Factors predicting the resectability of intramedullary spinal cord tumors and the progression-free survival following microsurgical treatment

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Intramedullary spinal cord tumors (IMSCTs) are relatively rare lesions, accounting for 2–8.5% of CNS tumors and representing 15% of adult and 35% of pediatric primary intradural tumors. Ependymoma is the most common intramedullary tumor in adults, followed by astrocytoma and hemangioblastoma, while astrocytomas are the most common spinal cord tumor in children. Complete microsurgical resection is guided by the presence or absence of a definable plane of cleavage and must be balanced against the risks of perioperative neurological impairment. Early surgery has been recommended given the improved postoperative functional outcome in patients who present with relatively minor neurological deficits. With improvements in microsurgical techniques, a total resection is now possible and is generally the aim given that the extent of surgery is associated with tumor recurrence and prognosis. Unfortunately, even with improved technology, the overall morbidity rates remain high. Deterioration of motor function has been observed in most case series, and this is followed by a period of recovery. Unfortunately, approximately 20% of these patients will sustain permanent deficit. Sensory function appears to recover sooner but decline more rapidly than motor recovery. This observation has led to the examination of the factors associated with functional outcome after tumor resection. Of these, intraoperative monitoring, tumor histology, cystic components, the extent of resection, tumor location, and postoperative radiotherapy appear to be associated with functional outcome.

In the current issue, Garcés-Ambrossi and colleagues from Johns Hopkins University have retrospectively analyzed the factors associated with gross-total resection (GTR), progression-free survival (PFS), and long-term neurological improvement after resection of IMSCTs in 101 consecutive adults and pediatric patients. A wide variety of intramedullary pathological entities were included. Of the total number of tumors analyzed, 51% were ependymomas, 35% were astrocytomas (16% WHO Grade I, 10% WHO Grade II, and 9% high grade) and 15% were hemangioblastomas. A GTR was achieved in 59% of the cases, depending on identifiable tumor plane and smaller tumor size. Surprisingly, GTR was found to be independent of tumor histology. The presence of a plane of resection resulted in improved PFS regardless of tumor histology. In the Johns Hopkins series, tumor progression had developed in 31% of patients at the last follow-up (mean 19 months), which is similar to reports in the literature. Tumor progression correlated with identifiable tumor plane and tumor histology. The authors further report that 34% of patients experienced acute neurological decline after surgery. Increased age and intraoperative changes in motor evoked potentials were predictive of significant perioperative neurological decline. Of note, however, preoperative baseline status returned in 41% of these patients within 1 month. Improvements in neurological function were observed in all modalities (sensory, motor, and bladder function). In this series of 101 patients, 55% maintained overall neurological outcome at the last follow-up. An identifiable tumor plane at surgery and improvements in neurological symptoms before discharge were associated with overall neurological improvement as judged by last follow-up.

Given the fact that radical resection has been associated with increased long-term survival, the main factor associated with tumor resectability is the presence of tumor plane, regardless of tumor type. Tumor plane varies among the different tumor types and can predict the degree of resection. Progression-free survival was improved by the presence of a plane of resection in cases of ependymomas, hemangioblastomas, and astrocytomas. The presence of a tumor plane was more predictive of PFS than was tumor histology.

Importantly, while a decline in neurological status
occurred frequently after tumor resection, improvement in neurological function was observed in almost half of the patients by 1 month. An association was observed between the identification of a tumor plane and an improvement in symptoms before discharge. These events appeared to be independent of tumor histology. Several other variables appeared to be independent of this outcome: duration of preoperative symptoms, tumor size and location, the presence of a syrinx, and the use of postoperative radiotherapy. This information could help to influence the presurgical discussion with the patient regarding the expected neurological outcome.

The aim of treatment with IMSCTs is to achieve a complete microsurgical resection. The current series by an experienced group at Johns Hopkins University has further defined the key role of a definable tumor plane in facilitating complete removal. Despite the relatively high rate of perioperative neurological morbidity, most deficits recover to an acceptable extent and the goal should be to optimize PFS. In our experience, the combination of microsurgical techniques and multimodal intraoperative monitoring helps to facilitate this goal.15

Garcés-Ambrossi and colleagues10 are to be congratulated on their meticulous analysis of a large series of IMSCTs. Future work should be directed at identifying potential biological markers that could predict tumor behavior, imaging methods to enhance the intraoperative definition of the tumor plane, and biopharmaceutical approaches to minimize perioperative neurological deficits.

Disclosure

Dr. Fehlings serves as a consultant to DePuy Spine and Stryker Biotech.

References


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