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Revisiting oligodendroglioma grading in the 2021 WHO classification: calcification and larger contrast-enhancing tumor volume may predict higher oligodendroglioma grade

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Abstract

Purpose: To investigate whether qualitative and quantitative imaging phenotypes can predict the grade of oligodendroglioma.

Methods: Retrospective chart and imaging reviews were conducted on 180 adults with oligodendroglioma (IDH-mutant and 1p/19q codeleted) between 2005 and 2021. Qualitative imaging characteristics including tumor location, calcification, gliomatosis cerebri, cystic change, necrosis, and infiltrative pattern were analyzed. Quantitative imaging assessment was performed from the tumor mask via automatic segmentation to calculate total, contrast-enhancing (CE), non-enhancing (NE), and necrotic tumor volumes. Logistic analyses were conducted to determine predictors of oligodendroglioma grade.

Results: This study included 180 patients (84 [46.7%] with grade 2 and 96 [53.3%] with grade 3 oligodendrogliomas), with a median age of 42 years (range 23-76 years), comprising 91 females and 89 males. On univariable analysis, calcification (odds ratio [OR] = 6.00, P < 0.001), necrosis (OR = 21.84, P = 0.003), presence of CE tumor (OR = 7.86, P < 0.001), larger total (OR = 1.01, P < 0.001), larger CE (OR = 2.22, P = 0.010), and larger NE (OR = 1.01, P < 0.001) tumor volumes were predictors of grade 3 oligodendroglioma. On multivariable analysis, calcification (OR = 3.79, P < 0.001) and larger CE tumor volume (OR = 2.70, P = 0.043) remained as independent predictors of grade 3 oligodendroglioma. The multivariable model exhibited an AUC, accuracy, sensitivity, specificity of 0.78 (95% confidence interval 0.72-0.84), 72.8%, 79.2%, 69.1%, respectively.

Conclusion: Presence of calcification and larger CE tumor volume may serve as useful imaging biomarkers for prediction of oligodendroglioma grade.

Clinical relevance statement: Assessment of intratumoral calcification and CE tumor volume may facilitate accurate preoperative estimation of oligodendroglioma grade. Presence of intratumoral calcification and larger contrast-enhancing tumor volume were the significant predictors of higher grade oligodendroglioma based on the 2021 WHO classification.

Keywords: Grade; Magnetic resonance imaging; Oligodendroglioma; World Health Organization.