Nomograms based on Pre-operative Multi-parametric Magnetic Resonance Imaging for Prediction of Molecular Subgrouping in Medulloblastoma: Results from a Radiogenomics Study of 111 Patients.


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BACKGROUND: Novel biological insights have led to consensus classification of medulloblastoma into four distinct molecular subgroups - wingless (WNT), sonic hedgehog (SHH), Group 3, and Group 4. We aimed to predict molecular subgrouping in medulloblastoma based on pre-operative multi-parametric magnetic resonance imaging (MRI) characteristics.

METHODS: A set of 19 MRI features were evaluated in 111 patients with histologic diagnosis of medulloblastoma for prediction of molecular subgrouping. MRI characteristics were correlated with molecular subgroups derived from tissue samples in 111 patients (WNT=17, SHH=44, Group 3=27, and Group 4=23). Multinomial logistic regression of imaging parameters was performed on a training cohort (TC) of 76 patients, representing two-thirds of randomly-selected patients from each of four molecular subgroups, to generate binary nomograms. Validation of these nomograms was performed on the remaining 35 patients as the validation cohort (VC).

RESULTS: Medulloblastoma subgroups could be accurately predicted by pre-operative MRI features in 74% of cases. Predictive accuracy was excellent for SHH (95%), acceptably high for Group 4 (78%), modest for Group 3 (56%) and worst for WNT (41%) subgroup medulloblastoma. SHH-specific nomogram was associated with excellent correlation between TC and VC, with area under the curve (AUC) of 0.939 and 0.991 respectively. AUC for Group 4 was acceptable at 0.851 and 0.788 in TC and VC respectively; however, these values were consistently suboptimal in WNT and Group 3 medulloblastoma.

CONCLUSION: The predictive accuracy of MRI-based nomograms was excellent for SHH and encouraging for Group 4 medulloblastoma. Further work is needed for Group 3 and WNT-pathway medulloblastoma.

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