Clinical Overview

The Neurosciences Group at Roosevelt Hospital works closely with the prestigious group of neurosurgeons led by Dr. Fred Epstein. The group has performed thousands of spinal cord tumor surgeries at NYU Medical Center, now at Beth-Israel North, and now at the Roosevelt Medical Center.

We collaborate closely with the neurophysiology team and have developed many techniques to monitor neural tracts to enable us to perform spinal surgery more precisely and safely. More recently, using dorsal column mapping to identify the physiological and functional midline of the spinal cord for myelotomy, this technique has enabled us to minimize injury to the dorsal columns. All patients undergoing intramedullary surgery have motor-evoked potential monitoring, somatosensory-evoked potential monitoring, dorsal column mapping, and the recording of “D” waves throughout the operation.1,2

Intradural spinal cord surgery carries significant risk for neurologic impairment. Intradural spinal cord tumors are rare neoplasms accounting for approximately 2% to 4% of central nervous system tumors. These tumors are primarily astrocytomas and ependymomas. Astrocytomas commonly occur in the pediatric population, whereas ependymomas are more frequently encountered in the adult population. These tumors are very slow growing and can reach significant proportions within the spinal cord before becoming symptomatic. They tend to expand the spinal cord and can distort the surface anatomy.2-4

Surgical resection is the definitive treatment for intramedullary spinal cord tumors.4,5,6,7 Resection of large centrally located intramedullary spinal cord tumors is achieved via a midline myelotomy.6,8 This is accomplished by defining the amplitude technique of mapping the dorsal columns to help locate the midline from within the dorsal median sulcus is performed after identifying the midline via standard anatomical landmarks without any objective neurophysiological data. Injury to the dorsal columns during this dissection can result in dysfunction manifesting as numbness, tingling, painful dysesthesias, or atactic gait.9

This can be significantly incapacitating on the patient’s functional status and can affect the ability to rehabilitate. Decreasing the risk of dorsal column dysfunction remains a challenge in the treatment of intramedullary spinal cord lesions requiring a midline myelotomy.4,5,6,7

Together with the standard pre-operative radiographic studies and intra-operative ultrasound to identify the exact location of the tumor within the spinal cord, we utilized an intra-operative functional technique of mapping the dorsal columns to help locate the midline for the myelotomy.4,5 This is accomplished by defining the amplitude gradient of conducted somatosensory-evoked potentials (SEP) using a miniature multi-electrode grid (Fig. 1.2). These signals are interpreted intra-operatively by the neurophysiology team correlating the surgical anatomy with the functional anatomy. We have found this technique particularly useful in patients with large intramedullary spinal cord tumors and syringomyelia.4,5,6,7

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**Figure 1.1** Artist rendering of normal spinal cord anatomy showing the elevaved posterior columns and dorsal median sulcus

**Figure 1.2** A miniature multi-electrode (1-8) grid is used intra-operatively to measure the amplitude gradient of conducted somatosensory-evoked potentials during functional mapping of the dorsal columns.

**Figure 1.3** MRI showing intramedullary tumor enlarging the cord, isointense on T1, hyperintense on T2, hyperintense on proton density, and not contrast enhancing.

**CASE PRESENTATION #1**

**Chief Complaint, Presentation, and History of Present Illness**

A 67-year-old female presented with a 4-year history of back pain and a 3-month history of increasing gait difficulty and right leg weakness. Neurological examination showed an ataxic gait, a spastic right leg with weakness 3/5, and diminution to pin sensation in the entire right lower extremity. The patient was grossly myelopathic in both lower extremities, joint position sense was absent in the right lower extremity and intact on the left. MRI scans revealed a large intramedullary tumor at T7-T8 enlarging the spinal cord. The tumor was isointense on T1, hyperintense on T2, without enhancement with gadolinium, and without a cystic component (Fig. 1.3)

**Diagnosis, Surgical Approach, and Follow-Up**

A standard thoracic laminectomy and durotomy were carried out, exposing the spinal cord and showing significant enlargement over 2 to 3 segments. We were unable to determine the extent of the midline macroscopically using the strip electrode for dorsal column mapping (Fig. 1.2), the neurophysiology team was able to locate the anatomic midline as lying between electrodes 6 and 7. The myelotomy was placed at the selected site, and a gross total removal of the tumor was achieved. The final pathology was gangliocytoma.

Postoperatively, the patient had transient increased weakness in the right lower extremity, but good strength in the left. Joint position sense was preserved on the left and absent on the right, and the patient was stable from her pre-operative exam. At follow-up, her right lower extremity strength continued to improve with physical therapy.

**REFERENCES**