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Impact of Neurophysiological Monitoring on Surgical Outcomes in Intradural Spinal Tumor Procedures

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Introduction

Intradural spinal tumors are a diverse group of neoplasms located within the dura mater of the spinal cord, which can be either intramedullary or extramedullary. These tumors, while relatively rare, pose significant challenges to neurosurgeons due to their delicate anatomical location and proximity to critical neural structures. Surgery remains the primary treatment modality for these tumors, but the risk of neurological damage during resection is high because of the intricate relationship between the tumor and surrounding spinal cord tissue, nerve roots, and blood vessels. To mitigate the risk of postoperative neurological deficits, the use of neurophysiological monitoring during spinal tumor surgery has become an increasingly important tool in modern neurosurgery. Neurophysiological monitoring provides real-time feedback about the functional integrity of the spinal cord and nerve roots during surgery, offering a dynamic, non-invasive approach to assess the effects of tumor resection on the neural structures. This article examines the role of neurophysiological monitoring in intradural spinal tumor surgery, exploring its impact on surgical outcomes, safety, and patient prognosis [1,2].

Description

Intradural spinal tumors can be categorized into two main types: intramedullary tumors, which arise from the spinal cord itself, and extramedullary tumors, which develop outside the spinal cord but within the dura. Examples of intramedullary tumors include gliomas and ependymomas, while extramedullary tumors may include meningiomas and schwannomas. The symptoms of intradural spinal tumors depend on their location and size but often include back pain, motor weakness, sensory loss, and bowel or bladder dysfunction. As these tumors grow, they can compress adjacent spinal cord structures, leading to significant neurological impairments. Given the close proximity of these tumors to critical spinal cord and nerve root functions, surgical removal poses a high risk of iatrogenic injury. Surgical resection of intradural spinal tumors is the mainstay of treatment, especially for tumors that are symptomatic or malignant. The primary goals of surgery are to alleviate neurological symptoms, prevent further neurological deterioration, and remove the tumor as completely as possible while preserving function. However, the challenge lies in removing the tumor without damaging the spinal cord or nerve roots. In cases where tumors are intimately involved with the spinal cord, total resection may not be feasible due to the risk of catastrophic neurological loss. To minimize the risk of damage, neurophysiological monitoring has become an essential adjunct during surgery. NPM techniques provide valuable intraoperative information that guides the surgeon's decision-making, helps in real-time detection of neural compromise, and improves the likelihood of preserving neurological function.

Conclusion

Neurophysiological monitoring has revolutionized the surgical management of intradural spinal tumors, offering a valuable tool for minimizing the risk of neurological damage during tumor resection. By providing real-time feedback on the functional integrity of the spinal cord and nerve roots, NPM enhances the surgeon's ability to navigate the delicate anatomical structures of the spinal cord, reducing the likelihood of postoperative motor and sensory deficits. As technology advances, the precision and utility of NPM in spinal tumor surgeries will likely continue to improve, further enhancing patient outcomes and the overall safety of these complex procedures. Despite its challenges, neurophysiological monitoring is an indispensable component of modern spinal tumor surgery, contributing to safer and more effective treatment of these challenging conditions.

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