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Case report

# Intraoperative neurophysiological monitoring in acute paralysis from spinal cord epidural abscess

John F. Morrison[a,*], Jay L. Shils[b], Vedran Deletis[c], Jeffrey E. Arle[b]

[a] Department of Neurosurgery, Warren Alpert Medical School, Brown University, Providence, RI, USA
[b] Department of Neurosurgery, Lahey Clinic, Burlington, MA, USA
[c] Intraoperative Neurophysiology, St. Luke's Roosevelt Hospital, New York, NY, USA

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## 1. Introduction

Spinal epidural abscess (SEA) remains an infrequent, but precarious neurosurgical emergency [1]. The most common infectious etiologies include *Staphylococcus aureus*, other Gram positive organisms, other Gram negative organisms, and *Tuberculosis*, in order of likelihood from a variety of sources (hematogenous, iatrogenic, direct spread) [1]. Current management involves medical treatment and observation for stable lesions or surgical evacuation for compressive lesions causing neurological deficit (motor, bowel, or bladder).

Intraoperative neurophysiological monitoring (IOM), originating in the 1970s, developed to provide diagnostic information on the nervous system to the surgical team while the patient is under the effects of anesthesia [2]. This has allowed for surgeons to be more aggressive in eloquent areas while preserving function; maximizing resection [3]. Here we describe two cases of acute paralysis from SEA who underwent IOM during decompressive surgery.

## 2. Case report

### 2.1. History and examination

*Case 1.* A 51-year-old woman presented with right scapular pain and upper back spasms 9-days prior to admission and was discharged with oral analgesics and muscle relaxants. The patient re-presented 3-days prior to admission, afebrile, without weakness, and wholly continent and was instructed to follow up with their primary care provider (PCP). One day prior to admission, the patient presented with increased pain at which time a LP showed a white count of 29. The patient was admitted to an outside hospital with bacterial meningitis and empirically started on intravenous vancomycin and ceftriaxone. MRI scans revealed changes consistent with an epidural fluid collection with significant, diffuse, spinal cord impingement from the C1–2 vertebrae to the lower-thoracic region (Fig. 1A). During scanning however, the patient developed progressive lower extremity (LE) weakness and incontinence and was transferred emergently for neurosurgical evaluation. History was significant only for lupus dermatitis for which low dose oral prednisone had been administered, and frequent horseback riding. On presentation the patient was incontinent of urine, had 0/5 strength in the right upper extremity (UE), 2/5 strength in the left UE, and bilateral 0/5 strength in the LEs.

*Case 2.* This 48-year-old woman developed low back pain and was treated, 6-days prior to admission, with intravenous and oral analgesics and without imaging. The patient re-presented 2-days

* Corresponding author at: 593 Eddy St, Department of Neurosurgery, Providence, RI 02903, USA. Tel.: +1 608 215 0872; fax: +1 401 444 7146.
*E-mail address:* jfmorrison@uwalumni.com (J.F. Morrison).

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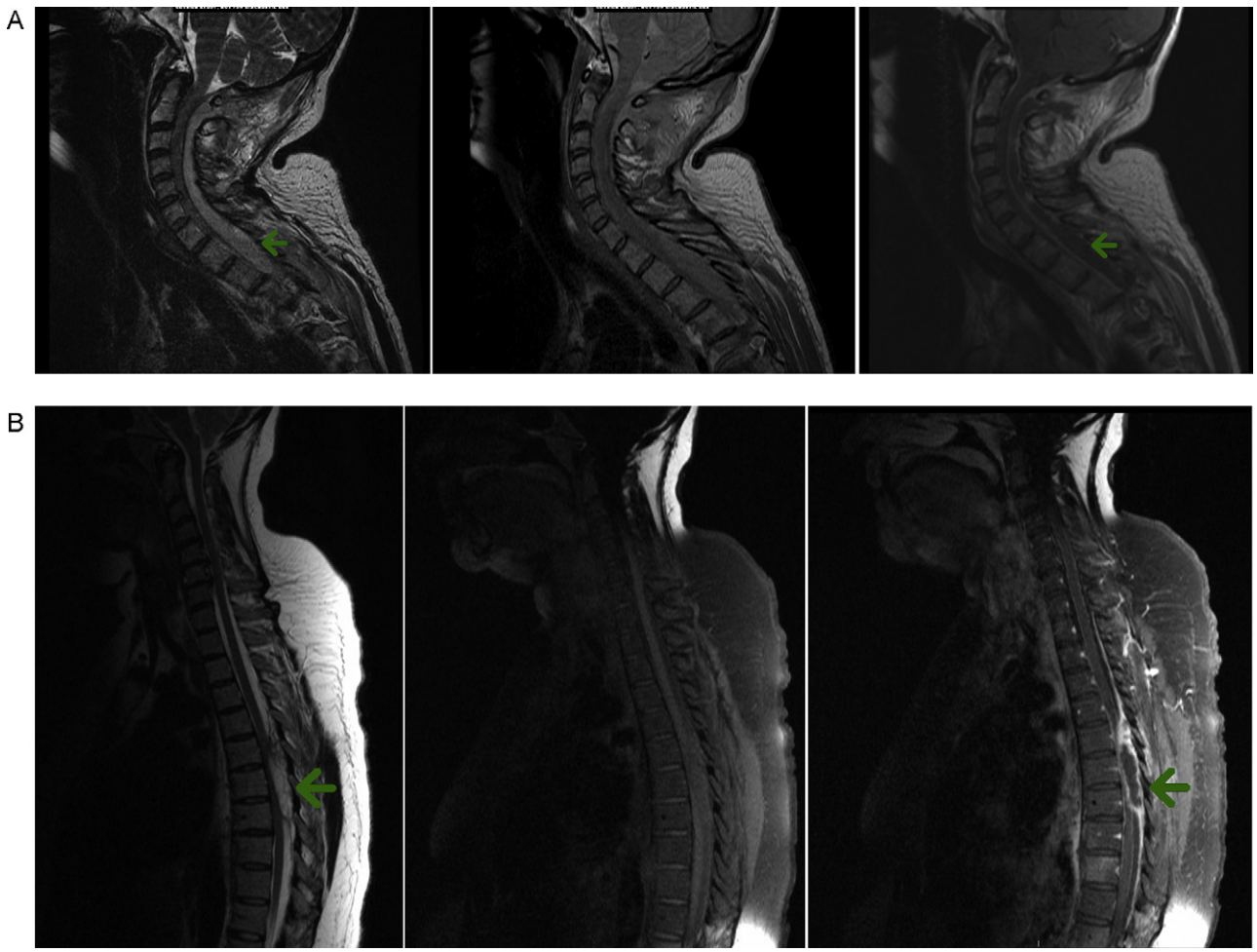


