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Correlation of Molecular Markers with MRI Features in High Grade Gliomas: Review of Evidence

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Abstract: ***A correlation between MRI features in high grade gliomas with the molecular markers will help in differentiating the tumors on initial imaging, which can further help us in making better clinical decisions. Here we review the current evidences of this correlation in gliomas.***

Keywords: High grade gliomas, MRI features, Molecular markers

Tumors of the central nervous system (CNS) constitute approximately 2% of all malignancies. The incidence of CNS tumors in India ranges from 5 to 10 per 100, 000 population, of which the incidence of high grade gliomas is 59.5% [1]. The standard of care for high grade gliomas is multimodal treatment, i. e., maximum safe surgical resection followed by concurrent chemo-radiation (external beam radiation therapy with concurrent temozolomide) followed by adjuvant chemotherapy (temozolomide for 6 months) [2].

In high grade gliomas, Conventional Magnetic resonance imaging show precise anatomic localization and/or centrally non-enhancing regions, that is typically related to necrotic areas histologiclly. A good correlation between apparent diffusion co-efficient (ADC) and tumor cellularity and its use for application in glioma grading has been documented [3].

It is postulated that radiological features may have a prognostic value and act as a surrogate marker for molecular markers. Imaging features, particularly FLAIR border pattern and tumor location, could distinguish molecular subgroups of grade II and III gliomas on the basis of the 2016 WHO classification, and the ability to distinguish these subgroups on initial diagnostic imaging may affect clinical decision making.

In Isocitrate dehydrogenase-1 (IDH1)-wild type lower grade gliomas, the imaging phenotype of non-lobar location, proportion of enhancing tumor, multifocal/multi-centric distribution, and poor definition of non-enhancing margin are helpful in prediction of IDH-1 mutation status in these tumors [4].

CNS tumor classification (WHO 2016) uses molecular markers in addition to histology as the molecular markers have prognostic significance [5]. Various studies have reported that frontal lobe tumors are predominantly IDH-1 mutant tumors as compared to IDH-1 wild type tumors [4, 6, 7]. Oligodendroglial tumors with IDH mutations are prone to locate in frontal lobe [8]. There has been evidence of agreement of presence of frontal tumors in IDH-1 mutated 1p19q co-deleted tumors [9].

The predominant frontal lobe location of IDH-mutant gliomas may be because neuroglial progenitor cells in the fore-brain sub-ventricular zone are likely cells of origin for IDH-1 mutant gliomas. This brings us to a conclusion that frontal lobe location is a good prognostic imaging feature as these tumors are more likely to be IDH-1 mutant and hence, have a better prognosis than IDH-1 wild type.

Researchers have reported IDH-1 mutated tumors exhibit less invasive features when compared with IDH-1 wild type genotype particularly proportion of enhancement [4, 10].

As per a study, IDH-1 mutant tumors have shown a poorly defined enhancing margin, and a well defined non-enhancing margin [4]. It has been reported that IDH-1 wild type tumors have an infiltrative pattern on MRI and IDH-1 mutant tumors are more likely to have sharp borders [11].

It has been reported that IDH-1 type wild type have higher proportion of enhancement [10], indicating to a conclusion that tumors with enhancement are more likely to be IDH-1 wild type and hence, have a poor prognosis as compared to tumors with absence of enhancement.

In conclusion, MRI has an added advantage of studying the changes seen in CNS tumors. There is a need that if MRI features can be correlated with molecular markers, then the tumors can be prognosticated and more tailored therapy can be planned.

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