A 44 year old male, 180 cm, 130 kg, presented to the ER with progressive numbness and weakness in his right arm, hand, and right leg. After a full workup was performed, he was revealed by MRI to have a cervical mass extending from C3 down to T1, which was most likely an intramedullary tumor. A cervical laminectomy was performed, followed by an intramedullary ependymoma resection in a two-stage procedure. The surgeons requested SSEP, EMG, and TceMEP monitoring. A TIVA anesthetic protocol was implemented to improve reliability of data collection.

As the case began, SSEPs were present from bilateral median nerve (MN) stimulation, as well as from left posterior tibial nerve (PTN) stimulation. Cortical SSEPs to right PTN stimulation were also present, but not as robust. TceMEPs displayed compound muscle action potentials from bilateral deltoids, hands, left leg and left foot, but right lower extremity responses were not present. Following laminectomy and dural opening, it was revealed that the mass had greatly distorted the anatomy of the spinal cord.

In the normal spinal cord, the midline is located at the dorsal median sulcus between two elevated posterior columns. However, the surface anatomy is frequently distorted in intramedullary tumors due to edema and cord rotation.

The surgeon was able to obtain separate repeat left and right MN responses to direct cord stimulation, indicating the fasciculus cuneatus tracts (brown circles above). He was able to obtain a small response over the right PTN, and large deflections over the LMN as well, in figure 3b above (green). However, the latencies do not match that of the normal SSEP. These may be myogenic or reflex potentials, given the light anesthesia and full twitches at the time. For correlation of data with surgical anatomy, one has to carefully compare response peak latencies obtained with minimal stimulation levels to determine appropriate sensory tracts. The surgeon was able to use dorsal column mapping information, in addition to the position of the dorsal median sulcal vein, to safely perform the myelotomy to gain access to the ependymoma for resection. It is worth noting that intraoperative SSEPs remained intact for the remaining case, indicating preserved dorsal columns.

For future steps, it would be recommended to explore a wider spinal cord map, suggesting stimulus thresholds, the use of a side-by-side bipolar stimulating probe for a more confined electric field, additional recording channels, and averaging more trials over a longer time frame to reduce noise, especially in the cortical channels. If reliable cortical channels were obtainable, the phase reversal method (Simon, 2011) could be used. Additionally, muscle relaxants could be given to limit any myogenic or reflex potentials seen. However, this would reduce the reliability of any EMG or TceMEP recordings obtained.

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REFERENCES