**Fig. 1.** Magnetic resonance imaging of cervical and thoracic spine. (A) From left to right: sagittal T2, T1, and contrast enhanced T1 weighted MRI of patient 1 cervical and thoracic spine. Extensive epidural abscess (arrows) from C1/2 to thoracic level unseen on imaging. (B) From left to right: sagittal T2, T1, and contrast enhanced T1 weighted MRI of patient 2 thoracic spine. Arrow indicates level of epidural abscess.

later and was admitted. Over a 4-day period she developed progressive numbness and tingling, leg weakness and incontinence resulting in an MRI scan with an enhancing epidural fluid collection at T6–T8 and significant cord impingement (Fig. 1B). History was significant for chronic low back pain and narcotic use. Strength on presentation was 0/5 bilaterally in LEs.

### 2.2. Operative technique

Both patients were brought emergently to the operating room for decompressive laminectomies. Somatosensory evoked potentials (SSEP) from bilateral UE/LEs measured functional integrity of the dorsal columns. Transcranial electrical motor evoked potentials (TceMEP) measured function through the lateral corticospinal tract to with recorded the end organ (muscle) action potential. Special electrodes (Ad-Tech Medical Instrument, Racine, WI) placed in the epidural space recorded direct (D-wave) potentials which measure the traveling wave directly from the lateral corticospinal tract.

*Case 1*. TceMEP recordings prior to laminectomies (Fig. 2A) with normal TceMEP responses are seen in the left UE (top two traces in the left panel) only, with a smaller response in the right forearm muscles. No responses are noted in the lower limbs bilaterally. Three small incisions and decompressive laminectomies were made including cervical, upper and lower thoracic areas, allowing access to the entire region of involvement and cultures obtained. Initial D-wave recordings at the cervicothoracic level (Fig. 2C, top trace) demonstrate that large fiber corticospinal tract information is still passing through at least to that level (C7/T1). A small #6 red rubber catheter (Bard, Covington, GA) was introduced under intervening segments of lamina and the abscess irrigated with vancomycin saline until clear. As the decompression continues, D-waves were progressively recorded at lower segments (T7/8 level – middle trace of Fig. 2C) with the final recording occurring at the T9/T10 vertebral level (bottom trace in Fig. 2C). Fig. 2B shows that at the end of the procedure, MEPs were recorded in both UEs, with a fourfold increase in amplitude and also in the right abductor hallucis. No lower limb MEP signals, however, were noted in the left LE.

*Case 2*. Laminectomy was made at the T5–T8 level and cultures obtained. Initial MEPs (Fig. 3A) indicated no responses in the lower limbs but normal responses were present in the upper limbs. Following laminectomy, prior to abscess removal, MEPs returned bilaterally in the abductor hallucis, but not in the anterior tibialis (Fig. 3B). During the procedure, epidural electrodes were positioned rostrally (Fig. 3C, top two traces), and caudally (Fig. 3C, bottom two traces) on the dura and a D-wave signal was recorded. The bottom trace in each pair is recorded when the electrode is first placed and is called the baseline while the top trace in each pair is the final D-wave recordings. Rostrally, there is no difference in the amplitudes of both tracings while caudally the final traces is approximately 25% higher in amplitude after decompression at the time of electrode removal.