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Association of partial T2-FLAIR mismatch sign and isocitrate dehydrogenase mutation in WHO grade 4 gliomas: results from the ReSPOND consortium

Matthew D Lee¹, Sohil H Patel², Suyash Mohan³, Hamed Akbari^{4 5}, Spyridon Bakas^{4 5 6}, MacLean P Nasrallah^{6 7}, Evan Calabrese⁸, Jeffrey Rudie⁹, Javier Villanueva-Meyer¹⁰, Pamela LaMontagne¹¹, Daniel S Marcus¹¹, Rivka R Colen^{12 13}, Carmen Balana¹⁴, Yoon Seong Choi¹⁵, Chaitra Badve¹⁶, Jill S Barnholtz-Sloan^{17 18}, Andrew E Sloan^{19 20}, Thomas C Booth^{21 22}, Joshua D Palmer²³, Adam P Dicker²⁴, Adam E Flanders²⁵, Wenyin Shi²⁴, Brent Griffith²⁶, Laila M Poisson²⁷, Arnab Chakravarti²³, Abhishek Mahajan²⁸, Susan Chang²⁹, Daniel Orringer^{30 31}, Christos Davatzikos^{4 5 32}, Rajan Jain^{33 30}; ReSPOND Consortium

Collaborators, Affiliations

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Abstract

Purpose: While the T2-FLAIR mismatch sign is highly specific for isocitrate dehydrogenase (IDH)-mutant, 1p/19q-noncodeleted astrocytomas among lower-grade gliomas, its utility in WHO grade 4 gliomas is not well-studied. We derived the partial T2-FLAIR mismatch sign as an imaging biomarker for IDH mutation in WHO grade 4 gliomas.

Methods: Preoperative MRI scans of adult WHO grade 4 glioma patients (n = 2165) from the multi-institutional ReSPOND (Radiomics Signatures for PrecisiON Diagnostics) consortium were analyzed. Diagnostic performance of the partial T2-FLAIR mismatch sign was evaluated. Subset analyses were performed to assess associations of imaging markers with overall survival (OS).

Results: One hundred twenty-one (5.6%) of 2165 grade 4 gliomas were IDH-mutant. Partial T2-FLAIR mismatch was present in 40 (1.8%) cases, 32 of which were IDH-mutant, yielding 26.4% sensitivity, 99.6% specificity, 80.0% positive predictive value, and 95.8% negative predictive value. Multivariate logistic regression demonstrated IDH mutation was significantly associated with partial T2-FLAIR mismatch (odds ratio [OR] 5.715, 95% CI [1.896, 17.221], p = 0.002), younger age (OR 0.911 [0.895, 0.927], p < 0.001), tumor centered in frontal lobe (OR 3.842, [2.361, 6.251], p < 0.001), absence of multicentricity (OR 0.173, [0.049, 0.612], p = 0.007), and presence of cystic (OR 6.596, [3.023, 14.391], p < 0.001) or non-enhancing solid components (OR 6.069, [3.371, 10.928], p < 0.001). Multivariate Cox analysis demonstrated cystic components (p = 0.024) and non-enhancing solid components (p = 0.003) were associated with longer OS, while older age (p < 0.001), frontal lobe center (p = 0.008), multifocality (p < 0.001), and multicentricity (p < 0.001) were associated with shorter OS.

Conclusion: Partial T2-FLAIR mismatch sign is highly specific for IDH mutation in WHO grade 4 gliomas.

Keywords: Astrocytoma; Glioblastoma; Isocitrate dehydrogenase; Magnetic resonance imaging; T2-FLAIR mismatch.

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