted following PRISMA guidelines. PubMed, MEDLINE, EMBASE, and Cochrane databases were searched for studies published between 2017 and 2024 that examined the impact of anesthetic techniques on neuromonitoring during scoliosis surgery. The focus was on studies reporting MEP outcomes, anesthetic protocols, and postoperative neurological and analgesic effects. RESULTS: The search initially identified 998 articles. After applying inclusion criteria based on relevance, recency, methodological quality, and citation frequency, 45 studies were selected for detailed review. CONCLUSION: The erector Spinae Plane Block (ESPB) provides distinct benefits over spinal and epidural anesthesia in scoliosis surgery, particularly in maintaining neuromonitoring accuracy, reducing hemodynamic instability, and minimizing complications. The ESPB's ability to deliver effective segmental analgesia without compromising motor function makes it a safer and more efficient option for postoperative pain management, enhancing patient outcomes.

Intraoperative neurophysiological monitoring in neuroanesthesia

Authors: Nunes, Rogean R.;Bersot, Carlos D. A. and Garritano, João G.
Publication Date: Oct ,2018
Journal: Current Opinion in Anaesthesiology 31(5), pp. 532–538

Abstract: PURPOSE OF REVIEW: The purpose of this review is to highlight the importance of making informed choices of anesthetics and evaluating the impact of depth of anesthesia, hemodynamic status and other factors capable of interfering with signal capture during intraoperative neurophysiological monitoring (IONM). RECENT FINDINGS: Over the last decades, neuromonitoring has advanced considerably, allowing for insights into neurological function during anesthesia and making it possible to assess intraoperative consciousness and neural integrity in real time. IONM is indicated in surgeries posing risk to targeted neural tissues and adjacent structures. The technique helps correlate surgical maneuvers with neurophysiological changes at high levels of sensitivity and specificity and can identify risk situations early enough to prevent postoperative neurological deficits. SUMMARY: Experience with IONM, the use of an adequate IONM modality, and knowledge of the effect of anesthetic techniques and agents on neurophysiological parameters are fundamental for reliable measurements. The current gold standard in IONM is total intravenous anesthesia without neuromuscular block.

Intraoperative neurophysiological monitoring of the spinal cord during spinal cord and spine surgery: a review focus on the corticospinal tracts

Authors: Deletis, Vedran and Sala, Francesco
Publication Date: Feb ,2008
Journal: Clinical Neurophysiology : Official Journal of the International Federation of Clinical Neurophysiology 119(2), pp. 248–264

Abstract: Recent advances in technology and the refinement of neurophysiological methodologies are significantly changing intraoperative neurophysiological monitoring (IOM) of the spinal cord. This review will summarize the latest achievements in the monitoring of the spinal cord during spine and spinal cord surgeries. This overview is based on an extensive review of the literature and the authors' personal experience. Landmark articles and neurophysiological techniques have been briefly reported to contextualize the development of new techniques. This background is extended to describe the methodological approach to intraoperatively elicit and record spinal D wave and muscle motor evoked potentials (muscle MEPs). The clinical application of spinal D wave and muscle MEP recordings is critically reviewed (especially in the field of Neurosurgery) and new developments such as mapping of the dorsal columns and the corticospinal tracts are presented. In the past decade, motor evoked potential recording following transcranial electrical stimulation has emerged as a reliable technique to intraoperatively assess the functional integrity of the motor pathways. Criteria based on the absence/presence of potentials, their morphology and threshold-related parameters have been proposed for muscle MEPs. While the debate remains open, it appears that different criteria may be applied for different procedures according to the expected surgery-related morbidity and the ultimate goal of the surgeon (e.g. total tumor removal versus complete absence of transitory or permanent neurological deficits). On the other hand, D wave changes--when recordable--have proven to be the strongest predictors of maintained corticospinal tract integrity (and therefore, of motor function/recovery). Combining the use of muscle MEPs with D wave recordings provides the most comprehensive approach for assessing the functional integrity of the spinal cord motor tracts during surgery for intramedullary spinal cord tumors.

However, muscle MEPs may suffice to assess motor pathways during other spinal procedures and in cases where the pathophysiology of spinal cord injury is purely ischemic. Finally, while MEPs are now considered the gold standard for monitoring the motor pathways, SEPs continue to retain value as they provide specificity for assessing the integrity of the dorsal column. However, we believe SEPs should not be used exclusively--or as an alternative to motor evoked potentials--during spine surgery, but rather as a complementary method in combination with MEPs. For intramedullary spinal tumor resection, SEPs should not be used exclusively without MEPs.

Intraoperative neurophysiological monitoring during spine surgery: An update.
Authors: Deletis V. and Sala, F.
Publication Date: 2004
Journal: Current Opinion in Orthopaedics 15(3), pp. 154–158

Abstract: Purpose of review: Intraoperative neurophysiological monitoring (IONM) during spine surgery has dramatically evolved over the past decade. A number of techniques have been recently proposed to monitor motor evoked potentials (MEPs), but contradictory results have been published, questioning their reliability to assess specifically the functional integrity of the motor pathways. The aim of the review is to present the state of the art of spinal cord monitoring and the different, complementary roles played by somatosensory evoked potentials (SEPs) and MEPs. Recent findings: The authors focused on recent publications analyzing the reliability of SEPs and different MEP techniques during surgeries for spine deformities, anterior-posterior stabilization or decompression, vertebrectomy, and discectomy. Finally, publications on nonsurgically induced changes in IONM parameters during spine orthopedic surgery, such as hypotension and hypothermia, are reviewed to emphasize their importance.

Effects of anesthetic agents and physiologic changes on intraoperative motor evoked potentials
Authors: Lotto, Michelle L.;Banoub, Mark and Schubert, Armin
Publication Date: Jan ,2004
Journal: Journal of Neurosurgical Anesthesiology 16(1), pp. 32–42

Abstract: Motor evoked potentials (MEPs) have shown promise as a valuable tool for monitoring intraoperative motor tract function and reducing postoperative plegia. MEP monitoring has been reported to contribute to deficit prevention during resection of tumors adjacent to motor structures in the cerebral cortex and spine, and in detecting spinal ischemia during thoracic aortic reconstruction. Many commonly used anesthetic agents have long been known to depress MEP responses and reduce MEP specificity for motor injury detection. Although new stimulation techniques have broadened the spectrum of anesthetics that can be used during MEP monitoring, certain agents continue to have dose-dependent effects on MEP reliability. Understanding the effects of anesthetic agents and physiologic alterations on MEPs is imperative to increasing the acceptance and application of this technique in the prevention of intraoperative motor tract injury. This review is intended as an overview of the effects of anesthetics and physiology on the reproducibility of intraoperative myogenic MEP responses, rather than an analysis of the sensitivity and specificity of this monitoring method in the prevention of motor injury.

