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# Imaging Correlation of Low-Grade Gliomas According To 2016 WHO Classification of CNS Tumors: A Short Review

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## Introduction

Previously CNS tumors were classified on the basis of 2007 WHO classification according to which CNS tumors were defined only on the basis of histology. According to 2016 WHO classification, CNS tumors are now defined on the basis of molecular parameters in addition to histology [1]. Low grade gliomas (WHO grade II and III gliomas) are classified into subtypes according to 2016 classification on the basis of IDH mutation and 1p/19q codeletion molecular status. Those low-grade gliomas which shows IDH mutation and 1p/19q codeletion on molecular analysis are labelled as oligodendroglioma, low grade gliomas which shows IDH mutation and intact 1p/19q are labelled as astrocytoma (IDH mutant) and low-grade gliomas in which there is no IDH mutation will be labelled as astrocytoma (IDH wildtype).

Imaging features of low-grade gliomas needed re-evaluation after WHO 2016 classification because tumors previously classified as oligodendroglioma on the basis of histology but shows intact 1p/19q status are now labelled as astrocytoma and tumors previously labelled as astrocytoma based on histologic features but now showing 1p/19q codeletion are labelled as oligodendroglioma. Thus, it was not clear as what are the imaging features which can predict the molecular diagnosis of these tumors. Various studies were performed to analyze morphological features between subgroups of low-grade gliomas according to 2016 WHO classification.

**Keywords:** CNS tumors; Astrocytoma; Oligodendroglioma; Gliomas; Mutant tumors; Heterogeneity; 1p/19q-codeleted; Molecular analysis

## IDH-Mutant vs. IDH-Wild Astrocytoma

There are some studies which has shown the correlation between morphological features of low-grade gliomas and their and IDH mutation status. It was shown in the study by Rachel et al that on FLAIR imaging, the borders of IDH mutant tumors are more well-defined as compared to the IDH wild type tumors which showed ill-defined tumor margins [2].

IDH wild type tumors are more common in older age group as compare to IDH mutant tumors. According to, patients with IDH wild type tumors showed greater signal heterogeneity and lower edge contrast enhancement within the FLAIR region compared to IDH mutant tumors [3,4]. Another study by Patel et al [3] showed that non-frontal location, larger proportion of enhancing tumors, multifocal/multicentric distribution, and poor definition of non-enhancing margins were also independent predictors of an IDH1 wild type [5].

Above features shows that IDH wild type tumors have more infiltrative pattern on MRI and these features could help distinguish the molecular subtype at initial MRI imaging which may then guide further surgical and medical management. For example, IDH mutant gliomas shows better prognosis in maximal surgical resection compared to IDH wild type gliomas [6-9].

## 1p/19q Codeleted (Oligodendroglioma) vs. 1p/19q intact (astrocytoma)

Several studies are done to determine the correlation between morphological features of low-grade gliomas and their 1p/19q codeletion status. Patel et al. [3] showed in his study that, among low grade gliomas, the absence T2-FLAIR mismatch is a highly specific marker for the IDH-mutated and 1p/19q codeleted molecular subtype of IDH-mutant gliomas [3].

Lasocki et al. [6] also showed that more than 50% T2-FLAIR mismatch is strong predictor of a non-codeleted tumor, while the tumor is likely 1p/19q-codeleted if there are calcifications [6]. According to study by Yamauchi et al. [4], IDH-mutated and 1p/19q codeleted tumors are characterized by the presence of calcification, frontal lobe location [4].

Johnson et al. [7] have shown that non-circumscribed borders correlate with 1p/19q codeleted oligodendroglioma [7], but this appearance was also present in 45% of 1p/19q intact astrocytoma reducing the specificity to predict codeletion with confidence.

Bahrami et al. [8] showed in their study that among patients with IDH mutant tumors, 1p/19q co-deleted tumors had greater signal heterogeneity and lower edge contrast enhancement compared to 1p/19q intact tumors [8]. If formal 1p/19q testing is not possible, above mentioned MR imaging features would be more helpful in determining 1p/19q status.

## Conclusion

After the introduction of 2016 WHO classification of CNS tumors, it is becoming more important to determine the morphological characters of low-grade gliomas which correlates with their IDH and 1p/19q status as determining these subgroups on initial MRI imaging may impact clinical decision making. Above mentioned studies have shown that IDH wild type astrocytoma are more common in older age group, have multifocal/multicentric distribution, shows more ill-defined borders on FLAIR sequences, showed greater signal heterogeneity and lower edge contrast enhancement, have larger proportion of enhancing tumors.

1p/19q codeleted oligodendroglioma shows presence of calcification, frontal lobe predominance and absence of T2-FLAIR mismatch sign. While more than 50% T2-FLAIR mismatch is strong predictor of a non-codeleted tumor. Although ill-defined borders correlate with 1p/19q codeletion but it was also present in 45% of noncodeleted tumors in one study making this MR imaging feature less specific. In case if molecular testing is not possible these imaging features can help us determining molecular subgroups. However, we still need further comprehensive evaluation of these imaging features to further strengthen our diagnostic confidence.

## References


1. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, et al. (2016) The 2016 World Health Organization classification of tumors of the central nervous system: a summary. Acta neuropathol 1131(6):803-820.
2. Delfanti RL, Piccioni DE, Handwerker J, Bahrami N, Krishnan A, et al. (2017) Imaging correlates for the 2016 update on WHO classification of grade II/III gliomas: implications for IDH, 1p/19q and ATRX status. J neurooncol 135(3): 601-609.
3. Patel SH, Poisson LM, Brat DJ, Zhou Y, Cooper L, et al. (2017) T2-FLAIR mismatch, an imaging biomarker for IDH and 1p/19q status in lower grade gliomas: a TCGA/TCIA project. Clinic Cancer Res 23(20): 6078-6085.
4. Yamauchi T, Ohno M, Matsushita Y, Takahashi M, Miyakita Y, et al. (2018) Radiological characteristics based on isocitrate dehydrogenase mutations and 1p/19q codeletion in grade II and III gliomas. Brain Tumor Pathol 19:1-1.
5. Park YW, Han K, Ahn SS, Bae S, Choi YS, et al. (2018) Prediction of IDH1-mutation and 1p/19q-codeletion status using preoperative MR imaging phenotypes in lower grade gliomas. American Journal of Neuroradiology 39(1): 37-42.
6. Lasocki A, Gaillard F, Gorelik A, Gonzales M (2018) MRI Features Can Predict 1p/19q Status in Intracranial Gliomas. AJNR Am J Neuroradiol 39(4): 687-692.
7. Johnson DR, Diehn FE, Giannini C, Jenkins RB, Jenkins SM, et al. (2017) Genetically defined oligodendroglioma is characterized by indistinct tumor borders at MRI. AJNR Am J Neuroradiol 38(4): 678-684.
8. Bahrami N, Hartman SJ, Chang YH, Delfanti R, White NS, et al. (2018) Molecular classification of patients with grade II/III glioma using quantitative MRI characteristics. J Neurooncol 139(3): 633-642.
9. Beiko J, Suki D, Hess KR, Fox BD, Cheung V, et al. (2013) IDH1 mutant malignant astrocytomas are more amenable to surgical resection and have a survival benefit associated with maximal surgical resection. Neuro-oncology 16(1): 81-91.



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