


## Case Report

# Intraoperative iatrogenic seizure induced by transcranial motor-evoked potential during spinal surgery: A case report and review of the literature

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## ABSTRACT

**Background:** Intraoperative neuromonitoring is an essential tool for detecting early intraoperative neurological changes during spinal surgery. Only rarely do seizures occur during transcranial motor-evoked potentials (Tc-MEP).

**Case Description:** A 44-year-old male presented with a magnetic resonance (MR)--documented L5-S1 T2-hyperintense intradural mass that heterogeneously enhanced with Gadolinium and extended through the right S1 neural foramen. Utilizing transcranial motor-evoked potential (Tc-MEP) before the skin incision, the patient developed the 1<sup>st</sup> seizure that lasted for 2 min. The 2<sup>nd</sup> seizure occurred after the initial incision and lasted for around 15 min; at this point, the procedure was terminated. After brain MR studies documented no structural lesion and other etiologies of seizures were ruled out, the patient underwent an uneventful resection of the L5-S1 spinal lesion.

**Conclusion:** Although the risk of seizures from Tc-MEP is very low, it is crucial to be aware of this potential side effect. If they occur, surgical procedures should be aborted and diagnostic studies performed to rule out the presence of structural lesions and/or other reasons for seizure activity.

**Keywords:** Complication, Epilepsy, Motor-evoked potential, Neuromonitoring, Seizure

## INTRODUCTION

Monitoring motor-evoked potentials (MEPs) and performing transcranial electrical stimulation during spinal surgery can decrease the risk of intraoperative and, therefore, postoperative new motor deficits.<sup>[2,6,7]</sup> Large cohort studies have, however, documented that iatrogenic seizures may occur during brain (i.e., 0.3%) or spine surgery (i.e., 0.7 excluding intramedullary cord lesions).<sup>[9]</sup> Here, a 44-year-old male developed two intraoperative seizures attributed to Tc-MEP performed following induction of anesthesia and before resection of a right-sided L5-S1 intradural mass.

## CASE REPORT

A 44-year-old male with 6 months of back pain had a lumbar computed tomography (CT) that showed an isodense intradural right-sided mass at the L5-S1 level. The magnetic resonance (MR)

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demonstrated that it was hyperintense on the T2-weighted image, heterogeneously enhanced with contrast, and extended through the right S1 foramen [Figures 1 and 2]. The plan was to perform a lumbar laminectomy with tumor resection utilizing transcranial motor-evoked potential (Tc-MEP) monitoring. Once intubation was accomplished (0.1 µg/kg/min of remifentanyl and 10mg/kg/min of propofol), Tc-MEP stimulation was initiated (i.e., 100-mA intensity, 750-µs pulse width, and 2-Hz frequency).

However, before the skin incision, the patient developed focal seizures involving the left upper and lower extremities that lasted for 2 min; they were terminated by anesthesia's increasing the dose of propofol. After exposing the spinous process of L5, a second focal left-sided seizure occurred that lasted 15 min; it was treated with an increased dose of propofol. Midazolam was added, and the operation was

aborted. The urgent brain CT and MR studies were both negative for a structural lesion, and laboratory studies were normal. The patient was kept intubated overnight on continuous electroencephalogram (EEG) monitoring; he had no recurrent seizures, and he was given and maintained on levetiracetam 500 mg twice daily. Two days later, he underwent an uneventful Tc-MEP monitored L5-S1 laminectomy for resection of a Schwannoma; he was discharged 2 days later on routine antiepileptic prophylaxis. Six months later, the patient still has not exhibited any additional seizure activity.

## DISCUSSION

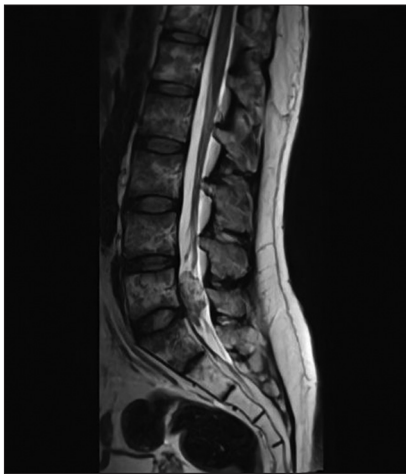
### Rare seizures with Tc-MEP monitoring during spine surgery