Pharmacologic and physiologic influences affecting sensory evoked potentials: implications for perioperative monitoring
Authors: Banoub, Mark;Tetzlaff, John E. and Schubert, Armin

Publication Date: Sep ,2003
Journal: Anesthesiology 99(3), pp. 716–737

Extract: This review discusses the physiologic and pharmacologic factors (including newer anesthetic agents and adjuncts) that influence sensory evoked potentials (SEPs), focussing on SSEPs, BAEPs, and VEPs. For ease of reference and to allow better comparisons between anesthetic agents, the discussion of anesthetic effects is separated from physiologic effects. The review intends to help clinicians recognize the important confounding perturbations so that intraoperative changes in SEPs can be interpreted optimally. It also aims to guide anesthetic planning so that reliable intraoperative EP monitoring can be accomplished during effective and safe anesthesia.

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RANDOMISED CONTROLLED TRIALS AND TRIALS

Effectiveness of the Bilateral and Bilevel Erector Spinae Plane Block (ESPB) in Pediatric Idiopathic Scoliosis Surgery: A Randomized, Double-Blinded, Controlled Trial
Authors: Domagalska, Małgorzata;Ciftsi, Bahadir;Janusz, Piotr;Reysner, Tomasz;Daroszewski, Przemysław;Kowalski, Grzegorz;Wieczorowska-Tobis, Katarzyna and Kotwicki, Tomasz
Publication Date: Aug 1 ,2024
Journal: Journal of Pediatric Orthopedics 44(7), pp. e634–e640

Abstract: BACKGROUND: This study aimed to compare the effect of the ultrasound-guided bilateral and bilevel erector spinae plane block (ESPB) on pain scores, opioid requirement, intraoperative motor-evoked potentials (MEPs), and stress response to surgery expressed by the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) versus standard analgesia methods following idiopathic scoliosis surgery. METHODS: This was a prospective, double-blinded, randomized controlled trial. Sixty patients aged 10 to 18 years and physical status ASA 1 or 2 were randomized into 2 equal groups, each receiving an ESPB or sham block. The primary outcome was the pain scores (Numerical Rating Scale, NRS) within 48 hours after spinal correction and fusion surgery for idiopathic thoracic scoliosis. The secondary outcomes were total opioid consumption, NLR, and PLR levels at 12 and 24 hours postoperatively and intraoperative MEPs. RESULTS: ESPB patients presented lower NRS scores, signifying less pain, at all time points (30, 60, 90, 120 min; and 6, 12, 24, and 48 h after surgery), all P <0.0001. The total opioid consumption, the incidence of nausea or vomiting, and the need for remifentanil and propofol during surgery were significantly lower in the ESPB group. The surgery-induced stress response expressed by NLR and PLR was considerably lower in the ESPB group. ESPB did not affect the intraoperative MEP's amplitude. CONCLUSIONS: ESPB is effective for postoperative analgesia, can reduce opioid consumption in patients undergoing scoliosis surgery, and reduces the stress response to surgery. ESPB does not interfere with neuromonitoring. LEVEL OF EVIDENCE: Level I.

Epidural Administration of Ropivacaine Reduces the Amplitude of Transcranial Electrical Motor–Evoked Potentials: A Double-Blinded, Randomized, Controlled Trial
Authors: Furutani, Kenta;Tobita, Toshiyuki;Ishii, Hideaki;Deguchi, Hiroyuki;Mitsuma, Yusuke;Kamiya, Yoshinori and Baba, Hiroshi

Publication Date: April ,2021
Journal: Anesthesia & Analgesia 132(4), pp. 1092

Abstract: BACKGROUND: An epidurally administered local anesthetic acts primarily on the epidural nerve roots and can act directly on the spinal cord through the dural sleeve. We hypothesized that epidurally administered ropivacaine would reduce the amplitude of transcranial electrical motor–evoked potentials by blocking nerve conduction in the spinal cord. Therefore, we conducted a double-blind, randomized, controlled trial.
METHODS: Thirty adult patients who underwent lung surgery were randomly allocated to 1 of 3 groups, based on the ropivacaine concentration: the 0.2% group, the 0.375% group, and the 0.75% group. The attending anesthesiologists, neurophysiologists, and patients were blinded to the allocation. The epidural catheter was inserted at the T5–6 or T6–7 interspace by a paramedian approach, using the loss of resistance technique with normal saline. General anesthesia was induced and maintained using propofol and remifentanil. Transcranial electrical motor–evoked potentials were elicited by a train of 5 pulses with an interstimulus interval of 2 milliseconds by using a constant-voltage stimulator and were recorded from the tibialis anterior muscle. Somatosensory-evoked potentials (SSEPs) were evoked by electrical tibial nerve stimulation at the popliteal fossa. After measuring the baseline values of these evoked potentials, 10 mL of epidural ropivacaine was administered at the 0.2%, 0.375%, or 0.75% concentration. The baseline amplitudes and latencies recorded before administering ropivacaine were defined as 100%. Our primary end point was the relative amplitude of the motor-evoked potentials at 60 minutes after the epidural administration of ropivacaine. We analyzed the amplitudes and latencies of these evoked potentials by using the Kruskal-Wallis test and used the Dunn multiple comparison test as the post hoc test for statistical analysis.
RESULTS: The data are expressed as the median (interquartile range). Sixty minutes after epidurally administering ropivacaine, the motor-evoked potential amplitude was lower in the 0.75% group (7% [3%–18%], between-group difference $P < .001$) and in the 0.375% group (52% [43%–59%]) compared to that in the 0.2% group (96% [89%–105%]). The latency of SSEP was longer in the 0.75% group compared to that in the 0.2% group, but the amplitude was unaffected.
CONCLUSIONS: Epidurally administered high-dose ropivacaine lowered the amplitude of motor-evoked potentials and prolonged the onset latencies of motor-evoked potentials and SSEPs compared to those in the low-dose group. High-dose ropivacaine can act on the motor pathway through the dura mater.

