Title: Use of Subdural Electrodes to Enhance D-wave Recordings in Spinal Cord Tumor Resection

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Introduction:

Direct wave (D-wave) intraoperative neurophysiological monitoring (IONM) is used during intramedullary spinal cord tumor (IMSCT) resection to assess corticospinal tract (CST) integrity. There are several obstacles to obtaining consistent and reliable D-wave monitoring and modifications to the IONM procedure may improve surgical resection. We present a limited case series where we compare caudally placed epidural D-wave recordings to subdural D-wave recordings.

Methods: We prospectively collected neuromonitoring data for IMSCT cases directly comparing epidural and subdural D-wave monitoring over the past 1 year. Operative and IONM reports were reviewed. IMSCT surgeries below the spinal level of T9 were excluded. Surgeries where there was not a direct comparison of epidural to subdural D-wave recordings were excluded. Comparative analysis was performed in each patient and across the cohort.

Results: A total of 5 surgeries met the inclusion criteria. Epidural D-wave recordings were obtained in 4 (80%) procedures. In one procedure, the epidural d-wave recording was not obtained. Subdural D-wave recordings were obtained in 100% of the cases. Epidural D-wave recordings were unreliable in 100% of patients due to excessive noise artifact and poor electrode impedance causing recordings to be unmonitorable and uninterpretable throughout the procedure. Subdural D-wave recordings were comparatively reliable and had significantly less noise artifact 100% of the time both within study patients and across the cohort. Subdural D-wave recordings attenuated in 2/5 (40%) procedures (including the procedure where the epidural D-wave recording was not obtained at all). All cases with D-wave attenuation had intervention and subsequent return of the recordings. The D-wave did not come back to 100% of established baseline in 1 case and this patient awoke with a transient motor deficit which resolved over time.

Conclusion: A spinal electrode placed subdurally within the subarachnoid space offers better connection with the SC, better impedance, less stimulus artifact and increased signal-to-noise ratio compared to traditional epidural placements. Further research is needed with a larger sample size to establish efficacy and statistical significance.