Tc-MEP (i.e., involving short-term, high-voltage electrical stimulation) for monitoring spinal surgery rarely results in seizure activity. However, Tc-MEP may contribute to other more common adverse such as cardiac arrhythmias, movement-related injuries, tongue lacerations, scalp burns, and headaches.<sup>[4]</sup> Kobylarz found that four of 27 patients undergoing laminectomy for spinal cord tumors exhibited short-lived EEG activity during Tc-MEP; they failed to document any clinical or electroencephalographic evidence of seizures, and patients sustained no complications.<sup>[3]</sup> In a large retrospective cohort study including various procedures (i.e., spinal cord, peripheral nerves, and craniotomies for supra- and infratentorial tumors and vascular lesions), 32 (0.8%) of 4179 patients experienced one or more intraoperative seizures utilizing either direct cortical electrical stimulation or Tc-MEP.<sup>[9]</sup> Another retrospective study found no seizures occurring following 508 spine operations performed utilizing Tc-MEP.<sup>[1]</sup>

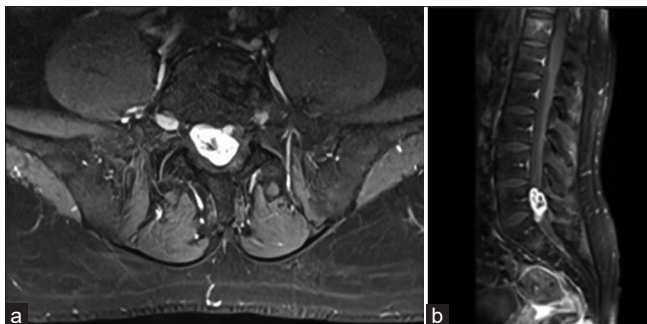
We found one case for Sokhal *et al.* in our literature review, which involved a 35-year-old man who had T4-T5 laminectomy for an intradural extramedullary tumor with Tc-MEP. The man experienced a 30-second seizure involving all of his limbs; the seizure was stopped by stopping the Tc-MEP and giving the patient 2 mg of IV midazolam, which prevented the seizure but allowed the surgery to proceed.<sup>[8]</sup>

### Factors predisposing to seizure activity when utilizing Tc-MEP monitoring for spine surgery

Many factors may increase the risk of seizures occurring during Tc-MEP monitoring of spinal surgery. These include a history of epilepsy, hypoxia, hypercarbia, hypoglycemia, and electrolyte imbalance. The following anesthesia medications can also lower seizure thresholds: nitrous oxide, enflurane, etomidate, ketamine, propofol, morphine, meperidine, fentanyl, sufentanil, alfentanil, and local anesthesia.<sup>[5]</sup> In our case, neither the patient nor any family members had



**Figure 1:** Magnetic resonance imaging (MRI) T2-weighted image of sagittal lumbar spine demonstrating the intradural mass at the level of L5–S1 with mixed signal intensity bony changes.



**Figure 2:** (a) Magnetic resonance imaging (MRI) T1-Gad+ image of the axial lumbar spine at the level of L5–S1 showing the enhancing intradural mass exiting through S1 neural foramina. (b) MRI T1-Gad+ image of sagittal lumbar spine showing the enhancing intradural mass at the level of L5–S1.

a history of seizures. Further, baseline and post-seizure blood gas analyses revealed no respiratory or metabolic abnormalities, and there was no evidence of electrolyte disturbance or hypoglycemia.

#### **Tc-MEP most likely etiology of patient's intraoperative seizures**

Transcranial MEP is most likely the etiology of seizures that we observed during the first surgery; however, both the brain CT and MR studies were negative, and the postoperative EEG monitoring showed no additional seizure activity. Further, the EEG 3 months after the patient's discharge showed no interictal epileptiform activity. We, therefore, concluded that the two intraoperative seizures were triggered by the Tc-MEP used to monitor this patient's spinal surgery.

#### **CONCLUSION**

Although the risk of seizures from Tc-MEP is very low, it is crucial to be aware of this risk if repetitive abnormal movements/seizures occur during spinal surgery.

#### **Ethical approval**

The Institutional Review Board has waived the ethical approval for this study.

#### **Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent.

#### **Financial support and sponsorship**

Nil.

#### **Conflicts of interest**

There are no conflicts of interest.

#### **Use of artificial intelligence (AI)-assisted technology for manuscript preparation**

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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