Dexmedetomidine Does Not Affect Evoked Potentials During Spine Surgery

Authors: Rozet, Irene;Metzner, Julia;Brown, Marcia;Treggiari, Miriam M.;Slimp, Jefferson C.;Kinney, Greg;Sharma, Deepak;Lee, Lorri A. and Vavilala, Monica S.
Publication Date: Aug ,2015
Journal: Anesthesia and Analgesia 121(2), pp. 492–501

Abstract: BACKGROUND: The effect of dexmedetomidine on evoked potentials (EPs) has not been elucidated. We aimed to investigate the effect of dexmedetomidine on somatosensory, motor, and visual EPs. METHODS: After IRB approval, 40 adult patients scheduled for elective spine surgery using total IV anesthesia with propofol and remifentanil were randomly assigned to receive either dexmedetomidine (n = 20) or placebo (n = 20) in a double-blind, placebo-controlled trial. After obtaining informed consent, positioning, and baseline EPs recording, patients were randomly assigned to either IV dexmedetomidine 0.6 μg/kg infused over 10 minutes, followed by 0.6 μg/kg/h, or a corresponding volume of IV

normal saline (placebo). EP measures at 60 ± 30 minutes after initiation of study drug were defined as T1 and at 150 ± 30 minutes were defined as T2. Changes from baseline to T1 (primary end point) and from baseline to T2 (secondary end point) in EP latencies (milliseconds) and amplitudes (microvolts) were compared between groups. Data presented as mean ± SD (95% confidence interval). RESULTS: Data from 40 patients (dexmedetomidine: n = 20; age, 54 ± 3 years; 10 males; placebo: n = 20; age, 52 ± 2 years; 5 males) were analyzed. There was no difference between dexmedetomidine versus placebo groups in primary end points: change of somatosensory EPs at T1, latency: 0.01 ± 1.3 (-0.64, 0.65) vs 0.01 ± 1.3 (-0.64, 0.65), P = 0.43 (-1.24, 0.45); amplitude: 0.03 ± 0.14 (-0.06, 0.02) vs -0.01 ± 0.13 (-0.07, 0.05), P = 0.76 (-0.074, 0.1); motor EPs amplitude at T1: 65.1 ± 194.8 (-35, 165; n = 18) vs 109.2 ± 241.4 (-24, 243; n = 16), P = 0.57 (-113.5, 241.57); visual EPs at T1 (right eye), amplitude: 2.3 ± 3.6 (-0.4, 5.1; n = 11) vs 0.3 ± 6.0 (-3.3, 3.9; n = 16), P = 0.38 (-6.7, 2.6); latency N1: 2.3 ± 3.6 (-0.4, 5.1) vs 0.3 ± 6.0 (-3.3, 3.9), P = 0.38 (-6.7, 2.6); latency P1: -1.6 ± 13.4 (-11.9, 8.7) vs -1.4 ± 8.1 (-6.3, 3.5), P = 0.97 (-9.3, 9.7) or secondary end points. There were no differences between right and left visual EPs either at T1 or at T2. CONCLUSIONS: In clinically relevant doses, dexmedetomidine as an adjunct to total IV anesthesia does not seem to alter EPs and therefore can be safely used during surgeries requiring monitoring of EPs.

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STUDIES

Comparing the effect between continuous infusion and intermittent bolus of rocuronium for intraoperative neurophysiologic monitoring of neurointervention under general anesthesia

Authors: Ko, M. J.;Oh, B.;Jung, J. W.;Oh, D. S.;Jin, S. C.;Kang, E.;Kim, Y. H.;Kim, S. H. and Kim, H.
Publication Date: 2018
Journal: Medicine 97(51), pp. e13816

Abstract: BACKGROUND: Medical researchers have been reluctant to use neuromuscular blocking drugs (NMBD) during the use of intraoperative motor evoked potential (MEP) monitoring despite the possibility of patient movement. In this study, we compared the effects of no NMBD and continuous rocuronium infusion on the incidence of patient involuntary movement and MEP monitoring. METHODS: In this study, 80 patients who underwent neuro intervention with MEP monitoring were randomly assigned into 2 groups. After an anesthetic induction, bolus of rocuronium 0.1 mg/kg was injected when it was needed (for patient involuntary movement or at the request of the surgeon) in group B, and 5 mcg/kg/min of rocuronium were infused in group I study participants. The incidence of patient involuntary movement and spontaneous respiration, the mean MEP amplitude, coefficient of variation (CV), the incidence of MEP stimulus change and train-of-four (TOF) count were compared. RESULTS: The incidence of involuntary movement and spontaneous movement were measured as significantly lower in group I ($P < .05$). The incidence of undetectable MEP did not differ as measured in both groups. The means and CVs of MEP amplitude in all limbs were significantly lower in group I. The mean TOF counts from 30 to 80 min of operation were significantly higher in group B. CONCLUSION: We conclude that the continuous infusion of rocuronium effectively inhibited the involuntary movement and spontaneous respiration of the patient while enabling MEP monitoring.

Systematic re-evaluation of intraoperative motor-evoked potential suppression in scoliosis surgery

Authors: Lo, Yew Long;Tan, Yam Eng;Raman, Sitaram;Teo, Adeline;Dan, Yang Fang and Guo, Chang Ming
Publication Date: -07-02 ,2018
Journal: Scoliosis and Spinal Disorders 13(1), pp. 12

Abstract: Background: Motor- (MEP) and somatosensory-evoked potentials (SSEP) are susceptible to the effects of intraoperative environmental factors. Methods: Over a 5-year period, 250 patients with adolescent idiopathic scoliosis (AIS) who underwent corrective surgery with IOM were retrospectively analyzed for MEP suppression (MEPS). Results: Our results show that four distinct groups of MEPS were encountered over the study period. All 12 patients did not sustain any neurological deficits postoperatively. However, comparison of groups 1 and 2 suggests that neither the duration of anesthesia nor speed of surgical or anesthetic intervention were associated with recovery to a level beyond the criteria for MEPS. For group 3, spontaneous MEPS recovery despite the lack of surgical intervention suggests that anesthetic intervention may play a role in this process. However, spontaneous MEPS recovery was also seen in group 4, suggesting that in certain circumstances, both surgical and anesthetic intervention was not required. In addition, neither the duration of time to the first surgical manoeuver nor the duration of surgical manoeuver to MEPS were related to recovery of MEPS. None of the patients had suppression of SSEPs intraoperatively. Conclusion: This study suggests that in susceptible individuals, MEPS may rarely occur unpredictably, independent of surgical or anesthetic intervention. However, our findings favor anesthetic before surgical intervention as a proposed protocol. Early recognition of MEPS is important to prevent false positives in the course of IOM for spinal surgery

