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What Factors Predict the Development of Neurologic Deficits Following Resection of Intramedullary Spinal Cord Tumors: A Multi-Center Study

Oluwaseun O Akinduro¹, Abdul Karim Ghaith², Michaelides Loizos³, Andrea Otamendi Lopez³, Anshit Goyal³, Leonardo de Macêdo Filho³, Marc Ghanem⁴, Ryan Jarrah², Diogo P Moniz Garcia³, Kingsley Abode-Iyamah³, Maziyar A Kalani⁵, Selby G Chen³, William E Krauss², Michelle J Clarke², Mohamad Bydon², Alfredo Quiñones-Hinojosa³

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Abstract

Introduction: Intramedullary spinal cord tumors (IMSCTs) are challenging to resect, and their postoperative neurological outcomes are often difficult to predict, with few studies assessing this outcome.

Methods: We reviewed the medical records of all patients surgically treated for IMSCTs at our multisite tertiary care institution (Mayo Clinic Arizona, Mayo Clinic Florida, Mayo Clinic Rochester) between June 2002 and May 2020. Variables that were significant in the univariate analyses were included in a multivariate logistic regression. "MissForest" operating on the Random Forest (RF) algorithm, was used for data imputation, and K-prototype was used for data clustering. Heatmaps were added to show correlations between postoperative neurological deficit and all other included variables. SHAP (Shapley Additive exPlanations) was implemented to understand each feature's importance.

Results: Our query resulted in 315 patients, with 160 meeting the inclusion criteria. There were 53 patients with astrocytoma, 66 with ependymoma, and 41 with hemangioblastoma. The mean age (standard deviation) was 42.3 (17.5), and 48.1% of patients were women (n=77/160). Multivariate analysis revealed that pathologic grade >3 (OR=1.55; CI=[0.67, 3.58], p=0.046 predicted a new neurological deficit. Random Forest algorithm (supervised machine learning) found age, use of neuromonitoring, histology of the tumor, performing a midline myelotomy, and tumor location to be the most important predictors of new postoperative neurological deficits.

Conclusions: Tumor grade/histology, age, use of neuromonitoring, and myelotomy type appeared to be most predictive of postoperative neurological deficits. These results can be used to better inform patients of perioperative risk.

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