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Molecular imaging of gliomas

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Abstract

Molecular characterization has become a key diagnostic tool for the classification and grading of primary brain tumors. Molecular markers, such as *isocitrate dehydrogenase (IDH)* mutation status, *1p/19q* codeletion, methylation of the *O(6)-methylguanine-DNA methyltransferase (MGMT)* promoter, or *CDKN2A/B* homozygous deletion discriminate different tumor entities and grades, and play a crucial role for treatment response and prognosis. In recent years, magnetic resonance imaging (MRI), whose main functions has been to detect a tumor, to provide spatial information for neurosurgical and radiotherapy planning, and to monitor treatment response, has shown potential in assessing molecular features of gliomas from image-based biomarkers. As an outstanding example, numerous studies have proven that the T2/FLAIR mismatch sign can identify *IDH*-mutant, *1p/19q* non-codeleted astrocytomas with a specificity of up to 100%. For other purposes, multiparametric MRI, often coupled with machine learning methods, seems to achieve the highest accuracy in predicting molecular markers. Relevant future applications might be anticipating changes in the molecular composition of gliomas and providing useful information about the cellular and genetic heterogeneity of gliomas, especially in the non-resected tumor parts.