A randomized crossover study of the effects of lidocaine on motor- and sensory-evoked potentials during spinal surgery

Authors: Urban, Michael K.;Fields, Kara;Donegan, Sean W.;Beathe, Jonathan C.;Pinter, David W.;Boachie-Adjei, Oheneba and Emerson, Ronald G.
Publication Date: -12-01 ,2017
Journal: The Spine Journal 17(12), pp. 1889–1896

Abstract: Background: Lidocaine has emerged as a useful adjuvant anesthetic agent for cases requiring intraoperative monitoring of motor-evoked potentials (MEPs) and somatosensory-evoked potentials (SSEPs). A previous retrospective study suggested that lidocaine could be used as a component of propofol-based intravenous anesthesia without adversely affecting MEP or SSEP monitoring, but did not address the effect of the addition of lidocaine on the MEP and SSEP signals of individual patients.
Purpose: The purpose of this study was to examine the intrapatient effects of the addition of lidocaine to balanced anesthesia on MEPs and SSEPs during multilevel posterior spinal fusion. Study Design: This is a prospective, two-treatment, two-period crossover randomized controlled trial with a blinded primary outcome assessment. Patient Sample: Forty patients undergoing multilevel posterior spinal fusion were studied.: Outcome Measures
The primary outcome measures were MEP voltage thresholds and SSEP amplitudes. Secondary outcome measures included isoflurane concentrations and hemodynamic parameters.
Methods: Each participant received two anesthetic treatments (propofol 50 mcg/kg/h and propofol 25 mcg/kg/h+lidocaine 1 mg/kg/h) along with isoflurane, ketamine, and diazepam. In this manner, each patient served as his or her own control. The order of administration of the

two treatments was determined randomly. Results: There were no significant within-patient differences between MEP threshold voltages or SSEP amplitudes during the two anesthetic treatments. Conclusions: Lidocaine may be used as a component of balanced anesthesia during multilevel spinal fusions without adversely affecting the monitoring of SSEPs or MEPs in individual patients.

Intraoperative neurophysiologic monitoring and neurologic outcomes in patients with epidural spine tumors.
Authors: Avila E.K.;Elder J.B.;Singh P.;Chen X. and Bilsky, M. H.
Publication Date: 2013
Journal: Clinical Neurology and Neurosurgery 115(10), pp. 2147–2152

Abstract: Purpose Multimodal intraoperative neurophysiologic monitoring (IOM) provides assessment of spinal cord pathways during neurosurgery. Despite widespread use, few data exist regarding sensitivity and specificity of IOM in predicting neurologic outcome during decompression and instrumentation for epidural spine tumors. Methods Retrospective analysis evaluated consecutive spine procedures involving IOM modalities (somatosensory evoked potentials [SSEP], motor evoked potentials [MEP], and electromyography [(EMG]) from 2007 to 2009. Demographic and surgical information, intraoperative neurophysiologic data, and pre- and postoperative neurologic status were collected. All cases involved neoplastic epidural spinal cord compression by a primary or metastatic tumor and included posterolateral decompression and instrumented fusion. Results Two-hundred and eight consecutive patients had spine surgery during this time period and one hundred and fifty-two met inclusion criteria. All patients had SSEP monitoring, with 4 having transient changes and 7 persistent changes. One hundred and twenty-two patients had combined SSEP and MEP monitoring, with 3 having transient changes and 4 persistent changes in MEP signals. Two patients had neurophysiologic changes associated with hypotension and correction led to normalization. One developed new neurologic deficits after surgery. Two from the total cohort had new postoperative neurologic deficits. One had a transient decrease in MEP amplitude while the other had no intraoperative changes. Discussion These cases are often long with significant blood loss, and stability of multiple IOM modalities provides reassurance that spinal cord function remains intact. Signal changes should result in scrutiny of blood pressure, surgical technique and anesthesia. Preserved IOM signals are suggestive of preserved neurologic outcome. © 2013 Elsevier B.V.

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CASE REPORTS

Degradation of Intraoperative Motor Evoked Potentials following Bilateral Erector Spinae Plane Blocks in Lumbar Spine Surgery - a case report
Authors: Acharya P., Ma K., Ruiz C. and Witiw, C.
Publication Date: 2022
Publication Details: Journal of Neurosurgical Anesthesiology. Conference: 50th Annual Meeting of the Society for Neuroscience in Anesthesiology and Critical Care, SNACC 2022. Seattle, WA United States. 34(4) (pp 466); Lippincott Williams and Wilkins,

Abstract: Introduction: Erector spinae plane (ESP) block has gained popularity as an opioid-sparing analgesic modality for thoracolumbar spine surgery in recent years1. Its analgesic effect is thought to be related to the local anesthetic (LA) mediated blockade of dorsal rami branches and systemic LA absorption. Nonetheless, evidence from cadaver studies and case reports suggest that the undesirably extensive spread of LA may result in the motor

blockade, and thus the concern was raised regarding its compatibility with intraoperative motor evoked potential (MEP)2,3. We hereby present a case involving the transient loss of bilateral lower-extremity (LE) MEPs loss following lumbar ESP blocks in lumbar spine surgery. Case summary: A 50-year-old man with L3-L5 spinal stenosis was presented for an elective L3-L5 posterior decompression and instrumented fusion. Preoperative examination revealed 5/5 motor strength in all extremities with no sensory deficit. After the induction of general anesthesia with propofol, remifentanil, and rocuronium 25 mg, the patient was maintained on propofol, sufentanil, and ketamine infusions. With the patient in the prone position, bilateral ultrasound-guided ESP blocks, each with 30 mL of Ropivacaine 0.2%, were performed at the L4 vertebrae using a 22G needle via an in-plane approach. A good injectate spread was noted on the ultrasound. Baseline MEP was obtained immediately following the ESP blocks, approximately 45 minutes after rocuronium administration. The initial MEP demonstrated the presence of robust signals at Adductor Digiti Minimi (ADM) and Rectus Femoris (RF) bilaterally, but signals were absent from bilateral Tibialis Anterior, Extensor Hallucis Longus, and Gastrocnemius and left Abductor Hallucis Longus (AHL) (Fig. 1). The right AHL MEP, though present initially, deteriorated over the next 8 minutes following the ESP block. MEPs were repeated over the next two hours of surgical exposure, and prior to the start of lumbar decompression, robust MEPs were obtained at all LE muscles where there previously had no baseline signals. This also included the reappearance of the right AHLMEPs, which were initially noted to have disappeared shortly after the ESP blocks. The remainder of the surgery was otherwise uneventful. Following extubation, the patient exhibited 5/5 power in all 4 extremities with no deficits, and the patient was eventually discharged home in stable condition

