Oligodendroglioma Classification

Oligodendroglioma IDH-mutant and 1p/19q-codeleted

Oligodendroglioma NOS

Anaplastic oligodendroglioma, IDH-mutant & 1p/19q-codeleted

Anaplastic oligodendroglioma NOS

They can be classified by degree of malignancy into grade II and grade III, according to WHO classification.

Only 30% of oligodendroglial tumors are anaplastic oligodendrogliomas

Supratentorial oligodendroglioma

Infratentorial oligodendroglioma

Spinal oligodendroglioma.

see Insular oligodendroglioma.

Combining histology and genetics in one diagnosis necessarily implicates the occurrence of occasional cases where genetics appears to contradict histology. No classification can encompass the totality of nature's breadth and diversity. For example, true oligodendroglioma without IDH mutation and without 1p/19q co-deletion may exist in pediatric patients. These "pediatric-type oligodendrogliomas" are mentioned in the Blue Book [1] ,but they are not part of the WHO Classification, and occurrence in adult patients remains unclear.

RNA sequencing

Tirosh et al., profile 4,347 single cells from six IDH1 or IDH2 mutant human oligodendrogliomas by RNA sequencing (RNA-seq) and reconstruct their developmental programs from genome-wide expression signatures. We infer that most cancer cells are differentiated along two specialized glial programs, whereas a rare subpopulation of cells is undifferentiated and associated with a neural stem cell expression program. Cells with expression signatures for proliferation are highly enriched in this rare subpopulation, consistent with a model in which CSCs are primarily responsible for fuelling the growth of oligodendroglioma in humans. Analysis of copy number variation (CNV) shows that distinct CNV sub-clones within tumours display similar cellular hierarchies, suggesting that the architecture of oligodendroglioma is primarily dictated by developmental programs. Subclonal point mutation analysis supports a similar model, although a full phylogenetic tree would be required to definitively determine the effect of genetic evolution on the inferred hierarchies. The single-cell analyses provide insight into the cellular architecture of oligodendrogliomas at single-cell resolution and support the cancer stem cell model, with substantial implications for disease management [2].

Molecular subtypes

Wu et al. identified and independently validated two reproducible subtypes associated with distinct molecular characteristics and clinical outcomes. The proliferative subtype, named Oligo1, was characterized by more tumors of CNS WHO grade 3, as well as worse prognosis compared to the Oligo2 subtype. Besides the clinicopathologic features, Oligo1 exhibited enrichment of cell proliferation, regulation of cell cycle and Wnt signaling pathways, and significantly altered genes, such as EGFR, NOTCH1 and MET. In contrast, Oligo2, with favorable outcome, presented increased activation of immune response and metabolic process. Higher T cell/APC co-inhibition and inhibitory checkpoint levels were observed in Oligo2 tumors. Finally, multivariable analysis revealed this classification was an independent prognostic factor in oligodendrogliomas, and the robustness of these molecular subgroups was verified in the validation cohorts [3].

Low-grade BRAF V600E mutant oligodendroglioma

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1)
Louis DN, Ohgaki H, Wiestler OD, Cavenee WK (2016) World Health Organization histological classification of tumours of the central nervous system. International Agency for Research on Cancer, Lyon

2)
Tirosh I, Venteicher AS, Hebert C, Escalante LE, Patel AP, Yizhak K, Fisher JM, Rodman C, Mount C, Filbin MG, Neftel C, Desai N, Nyman J, Izar B, Luo CC, Francis JM, Patel AA, Onozato ML, Riggi N, Livak KJ, Gennert D, Satija R, Nahed BV, Curry WT, Martuza RL, Mylvaganam R, Iafrate AJ, Frosch MP, Golub TR, Rivera MN, Getz G, Rozenblatt-Rosen O, Cahill DP, Monje M, Bernstein BE, Louis DN, Regev A, Suvà ML. Single-cell RNA-seq supports a developmental hierarchy in human oligodendroglioma. Nature. 2016 Nov 2. doi: 10.1038/nature20123. [Epub ahead of print] PubMed PMID: 27806376.

3)
Wu F, Yin YY, Fan WH, Zhai Y, Yu MC, Wang D, Pan CQ, Zhao Z, Li GZ, Zhang W. Immunological profiles of human oligodendrogliomas define two distinct molecular subtypes. EBioMedicine. 2022 Dec 14;87:104410. doi: 10.1016/j.ebiom.2022.104410. Epub ahead of print. PMID: 36525723; PMCID: PMC9772571.