[Two cases showing the absence of motor evoked potentials without developing postoperative paraplegia following thoracoabdominal aortic repair--role of epidural cooling, spinal drainage and aorto-iliac side-arm conduit distal perfusion] **Please note: this article is in Japanese**
Authors: Nakazawa, Koichi;Inatomi, Yuzuru;Yamamoto, Yudai;Kobinata, Hiroyuki and Makita, Koshi
Publication Date: Aug ,2012
Journal: Masui - Japanese Journal of Anesthesiology 61(8), pp. 847–851

Abstract: We describe two cases which developed loss of motor evoked potentials from bilateral lower limbs following thoracoabdominal aortic repair. Paraplegia was suspected in both cases; however, one case of Crawford type 2 aneurysm showed transient left leg monoplegia with a sensory deficit and the other case of aortic pseudoaneurysm showed no neurologic dysfunction postoperatively. We employed epidural cooling and spinal drainage for spinal protection and distal perfusion was provided through aorto-iliac side-arm conduit. Despite the prolonged spinal ischemia during thoracoabdominal aortic repair, spinal drainage and epidural cooling were very helpful for protecting the spinal cord from ischemia. The interpretation of MEPs seems very difficult especially when the potentials remain absent even after reconstruction or reperfusion of segmental arteries, because variety of intraoperative factors may affect them.

Effect of epidural ropivacaine on somatosensory and motor evoked potentials
Authors: Souvatzis, Xenia;Askitopoulou, Helen and Katonis, Pavlos
Publication Date: May ,2009
Journal: Journal of Clinical Anesthesia 21(3), pp. 209–212

Abstract: The case of a 57-year-old man who underwent major spinal surgery as a result of

a traumatic burst fracture of the T(12) vertebra, is presented. Changes in somatosensory evoked potentials and motor evoked potentials following the intraoperative epidural administration of ropivacaine, is described.

Prolonged loss of leg myogenic motor evoked potentials during thoracoabdominal aortic aneurysm repair, without postoperative paraplegia.
Authors: Denda, Sadahei;Taneoka, Miki;Honda, Hiroyuki;Watanabe, Yukiko;Imai, Hidekazu and Kitahara, Yasushi
Publication Date: 2006
Journal: Journal of Anesthesia 20(4), pp. 314–318

Abstract: No postoperative paraplegia occurred in a patient whose leg myogenic motor evoked potentials (mMEPs) disappeared during thoracoabdominal aortic aneurysm repair. A 69-year-old man underwent resection and repair of a type III (Crawford classification) thoracoabdominal aneurysm. An epidural catheter was placed into the epidural space for epidural cooling, and a Swan-Ganz catheter was placed into the subarachnoid space for cerebrospinal fluid (CSF) drainage. Continuous CSF pressure and temperature measurement was carried out the day before surgery. The mMEPs gradually disappeared 10 min after proximal double aortic clamping and complete aortic transection. Selective perfusion of intercostal arteries was started about 20 min after the loss of the mMEPs, but the mMEPs were not restored. Possibly, spinal cord hyperemia, induced by selective perfusion of the intercostal vessels, narrowed the subarachnoid space so that CSF could not be satisfactorily drained during surgery. The spinal cord hyperemia may have decreased spinal function and suppressed the leg mMEPs. The persistence of the loss of mMEPs was undeniably due to the influence of the anesthetic agent or a perfusion disorder in the lower-extremity muscles. Of note, moderate spinal cord hypothermia and postoperative CSF drainage probably resulted in improved lower-limb motor function.

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CONFERENCE PAPERS

Anaesthesia Consideration
Authors: Barsa, M.
Scoliosis Surgery
Publication Date: 2023
Publication Details: Regional Anesthesia and Pain Medicine. Conference: 40th Annual ESRA Congress. Paris France. 48(Supplement 1) (pp A368-A369); BMJ Publishing Group,

Abstract: Scoliosis Is an abnormal lateral curvature of the spinal column. Cobb angle of 10 degrees regarded as a minimum angulation to define it. The most common form of scoliosis is idiopathic. Preoperative evaluation include assessment for the presence and severity of pulmonary dysfunction from restrictive lung disease. It's unlikely will improve during scoliosis surgery and may make intraoperative and postoperative ventilation challenging. Significant postoperative atelectasis should be anticipated, and in severe cases of scoliosis, prolong postoperative ventilation may be required. Cardiac function is one more important side that we have to consider. Regional hypoventilation caused by abnormal diaphragm movement and chronic hypercarbia and hypoxemia from advanced pulmonary disease can lead to pulmonary hypertension and of the right ventricle failure. A large incision may lead to loss of up to one half of a patient's blood volume. To prevent haemorrhage complication next steps are require: preoperative iron supplementation or erythropoietin, Cell Saver mashing, Deliberate hypotension, arterial access for PPV, SVV and CO, goal directed fluid therapy,

Thromboelastography, proper prone positioning, neuromonitoring. Due to the large wound area and traumatic spinal correction, patients suffer from severe pain immediately after scoliosis surgery. The treatment of this postoperative pain remains one of the major challenges in scoliosis surgery, and insufficient treatment can increase postoperative morbidity, complication rates, and length of hospitalization. We have following options - epidural anaesthesia, intrathecal morphine, Lidocaine iv and ketamine, ESP block. Epidural founds its place in pain management after spinal surgery. Epidural catheter can be used as an effective means of postoperative pain management for children with scoliosis, it is more effective than intravenous patient-controlled analgesia in postoperative pain management after posterior spinal fusion. It accelerates postoperative mobilization, independent ambulation, and decries duration of hospital stay. Epidural anaesthesia without opioids is a safe and sufficient method to regulate postoperative pain in patients even with neuromuscular scoliosis and respiratory impairment. There are some limitations that we should consider. Catheters might be an additional source of infection by channelling the way for bacteria during their application. It may get stuck in surrounding tissues or even rupture. Catheter is installed after the surgery, and it does not reduce pain intraoperatively, therefore, amount of opioids during surgery remains to be substantial. Intrathecal morphine injection A lot of studies carry out conclusion that intrathecal morphine reduces postoperative pain and opioid consumption in the 24 hours following spine surgery. There are some evidences that intrathecal opioids may decrease intraoperative blood loss, though the mechanism of the blood-sparing effect remains unclear. Some hypothesize that the diminished blood loss may be due to lower mean arterial pressures. Nevertheless, other studies have demonstrated no difference in blood pressures. In spite of all benefits, we should keep in mind several possible complications associated with intrathecal morphine. Respiratory depression and sedation It can be sufficiently severe and require escalation of care and readmission to ICU. Other complications - post dural puncture headache, cerebrospinal fluid leaks and surgical site infections. Morphine has the side effect - nausea, vomiting We should be aware of the risk-to-benefit ratio when deciding whether to administer ITM for postoperative pain management. Lidocaine and ketamine have no relation to regional methods of anaesthesia, nevertheless booth this method achieves the same goals - they reduce postoperative pain and opioid consumption. Lidocaine iv improved pain scores and reduced 48-h opioid requirements in patients undergoing spine surgery. Patients given lidocaine had slightly fewer 30-day complications than patients given placebo. IV lidocaine improved the postoperative gastrointestinal function. Lidocaine reduces postoperative nausea, vomiting and the supply of antiemetics. Functional walking capacity distance increased significantly in lidocainetreated children. The analgesic effect of lidocaine is diversified. This drug has peripheral and central actions, which reduces neural responses to pain. Lidocaine suppresses spontaneous impulses generated from injured nerve fibres and the proximal dorsal root ganglion. Lidocaine does not adversely affect the monitoring of motor evoke and somatosensory-evoked potentials in individual patients during surgery and can be used as an adjunctive medication with TIVA regimens to reduce the required dose of other MEP suppressing medications. Ketamine at sub-anaesthetic doses, has been shown to modulate nociceptive hypersensitization through its antagonist effects on NMDA receptors by blocking pain signalling input Several studies have demonstrated that the addition of intraoperative and postoperative intravenous ketamine infusion can reduce the amount of morphine equivalents consumed in the 48-h postoperative time period, founding the effects of ketamine on the pain control regimen. Additionally, significant reduction in the incidence of nausea and vomiting provides an additional benefit of ketamine. Yet, other studies conclude that ketamine reduces the amplitude and increases the latency of transcranial electrical MEP. ESP block, due to the peculiarity of the innervation of the spinal column, shows the

best results in reduction of pain after spine surgery. Resent MRI studies on cadavers and healthy volunteers confirm the spread of anaesthetic to the dorsal ramus of the spinal nerve, which innervates the muscles, soft tissues around spine column, and transverse processes of the spine. Further studies demonstrate a significant reduction in the opiate use with lower rates of pain intensity after lumbar spine surgeries. Moreover, we have first clinical cases that describes successful performing ESP block in scoliosis surgery. ESP is volume dependent block. To reach paravertebral and epidural spaces and effect ventral ramus of the spinal nerve at several levels high volume of anaesthetic is required. But, for spine surgery we need to effect only dorsal ramus, so we can reduce the volume of anaesthetic, and inject it bilaterally on two levels in order to block more spine levels as much as possible to place of screws implementation. Apparently, we will not affect motor evoked potentials, considering that we block only the dorsal branch of the spinal nerve, but further researches are required. Spine surgeries belongs to the most traumatic intervention and may conduct pronounce postoperative pain. If it treated not appropriately, it can lead to hyperalgesia and chronic pain. The incidence of moderate to severe chronic postsurgical pain at 12 months after spine surgeries can reach up to 39.1% All methods of anaesthesia discussed today has impact on pain perceiving from various sides. Some of them, affects transduction, transmission, and modulation by interrupting the conduction of the pain impulse, another affects perception by reducing sensitization and tolerance to pain by reducing the quantity of narcotic analgesics. Due to this mechanism, the essential balance between nociception and antinociception is sustained.

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ARTICLES

Inadvertent inhibitory effect of epidural anesthesia on motor-evoked potential (MEP) monitoring in a patient undergoing total hip arthroplasty. Please note: this is a letter to the editor.
Authors: Tsurumachi, Naoi;Saima, Shunsuke and Okuda, Yasuhisa
Publication Date: 2024
Journal: Journal of Anesthesia 38(2), pp. 286–287

Effects of epidural administration of lidocaine andropivacaine on myogenic motor evoked potentials: 3AP6-4
Authors: Horiuchi, T.;Kawaguchi, M.;Hayashi, H.;Inoue, S. and Furuya, H.
Publication Date: June ,2007
Journal: European Journal of Anaesthesiology | EJA 24, pp. 27

Abstract: Background and Goal of Study: Motor evoked potentials (MEP) to transcranial electrical stimulation are used for the patients undergoing thoracoab-dominal aortic surgery to prevent postoperative neurological deficits ([1]). During such surgery, epidural anesthesia may be applied, however, the effects of epidural anesthesia on myogenic MEPs remained undetermined. We investigated the effects of epidural administration of lidocaine and ropivacaine on myogenic MEPs. Materials and Methods: This study is a prospective randomized control trial. After institutional approval and written informed concent, twenty-four patients who underwent elective abdominal aortic aneurysm surgery were studied. After the recording of control MEPs in response to transcranial multi-pulse stimulation under propofol and fentanyl anesthesia, 5ml of 2% lidocaine (n = 8) or 0.75% ropivacaine (n = 8) or saline (n = 8) was epidurally administered and then MEPs were recorded every 5 to 15

minutes. Percent changes of MEP amplitudes were analyzed by repeated measures analysis of variance. Results and Discussions: Control MEP amplitudes were similar among three groups. In all groups MEP amplitudes remained unchanged during the study period until 45 minutes after epidural administration. Conclusion(s): The results indicated that relatively small dose of lidocaine and ropivacaine had little influences on myogenic MEPs in patients under propofol and fentanyl anesthesia.

Neurophysiological mechanisms underlying motor evoked potentials in anesthetized humans. Part 2. Relationship between epidurally and muscle recorded MEPs in man.
Authors: Deletis, V.;Rodi, Z. and Amassian, V. E.
Publication Date: Mar ,2001
Journal: Clinical Neurophysiology 112(3), pp. 445–452

Abstract: objective and methods: Direct (D) and transynaptic, (i.e. indirect) (I) corticospinal tract (CT) discharges were simultaneously recorded epidurally with muscle motor evoked potentials (MEPs) in patients under different levels of anesthesia. The effects of the one, two or more equal electrical stimuli, applied transcranially or directly to the motor cortex, were studied at different interstimulus intervals (ISIs) to determine the optimal conditions for eliciting I and MEP responses. results and conclusion: At anesthetic levels permiting large D and I responses to single stimuli, optimal D and I wave facilitation and MEPs occurred with two stimuli at ISIs greater than 4 ms (e.g. at 5.9 and 8 ms). When single electrical stimuli elicit only a D response, optimal MEP responses are determined by the number of stimuli and the recovery of CT fibers excitability (e.g. at an ISI of 4 ms).

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OLDER ARTICLES

The effects of epidural and intravenous lidocaine on somatosensory evoked potentials after stimulation of the posterior tibial nerve
Authors: Klasen, J.;Thiel, A.;Detsch, O.;Bachmann, B. and Hempelmann, G.
Publication Date: Aug ,1995
Journal: Anesthesia and Analgesia 81(2), pp. 332–337

Abstract: The measurement of somatosensory evoked potentials (SEPs) after stimulation of the posterior tibial nerve (PTN-SEPs) has been proposed as an objective indicator of the quality of lumbar epidural block. It is unclear whether peak latency increases after epidural application of local anesthetics may be due in part to systemic effects of the drug absorbed from the epidural space. In this clinical study, we compared PTN-SEPs after intravenous and epidural administration of lidocaine to those of a control group who did not receive lidocaine. Plasma concentrations of lidocaine remained within expected ranges for epidural and intravenous administration. No subjects developed signs for overdose or toxicity. After epidural application of 2% lidocaine, mean latencies of peaks P1, N1, and P2 increased significantly in comparison to baseline values. In 3 of 10 patients, latency changes were not observed. Intravenous lidocaine did not produce statistically significant changes in latencies, although a trend toward increasing latencies appeared to be present. In the control group without lidocaine, no statistically significant changes occurred during the 1-h study period. No correlation was found between peak latency changes and plasma concentrations of lidocaine. We conclude that latency increases observed after epidural application of lidocaine are due primarily to local, not systemic, effects of the local anesthetic.

The effects of differing concentrations of bupivacaine on the epidural somatosensory evoked potential after posterior tibial nerve stimulation

Authors: Loughman, B. A.;Fennelly, M. E.;Henley, M. and Hall, G. M.
Publication Date: Jul ,1995
Journal: Anesthesia and Analgesia 81(1), pp. 147–151

Abstract: The somatosensory evoked potential (SEP) recorded from the cervical epidural space in response to stimulation of the posterior tibial nerve is often used to monitor spinal cord integrity during scoliosis surgery. Epidural analgesia may be used as part of the anesthetic technique for scoliosis surgery, but the effects of the local analgesic on the evoked potential must be determined to ensure that it does not interfere with the monitoring of spinal cord function. Therefore, we compared the effects of the administration of 10 mL of 0.25% (n = 8), 0.5% (n = 8), or 0.75% (n = 8) bupivacaine injected into the L3-4 epidural space on the somatosensory evoked potential to posterior tibial nerve stimulation in patients anesthetized with a propofol infusion, nitrous oxide and oxygen, immediately before scoliosis surgery. Compared with a control group (n = 8), a concentration-dependent effect of bupivacaine was found on overall amplitude of the evoked potentials and the amplitude of all peaks. There were no significant differences between 0.25% bupivacaine and the control group, but both 0.5% and 0.75% bupivacaine were associated with clinically and statistically significant decreases in overall amplitude ($P < 0.002$, 0.5% bupivacaine; $P < 0.001$, 0.75% bupivacaine). Latency increased similarly in all groups. We conclude that bupivacaine in concentrations greater than 0.25% is not suitable for scoliosis surgery, if spinal somatosensory evoked potentials (SSEP) are to be measured.

Effects of epidural bupivacaine or mepivacaine on somatosensory evoked potentials and skin resistance responses

Authors: Malmqvist, E. L.;Berg, S.;Holmgren, H.;Rutberg, H. and Bengtsson, M.
Publication Date: 1992
Journal: Regional Anesthesia 17(4), pp. 205–211

Abstract: OBJECTIVE: The main purpose of this study was to compare the depth of neural block in lumbar epidural analgesia using either 20 mg/ml mepivacaine or 5 mg/ml bupivacaine. METHODS: Sixteen healthy patients were randomly divided to receive blindly either 17.5 ml mepivacaine (median, 15-20) or 17.5 ml bupivacaine (median, 14-20) for lumbar epidural analgesia. Afferent block was assessed by somatosensory evoked potentials (SEPs) during electrical stimulation of cutaneous sensory nerves at the T10, L1, L4, and L5 dermatomes. Efferent block was assessed by skin resistance responses (SRRs) recorded from the hand (C6), T12-L1, and foot (L5). RESULTS: Upper level of analgesia (pin-prick, cold) was T4 (T1-11) in the mepivacaine group and T4-5 (T2-9) in the bupivacaine group. In the mepivacaine group, SEPs were abolished in seven of eight cases at the T10 stimulation level and in five of eight cases at the L1 level. In the bupivacaine group, SEPs were abolished in two of eight cases at the T10 level and in three of eight cases at the L1 level. At the L4 and L5 levels, SEPs were only slightly changed in both groups. In the mepivacaine group, SRRs were completely or almost completely blocked (0-35% of control values) in all of eight cases at both the T12-L1 level and in the foot. Corresponding values for bupivacaine were six of seven and five of eight, respectively. Skin resistance responses in the foot and hand were significantly (p less than 0.05) lower in cases with abolished SEPs at the T10 stimulation level compared with those cases with preserved (although reduced) SEPs. CONCLUSIONS: Twenty mg/ml mepivacaine produces a more complete neural block than 5 mg/ml bupivacaine. The responsiveness of the afferent and efferent limbs of the

nervous system was blocked in a similar manner as was shown by depression of the SEPs and SRRs.

Effects of etidocaine administered epidurally on changes in somatosensory evoked potentials after dermatomal stimulation
Authors: Lund, C.;Hansen, O. B.;Kehlet, H.;Mogensen, T. and Qvitzau, S.
Publication Date: 1991
Journal: Regional Anesthesia 16(1), pp. 38–42

Abstract: The effect of lumbar epidural anesthesia with similar volumes (approximately 20 ml) of 1% and 1.5% etidocaine on early (less than 0.5 seconds) somatosensory evoked potentials (SEPs) to electrical stimulation of the S1, L1, and T10 dermatomes was examined in two groups of ten patients in a randomized, double-blind study. Level of analgesia to pinprick was T7.7 +/- 0.9 in the 1% group and T6.6 +/- 0.6 in the 1.5% group and all patients had total motor block. Despite similar analgesia to pinprick, SEP amplitude was more reduced in the 1.5% group, in which SEPs were abolished in all patients at the L1 level.

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BOOK CHAPTER

'Motor Evoked Potential'
Authors: Doyal, A., Schoenherr, J.W. and Flynn, D.N.
Publication Year: 2023
In Book Title: StatPearls
Treasure Island (FL): StatPearls Publishing

Abstract: Intraoperative injuries or ischemia to the brain, spinal cord, or peripheral nerves can be devastating. Damage to motor pathways can cause lifelong weakness or paralysis, resulting in significant reductions in the quality of life and permanent disability. Several neuromonitoring modalities have been developed to allow monitoring of neurologic function during surgeries associated with the risk of neurologic damage, such as surgeries on the brain, spine, or aorta. Commonly used neuromonitoring techniques include electroencephalogram (EEG), spontaneous electromyogram (EMG), somatosensory evoked potentials (SSEPs), and motor evoked potentials (MEPs). Modalities are often used in combination to provide information on multiple neurologic pathways during a procedure. Collectively, intraoperative neuromonitoring techniques have largely replaced the "wake-up test" during surgery, as information regarding neuronal integrity can be obtained while the patient remains anesthetized. Clinically significant changes in neuromonitoring signals are detected in real-time by a neurophysiologist and relayed to the surgeon and anesthesiologist. Ideally, early detection of injury allows time for surgical or anesthetic changes to be made in order to prevent permanent neuronal damage. The focus of this review is motor evoked potentials. The indications, contraindications, anatomy, physiology, the impact of anesthetics, and potential complications associated with MEP monitoring will be reviewed.

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DATABASES AND INFORMATION SOURCES USED

	Pubmed		**HMIC**		**BMJ Best Practice**
x	**Medline**		**Social Policy and Practice**	x	**Cochrane Library**
	Emcare		**CINAHL**	x	**TRIP**
x	**Embase**		**PsycINFO**		**Grey Literature**
	AMED	x	**UpToDate**	x	**Other: clinicaltrials.gov ; ISRCTN, Google Scholar, LENS.org, Elicit (AI)**

PURPOSE OF SEARCH			
	Patient info/health & well being	**x**	**Clinical decision making (inc. patient care)**
	Executive Team support	**x**	**Research/Education/Professional development**
	Quality Improvement		**Primary Care & Neighbourhoods Directorate support**
	KM/Management decision making		**Other**

USER CATEGORY OF REQUESTOR			
	Medical students		**Patients/public**
	Nursing/midwifery students		**Physician Associates**
	Doctor/Psychiatrist		**Public Health (Somerset CC)**
	Nurses/Midwives	**x**	**Other**
	Allied Health professionals		

HAS PERMISSION TO SHARE THE RESULTS BEEN OBTAINED FROM THE REQUESTOR?			
x	**YES - share**		**NO – do not share**

KEY WORDS/SEARCH STRATEGY INCLUDING MESH HEADINGS	**LIMITS USED**

intraoperative neurophysiology intraoperative neurophysiological monitoring IOM IONM Scoliosis scoliosis surgery deformity surgery Epidural anaesthetic bolus infusion of levobupivacaine local anaesthesia MEPs motor evoked potentials Search History EMBASE Embase <1974 to 2025 March 06> 1 exp Intraoperative Neurophysiological Monitoring/ 1524 2 ((intra?operative adj5 neurophysiolo* adj5 monitor*) or (intraoperative adj5 neurophysiolo*) or IOM or IONM).tw,kf. 7588 3 ((surger* or operation*) adj5 neurophysio*).tw,kf. 680 4 or/1-3 [IONM] 8578 5 exp Anesthesia, Epidural/ 37266 6 ((an?esthetic adj5 bolus) or levobupivacain* or epidural*).tw,kf. 73448 7 (((Adrenaline adj3 articaine hydrochloride) or (Bupivacaine or Chlorhexidine or Chloroprocaine or Fluorescein or Lidocaine or Mepivacaine or Methylprednisolone or Phenazone or Oxybuprocaine or Prilocaine or Chirocaine)) adj5 (fentanyl or hydrochloride or cetrimide or phenylephrine or prilocaine or felypressin)).tw,kf. 7674 8 or/5-7 [anaesthesia] 90922 9 exp Evoked Potentials, Motor/ 18611 10 ((motor adj5 evok* adj5 potent*) or MEP).tw,kf. 21190 11 or/9-10 [MEP] 28568 12 exp Spine/su [Surgery] 5218 13 ((spine or lumbar* or disc* or back) adj5 (surger* or opera*)).tw,kf. 111001 14 or/12-13 [Spine surgery] 115282 15 exp Scoliosis/su [Surgery] 10359 16 ((Crooked adj3 spine) or (Abnormal adj3 curve adj5 spine) or (Lateral adj5 curvature adj5 spine) or (Curved adj3 spine) or (S?shaped adj3 spine) or scoliosis or (deformit* adj3 surger*)).tw,kf. 39902 17 or/15-16 [scoliosis] 41699 18 4 and 8 and 11 and 14 24 19 8 and 11 and 14 52 20 limit 18 to (english language and yr="2000 -Current") 23	English

21	limit 19 to (english language and yr="2000 -Current") 49	
22	8 and 11 447	
23	limit 22 to (english language and yr="2010 -Current") 290	
24	limit 23 to (english language and yr="2018 -Current") 164	
25	(epidural* or extradural* or peridural*).tw,kf. 80312	
26	neuraxial an?esthe*.tw,kf. 2736	
27	5 or 25 or 26 [epidural] 91770	
28	11 and 27 497	
29	14 and 28 68	
30	limit 29 to yr="2000 -Current" 66	
31	exp spinal anesthesia/ 30143	
32	5 or 25 or 26 or 31 [epidural with spine anesthesia] 113720	
33	11 and 32 509	
34	limit 33 to yr="2000 -Current" 439	